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Wild Chinook Salmon Management: An International Conservation Challenge

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ABSTRACT

The complexity of managing wild chinook salmon (*Oncorhynchus tshawytscha*) stocks arises primarily from marine migrations across political boundaries, the currently seriously overfished condition of stocks along the North American Pacific Coast, and detrimental impacts from activities of competing users of the freshwater habitat. Despite the fact that data and analytical capabilities are adequate, many chinook salmon stocks continue to decline. This is happening because consistent management standards are lacking or not applied by decision-making bodies in favor of various unquantified socio-political alternatives. Yielding to socio-political pressures occurs even at the biological staff level, resulting in compromised biological recommendations that further undermine the fundamental management goal of long-term stock health and viability. We describe three chinook salmon case histories as paradigms of the problem: (1) the Georgia Strait stock where managers have failed to apply management standards aimed at increasing spawning escapements; (2) the Klamath River stock where managers have applied situational management standards which continuously compromise or ignore spawning escapement objectives; and (3) the upper Columbia River "bright" stock where conditional standards are being applied by numerous regulatory entities placing spawning escapement needs at a lower priority than other considerations.

Important naturally spawning chinook salmon (*Oncorhynchus tshawytscha*) runs are dwindling all along North America's Pacific Coast from California to southeast Alaska. Older age classes are disappearing from harvests and, as a result, average fish size has declined. Catches, run sizes, and spawning escapements have all been decreasing. Despite these classic signs of overfishing, effective corrective actions are lacking. Realistic hope for change appeared in 1983 when the long-negotiated United States/Canada treaty on salmon interceptions reached the draft stage. In special recognition of the breadth and seriousness of this problem, specific chinook salmon conservation arrangements were negotiated into the draft treaty starting in 1983. This promising international effort, however, has been thwarted to date, and other readily available but politically unpopular solutions to domestic United States and Canadian chinook salmon conservation problems have not been implemented.

The basic biology of chinook salmon places the species in the conservation trap of needing immediate action, but this action must come either from unpopular unilateral management measures or joint multi-jurisdictional political action. Chinook salmon are marine residents for 1 to several years prior to maturity and usually move across state and/or international political boundaries. These factors make the immature fish vulnerable to excessive fishing pressure and high interception rates in political jurisdictions away from the river of origin. Once a fish escapes the marine fishery harvest (currently about a one-third or less chance), terminal fisheries frequently exist to harvest mature adults migrating to natal streams. The role of overfishing in the chinook salmon management dilemma is now apparent

Table 1. Natural chinook salmon stock condition along the Pacific Coast as indicated by desired vs. 1983[a] adult spawning escapement levels (number of fish). Stocks currently experiencing chronic underescapements are noted with an asterisk.

Stock	Spawning escapement levels		
	Desired	Present	Percent of goal
Sacramento River			
Upper river falls*	99,000	46,100	47
Lower river falls	60,000	52,600	88
Late fall, winter, spring	[d]	22,700[b]	
Feather River falls	27,000	22,800	84
Yuba River falls	9,000	11,600	129
American River falls	24,000	18,200	76
San Joaquin River falls	7,000	10,800	154
Klamath River			
Falls*	97,500	31,500	32
Springs	[d]	[d]	
Oregon coastal falls	150,000–200,000	[c]	100[c]
Columbia River			
Upper river springs*	100,000–120,000	54,900	55
Upper river summers*	80,000–90,000	18,000	23
Upper river fall ("brights")*	40,000	48,700	122
North Washington coastal			
Spring/summer	[d]	5,600	
Falls	[d]	23,100	
Grays Harbor			
Springs	1,400	800	57
Falls*	14,600	4,500	31
Puget Sound[e]			
Springs*	3,500	Not available	
Summer and fall	35,850	63,000	176
Fraser River			
Springs, summers, and falls*	118,000	55,000	47
Georgia Strait			
Springs, summers, and falls*	72,000	35,000	49
West Coast Vancouver Island			
Falls*	36,000	14,000	39
Central British Columbia			
Springs and summers*	46,000	23,000	50
Northern British Columbia			
Springs and summers*	58,000	30,000	52
Southeast Alaska			
Springs*	64,200	26,700	42

[a] 1983 level reported in PFMC (1984) or Chinook Technical Committee (1983).
[b] Includes jacks and upper Sacramento and Feather River totals combined.
[c] Spawning escapement not quantified but goal was judged to have been met in 1983.
[d] Not quantified.
[e] Data from the Washington Department of Fisheries, Olympia, Washington 98504, USA, and represent return to the mouth of Strait of Juan de Fuca.

and acknowledged on an international basis. In this paper, we review the nature and extent of this coast-wide problem and, through detailed examination of three case histories, explore the typical rationales developed to justify current ineffective management. The need for management standards that accord the highest priority to maintenance of optimum (usually maximum sustainable yield) spawning escapements is emphasized.

The Problem

Stock status for virtually the entire Pacific Coast has been summarized by technical teams of the Pacific Fishery Management Council (PFMC 1983, 1984), North Pacific Fishery Management Council (NPFMC 1982) and the Chinook Technical Committee (1983). This information identifies those wild Pacific Coast chinook salmon stocks experiencing chronic conservation problems. Pacific Coast river systems from northern California to southeast Alaska are consistently "under-escaped" by about 500,000 spawners per year (Table 1). Spawning escapements of some stocks are now more than 70% below optimum goals.

This problem is not a surprise that developed overnight. In 1978, a team of fisheries scientists formed by PFMC concluded that 40% more chinook were needed to meet spawning escapement requirements under existing habitat conditions from the combined areas of California, Oregon, and Washington (PFMC 1979). Until the early 1970's, stocks were generally not overfished to the point of under-escapement. Controls on inside commercial and sport fisheries became increasingly restrictive to achieve adequate spawning escapements. For conservation reasons, directed terminal-area net fisheries have now been eliminated from virtually every wild chinook salmon run north of Washington. The remaining harvest on these runs occurs only in mixed-stock, commercial troll, and recreational fisheries, and as incidental catch during net fisheries targeted on other species or hatchery chinook stocks. The conclusions of the NPFMC Salmon Plan Development Team state the situation clearly (NPFMC 1982):

> "Many natural chinook salmon stocks are experiencing extreme conservation problems. Based on the current rate of decline in escapement levels for certain stocks, the Team concludes that if present exploitation rates on these stocks are allowed to continue, these stocks will be reduced to critically low levels over a relatively short time frame. In order to avert the possible loss of some severely depressed stocks as viable contributors to fisheries, and to promote the recovery of depressed stocks, immediate action in the form of harvest reductions is necessary."

A good example of the development of this problem is data from British Columbia. During

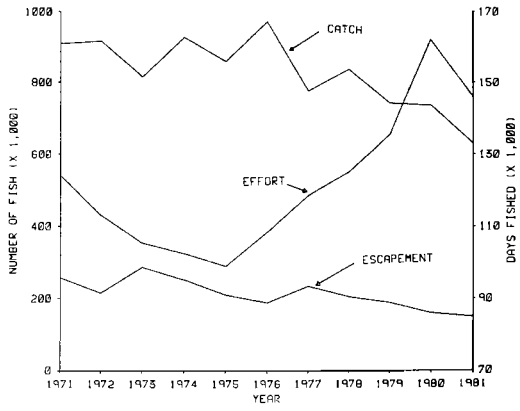

Figure 1. British Columbia ocean troll fishery chinook salmon catch, total ocean troll fishery effort, and total British Columbia chinook salmon spawning escapement.

the 1970's, the ocean troll fishery signaled a warning when catch began declining as fishing effort increased. Concurrently, spawning escapements began declining (Fig. 1). The decline in numbers of fish caught also deceptively underrated the scope of the problem. Average fish size also was declining as fishing pressure continued to increase. Between 1951 and 1975, the average rate of decline was 0.11 kg per year or 2.5 kg over the 24-year period (Ricker 1980). These trends preceded the period when numerical overfishing occurred. By the late 1970's, overfishing was obvious—not only in British Columbia but in other areas as well. We have now entered an era where the short-term regulatory controls necessary to correct this problem will have to be more severe than if overfishing had never been allowed to occur.

The major rationale given publicly while this problem developed was the often-heard "insufficient data" argument against active management in the face of uncertainty. Resource managers were burdened with conclusively proving overfishing before fishery closures could be considered rather than a requirement to prove the existence of a harvestable surplus prior to allowing a harvest. Sufficient tagging and spawning escapement data, as well as mixed-stock computer modeling capabilities, presently exist to achieve the desired end product of spawning escapements which maximize future harvest potential. These capabilities have existed for five

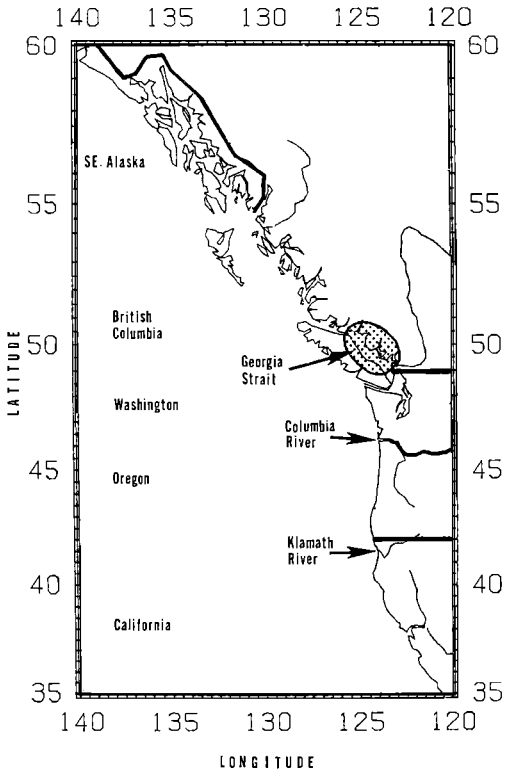

Figure 2. Location of the Georgia Strait, the Columbia River, and the Klamath River.

seasons in some cases. The political agencies along the coast responsible for the wise use of this resource have responded to these technical and scientific advances. Unfortunately, the primary harvest management responses have not resulted in increased escapements. Instead, overfishing has been accepted through implementation of excessively protracted rebuilding schedules and by justifying purposeful overfishing with a variety of rationales.

The annual cost of present coast-wide mismanagement is easy to envision in general terms. A present escapement shortfall of about 500,000 spawners coupled with a modest catch-to-escapement ratio of 2 or 3 caught per spawner equates to 1,000,000 or more fish per year no longer available for harvest. This lost harvest potential should, by itself, provide adequate impetus for corrective measures. But, as emphasized by the NPFMC Salmon Team, the problem is now severe enough that the basic viability of some stocks is in question. Nearly all entities with responsibility for these stocks share the common objective of maximizing resource benefits, and these are directly linked to the attainment of established optimum-spawning escapement goals. We are not aware of any publicly stated objective that proposes purposeful overfishing or resource degradation through habitat destruction.

Georgia Strait Chinook Salmon (A Case of Failing to Apply Standards)

Chinook salmon originating from Georgia Strait tributaries are managed for the naturally spawning component of the runs, although many rivers have components produced by enhancement facilities (Fig. 2). The optimum spawning escapement goal is felt to be 60,000 spawners but the contemporary spawning levels are about 30,000—50% of the goal (NPFMC 1982 and Chinook Technical Committee 1983). A large quantity of coded-wire tag recovery data exists to show the marine distributions and harvest impacts of various fisheries exploiting this resource, and several computer models are available to evaluate alternative, mixed-stock fishery management strategies. One has been in use since 1978 (Argue et al. 1983).

The harvest of Georgia Strait wild chinook salmon occurs primarily as immature 2- and 3-year-old fish (over 80% of the harvest). Age-2 fish are harvested largely by the Georgia Strait marine recreational fishery and the Johnstone Strait and central British Columbia net fisheries (Fig. 3). At Age 3, the main harvesters are Georgia Strait troll and recreational fisheries, with some ocean fishery exploitation in the central British Columbia troll fishery. The harvest of 4- and 5-year-old salmon (predominantly as mature fish) occurs mostly in ocean waters along the British Columbia coast and makes up only about 17% of the total exploitation. Total adult equivalent (i.e., as if all harvest occurred in the terminal area) exploitation rate is estimated to be 81%. This stock contains a "resident" population component; i.e., a portion of the population does not migrate to the open ocean but remains inside the Strait for most of the life cycle. Due to this marine harvest distribution, United States fishery interceptions do not impact this stock to a significant degree. Development of this conservation problem since 1974 (Fig. 4) has occurred entirely within Canadian jurisdiction. Potential solutions lie with the Canadian government as

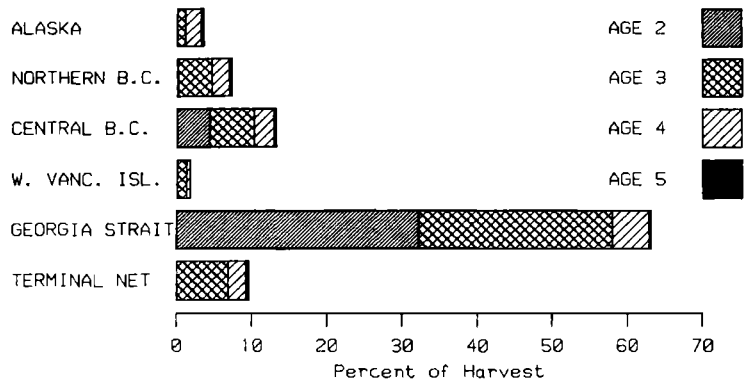

Figure 3. Harvest distribution of Georgia Strait chinook salmon as determined from coded-wire tag recovery data available before 1983. Groups tagged represent fall chinook salmon stocks on the Vancouver Island side of Georgia Strait. Mainland summer chinook would have a different distribution. Data from NPFMC (1982).

the sole manager of the salmon resource in Canada. The primary users of Georgia Strait chinook salmon are recreational fishermen from the urban areas of Vancouver and Victoria plus Georgia Strait commercial troll fishermen. Both groups are well organized and politically powerful in British Columbia.

The problem was first recognized in the late 1970's. At that time, a doubling of the Georgia Strait spawning escapement was felt to be appropriate. A major analytical effort was undertaken to develop the necessary tools for examining alternative harvest management strategies relative to this goal. The primary focus was the development of computer modeling capabilities for the mixed-stock fishery based on known stock information from coded-wire tag recovery data (Argue et al. 1983). An effort to inform the fishing public with visual aids about the problem and how the Government intended to solve it cooperatively with the users was initiated concurrently with these technical developments (e.g., Clover Productions 1980). The first important regulatory package was proposed for the 1981 season by the Canada Department of Fisheries and Oceans. This proposal would have reduced the daily bag limit from four salmon of any species to retention of only one chinook salmon in the daily limit. Additionally, the proposal included a ban on the use of sport fishing downriggers (a specialized mechanism which increases sport fishing efficiency for chinook salmon), the establishment of spot area closures, and a winter chinook salmon closure. This package was submitted to organized recreational fishing interests for comment. Recreational fishermen and support industries strenuously opposed these changes and, through the Sport Fishing Advisory Board, proposed an alternative seven-point plan which they maintained would make the same contribution to spawning escapements with less economic impact. The major thrust of this user-group package was subsequently adopted and forms the backbone of the current regulatory regime for recreational anglers. The seven-point plan included a liberal annual creel limit, an increase in the minimum size limit, daily creel limit reductions in winter, and spot closures. Implementation of all of the seven-point plan regulations was not completed until 1982. An area licensing system also was established for the commercial troll fishery.

An analysis of the seven-point plan by the Canada Department of Fisheries and Oceans biological staff indicated these management measures were unlikely to provide significant improvements in Georgia Strait chinook salmon spawning escapements. The only measurable impact was predicted to be a harvest decline in 1982, largely resulting from increasing the recreational size limit from 12 to 18 inches. This new size limit was expected to severely limit recruitment of Age-2 fish in the first year. Catches in the second year (1983) were expected to stabilize due to some Age-2 savings being transferred into the Age-3 catch. Although the 1982 harvest did decline (Fig. 4), the 1983 catches

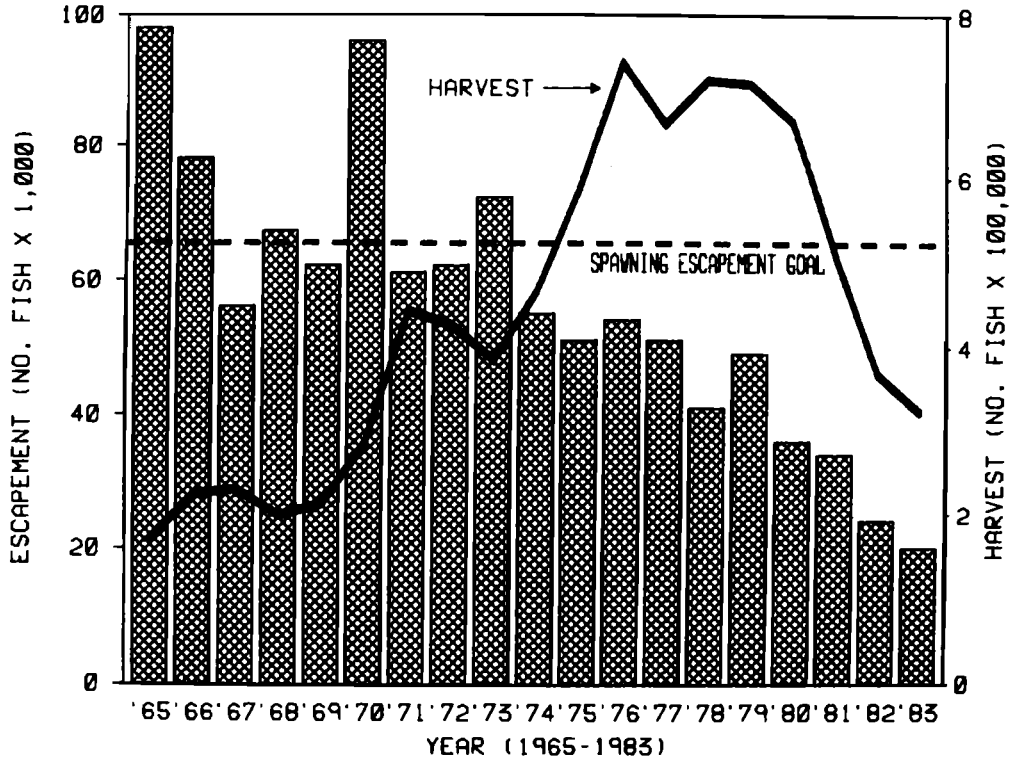

Figure 4. History of Georgia Strait chinook salmon spawning escapements and the all-stock harvest trends of the commercial troll and recreational fisheries in Georgia Strait.

appeared to have contradicted expectations by declining again, and spawning escapements have not increased or stabilized. Unfortunately, the cause of the unexpected 1983 drop cannot be categorized into stock abundance and regulatory impact components. Stock abundance in 1983 was expected to be low as a result of low 1979–1980 brood year spawning escapements.

For the 1983 season, a 25% harvest reduction (measured from the 1981–1982 average catch) was proposed under auspices of the United States-Canada Agreement for the Georgia Strait along with other chinook salmon fisheries experiencing equally severe conservation problems. Final implementation was expected to be a quota or lid on the catch. Promulgation of regulations for this reduction in the Georgia Strait fishery was explicitly tied to successful implementation of that Agreement, even though the Georgia Strait chinook salmon problem is entirely a Canadian matter. The Agreement was not implemented in 1983 and regulatory measures to reduce harvest were not promulgated. For the 1984 season, Georgia Strait management intent has been removed from the context of a Canada-United States Agreement. Thus, the inappropriate link between an Agreement and resolution of an internal management problem appears to have been broken. At this time (May 1984), the long-range management goals and the 1984 fishing plan for Georgia Strait recreational fisheries are still being intensely debated, and sport fishing interests remain strongly opposed to future restrictions.

The primary rationales given to date for not correcting the Georgia Strait chinook salmon problem have been: (1) feelings that the management measures implemented to date are all that could be "sold" to the affected user groups; (2) an inability to resolve the intense debate over allocations and equitable sharing of the conservation burden among user groups; (3) a belief that exerting high harvest rates in Georgia Strait might also exert high interception rates on United States stocks (primarily Puget Sound chinook

salmon stocks) thereby keeping the pressure on the United States to come to an agreement; and (4) unilaterally regulating Georgia Strait chinook harvest is best accomplished as part of an overall all-species interception agreement.

The management measures used through 1983 for Georgia Strait chinook salmon have been tailored to popular user-group consumption and political goals and not to a defined biological need. The management problem is quite apparent, the opportunity for its resolution is equally self-evident, and the management authority is clear. There appears to have been a failure to apply standards aimed at increasing spawning escapements. Corrective actions will now require substantial and unpopular curtailments of the harvest for at least two politically powerful user groups in British Columbia.

The Canadian government now faces a dilemma in trying to evaluate the unexpected declines in 1983 chinook salmon harvest and spawning escapement. A decision must be made on whether the seven-point regulation plan has had an unexpected impact or that there has been a continued decline in stock abundance. If the decline has continued, the appropriateness of the proposed United States-Canada 25% catch reduction will need serious re-evaluation. These decisions will have to come from the present data base in the face of an historically severely overfished resource. Failure to separate the Georgia Strait stock situation, a purely Canadian problem, from the overall international interception question and failure to separate user group allocation issues from the overall conservation problem have needlessly delayed implementation of conservation measures.

Klamath River Chinook Salmon (A Case of Compromising Standards)

The Klamath River fall chinook salmon stock is a large stock with an optimum spawning escapement goal of 115,000 adults (97,500 natural plus 17,500 hatchery fish) (Fig. 2). The management objective is maximization of the sustainable harvest of the natural stock component. The 1983 spawning escapement level was 45,600 (31,500 natural and 14,100 hatchery fish), or only 32% of the natural stock goal. Sufficient coded-wire tag recovery data exist to delineate the harvest profile and rates for this stock. By the 1983 season, computer modeling capabilities were available to analyze alternative ocean-fishery management options. The State of California has management authority over non-Indians in the terminal areas and over California ocean fisheries. Other harvest management jurisdictions with authority over the fate of this stock are the State of Oregon off Oregon, the United States federal government in the Fisheries Conservation and Management Zone (FCZ), and for Indian fisheries, the U.S. Department of the Interior and the Hoopa Valley Tribal Business Council.

Ocean harvest of Klamath River fall chinook is primarily by the northern California and southern Oregon commercial troll fisheries (Fig. 5). A sport fishery and Indian gill-net fishery exploit this stock in the river. All of these user groups are politically quite influential. The extent and nature of Indian fishing rights in the Klamath River have not been resolved, and state authority to control Indian fisheries is presently unclear (PFMC 1983). The latter situation has led the State of California to accept terminal harvest by Indian users as uncontrollable. In addition, the state regulation of in-river recreational fisheries has had little beneficial impact on runs returning at levels far below the spawning escapement goals.

Ocean fishery management aimed at increasing spawning escapements can come from unilateral or joint action by the states of California and Oregon, and from the United States federal government. Apparently, regulation of Indian fisheries can come only from the Department of the Interior and/or the Hoopa Valley Tribe. The options available would require restricting harvests of these primary user groups and, based on recent years' PFMC experience, these would surely be unpopular in ocean fisheries. Formal recognition of the problem occurred in 1978. Since then, the Klamath River problem has been an annual topic for consideration by PFMC. The actions by this body and the federal government since 1978 provide a concise example of how the institutional management system has failed to deal with this conservation problem.

The spawning escapement goal of 115,000 was established by the PFMC for the 1979 season. It was recognized that this escapement level had not been achieved in either 1977 or 1978. Klamath River fall chinook salmon abundance was expected to be depressed in 1979 because of droughts impacting juvenile production from the 1976 and 1977 brood years. In spite of these known circumstances only minor restrictions

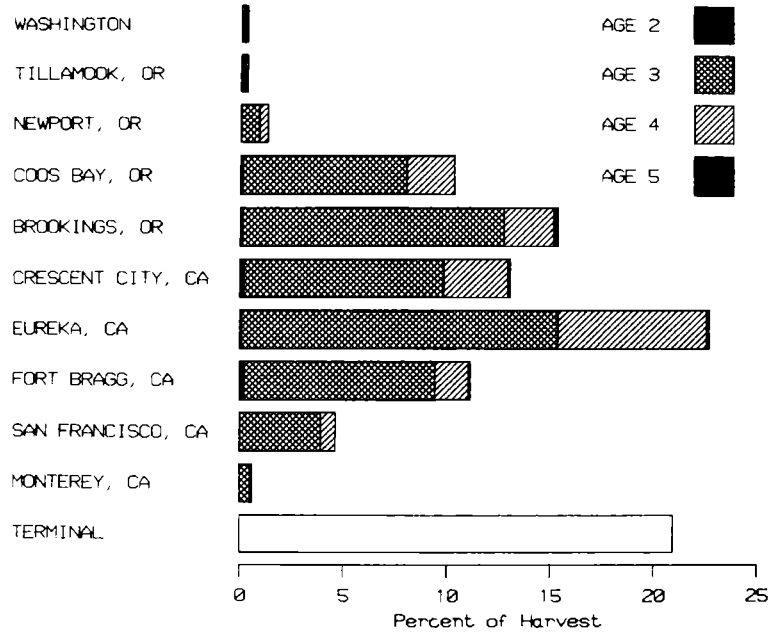

Figure 5. Harvest distribution of Klamath River fall chinook salmon as determined from coded-wire tag recovery data from the 1976-1978 brood years. Terminal harvest is by Indian net and recreational fisheries and the remainder is commercial troll and recreational harvest by ocean fisheries.

were implemented in the 1979 California-Oregon troll fishery. The ocean fishery harvests in the Fort Bragg to Coos Bay region were 35% above the 1971–1975 average and the terminal fishery harvest rate also increased. The resulting terminal run size and spawning escapements declined accordingly (Fig. 6). PFMC responded to 1979 overfishing and drought impact by adopting an interim spawning escapement goal of 86,000, or 75% of the optimum goal for 1980. The commitment also was made to reach the 115,000 optimum in one complete brood cycle (i.e., 4 years). The rationale given for adopting an interim goal was to avoid severe disruption of California ocean fisheries (PFMC 1980). The long-term lost harvest potential resulting from deferring achievement of the optimum escapement goal was not considered. To achieve the 1980 interim goal, a single time/area closure was instituted off northern California (June 1 to July 15 from Cape Vizcaino, California to the California-Oregon border). In spite of this measure, the catch declined only to the level that existed prior to active ocean fishery management for this stock (Fig. 6). The resultant 1980 return to the river and, concomitantly, the spawning escapement declined further.

Prior to the 1981 season, California troll fishermen declared there was an economic disaster even though the 1980 harvest was nearly equal to the 1971–1975 average. Stock abundance was expected to be at about the same level as in 1978. Again, in response to user-group pressures for short-term relief, PFMC further delayed its commitment to achieve the optimum spawning escapement level—this time to a two-cycle (i.e., 8-year) program. The ultimate "health" of this stock thereby was deferred until 1988. To achieve the new interim goal, the July closure was eliminated, and a quota equal to the 1971–1975 average catch was established for northern California. Oregon was excluded from this quota management program. This management measure equated to no directed management activity. The 1981 terminal run size increased over the 1980 level, but benefits to spawning escapement were offset by a record high terminal harvest rate of 51% of the total adult return to the river. Indian gill-net fisheries had a 43% harvest rate, with the sport fishery harvesting the re-

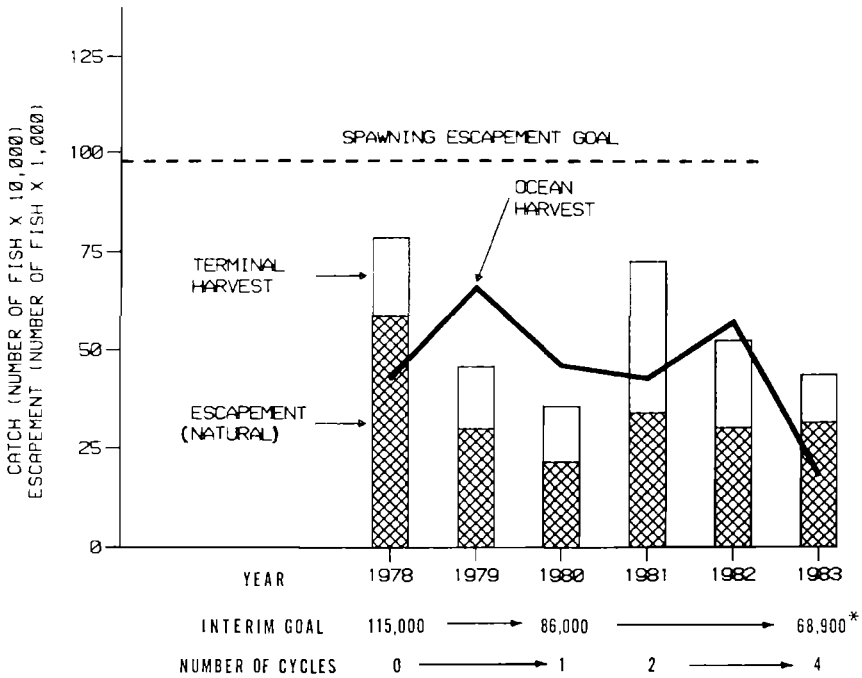

Figure 6. History of Klamath River fall chinook salmon spawning escapements, terminal harvests, and the all-stock harvest trends in the Fort Bragg, California-Coos Bay, Oregon ocean fisheries. Major changes in management goals noted below graph. Asterisk means definition of escapement goal changed to river returns, not spawning escapement.

mainder. Spawning escapement was 38,300 or more than 50% below the interim objective of 86,000 fish and no progress was made toward the optimum goal of 115,000 (Fig. 6).

In 1982, abundance was expected to be similar to 1978 and 1981. Economic hardship arguments once again were vociferous against ocean catch reductions. The 86,000 interim goal and two-cycle rebuilding schedule was maintained, but the initial regulations proposed by PFMC were a liberalization over those of 1981 (removal of the quota and added 2 weeks' fishing time in June). The net effect of these liberalized proposals was expected to be a terminal run of 69,000 salmon and, assuming a constant in-river harvest of 35,000, a spawning escapement of 34,000 fish (PFMC 1982). In other words, the proposed regulations would have reduced the run size and spawning escapements below 1981 levels and intentionally not addressed even the interim escapement goal. The Secretary of Commerce, who actually promulgates regulations under the FCMA, returned the proposed PFMC regulation package for reconsideration, citing the fact that any management regime must "move toward achieving the interim spawning escapement goal by achieving a significant increase over 1981 escapement" (memorandum from W. G. Gordon on March 31, 1982, to H. McDevitt and E. C. Fullerton, Pacific Fishery Management Council, Portland, Oregon).

PFMC reconsidered its 1982 regulation proposal and recommended an early-season quota (140,000) in the area of Point Arena to the California-Oregon border and a 2-week September closure in this same area. The impact of this proposal was expected to be a terminal run size of 76,000 and a spawning escapement of 41,000. Because this terminal run would be essentially the same as in 1981, this meant that any projected spawning escapement increase above 1981 levels would somehow have to come from terminal-area fishery restrictions. No net change in harvest impacts was anticipated for the ocean fisheries between 1981 and 1982. Again, the Secretary viewed these measures as inadequate (let-

ter from W. G. Gordon on April 22, 1982, to H. McDevitt, Pacific Fishery Management Council, Portland, Oregon). This time he responded with a Secretarial Amendment independent of the PFMC process. This action presumably represented implementation of the checks and balances aspects of the Fisheries Conservation and Management Act of 1976 (United States Public Law 94-265). The Secretary's regulations that eventually were promulgated did not incorporate PFMC's ideas of an early-season quota or a September closure, but instead utilized an additional 1-week June closure as the only means for achieving a significant step towards the interim goal. Another Secretarial commitment was made for an August in-season update of stock condition as a basis for in-season regulation adjustments if necessary. The projected result of these actions was an actual decrease in the terminal run size (74,000) and a spawning escapement of 39,000. This management action was thus more liberal than the previously rejected PFMC proposals.

No in-season update was made during the 1982 season and ocean harvests once again increased. The actual effect of the Secretary's amendment turned out to be a decline in the size of the terminal run from 1981 and no significant change in the wild stock spawning escapement. Thus, the "checks and balances" portion of the FCMA failed in 1982.

This management trend for Klamath River fall chinook salmon was continued in 1983. Serious debate over the appropriateness of the 115,000 spawning escapement objective prompted formation of the Klamath River Task Force. This body was made up of interested user groups and technical participants and concluded prior to the 1983 season that the existing optimum spawning escapement goal of 115,000 was the best estimate available and should be used in the future management of this stock (PFMC 1983). Pre-season 1983 abundance forecasts for wild components of the run indicated a run size comparable to 1982 resulting from record low spawning escapements in 1979 and 1980 (2 years of active management). Instead of responding to the continuing conservation needs of this stock, economic hardship arguments accepted in previous seasons again prevailed in 1983. Conservation goals for this stock were changed again in three important respects.

First, the rebuilding schedule was once again lengthened, this time to a four-brood cycle (i.e., 16-year) program. Second, the annual escapement goal was changed to 4-year averages (the 1983–1986 average goal is 68,900). Along with this change, the explicit PFMC management intent is to have constant ocean fishery regulations for each 4-year period unless "a serious resource crisis develops" (Carper, 1984). What constitutes "a serious resource crisis" has not been defined and the intent is for this to be a Pacific Council judgment as circumstances develop in the future. And third, the goal was changed from spawning escapements (past all fisheries) to ocean escapements (or simply returns to the river mouth). This third change resulted from confusion over authority to control the terminal area Indian gillnet fishery and from an apparent lack of resolve to further restrict river sport fisheries.

The consequences of these changes are scheduled overfishing until 1999, a loss of management responsiveness to annual population changes, and spawning escapements that will amount to whatever is left over after terminal sport and net fisheries. If these fisheries are able to exert terminal harvest rates between 21 and 51% as they have since 1978, an ocean fishery escapement or terminal run size of between 146,000 and 235,000 would be necessary to achieve the optimum spawning escapement level.

The actual 1983 total stock abundance turned out to be extremely depressed, with northern California troll fishery harvest declining nearly 70% from the 1982 level. Troll fishery effort declined by 60% in response to this poor fishing success. Along with this catch decline, the average weight of chinook salmon landed by the California troll fishery declined to about 70% of the 1971–1975 average. Reduced fecundity and average egg size also were documented for Klamath River chinook. The 1983 El Niño is believed responsible for the major part of these changes (PFMC, 1984). A mass of warm, high-salinity water associated with El Niño apparently suppressed upwelling which is a major factor determining primary productivity in California-Oregon coastal waters. The actual in-river 1983 run size was 57,900 adults (Fig. 6), or a slight decrease from the 1982 level. Terminal harvest rates declined from 35 to 21% (14% Indian and 7% sport) between 1982 and 1983. Natural stock spawning escapement increased slightly (5%) to 31,500 adults.

The Salmon Plan Development Team (SPDT)

of the PFMC projected for 1984 that a serious resource crisis existed (SPDT 1984a). The Team cited a 77% decline in the 1983 return of jacks (precocious 2-year-old males) over the previous record low count as the primary basis for their concern. The Team concluded these data could mean the smallest return of 3-year-old adults since 1979, and that such a small run "would virtually guarantee that the 1983–1986 average ocean escapement goal of 68,900 could not be met even with no ocean fishing" (SPDT 1984a). In response to this prediction and considering the stated management objectives, the Team recommended a complete closure of the northern California/southern Oregon troll fisheries which most importantly impacts this stock (i.e., Cape Vizcaino, California to Cape Blanco, Oregon).

The appropriateness of this recommendation with respect to the rebuilding program was verified by the PFMC's Scientific and Statistical Committee. This Committee also considered the likely economic impact of the Team's recommendation and concluded that "although it . . . [the Team's recommendation] will result in significant hardships on current harvesters, a departure from . . . [this recommendation] will cause greater losses of economic value in future years" (Scientific and Statistical Committee statement on salmon issues to the PFMC on April 11, 1984, Pacific Fishery Management Council, Portland, Oregon).

Predictably, the Team's recommendation generated substantial debate and criticism not only from the fishing industry but also this time from the political system as well. This criticism culminated in California State Senate Joint Resolution 44 which was unanimously passed. This resolution clearly stated the Senate's opinion ". . . that the Legislature of the State of California rejects the 1984 salmon plan recommended by the Salmon Plan Development Team . . . and . . . calls for the immediate resignation of the Salmon Plan Development Team." It is unfortunate and inappropriate that the California State Senate chose to expose the Salmon Plan Development Team to the same political pressure tactics traditionally used to influence decisions made at the political level (e.g., Council or Secretary of Commerce). All of the Council's Plan Development Teams carry the primary responsibility for providing clear, unbiased, and technically sound management recommendations. Use of such tactics on the Team represents a deliberate attempt by the California state political system to subvert this mandate.

The PFMC eventually recommended a troll season but in the face of this compromise and in spite of the California State Senate's clarion call of disapproval, the Team has remained convinced of the inappropriateness of allowing a harvest: ". . . a zero troll fishery between Cape Vizcaino and Cape Blanco in 1984 continues to be the only option that will satisfy the Council's rebuilding schedule for Klamath River chinook salmon" (SPDT 1984b). The Team estimated the 1984 regulatory package adopted by the PFMC will result in a return (51,000 adults) which is less than the 1983 return (SPDT 1984b). The Team further concluded that, if this run size is the outcome in 1984, "near-record [ocean] escapements will be necessary in 1985 and 1986" to meet the 1983–1986 average ocean escapement goal of 68,900 and "that record [ocean] escapements are extremely unlikely in 1985 and 1986" (SPDT 1984b). Thus, the actions for 1984 represent a conscious decision to not meet the objectives and goals compromised for Klamath River chinook salmon over the last 5 years. The Secretary of Commerce has approved these regulations, apparently concurring with the PFMC's compromise decision. His approval of 1984 regulations which do not adhere to the Klamath River rebuilding schedule is also a conscious decision to not implement the MFCMA checks and balance system to ensure achievement of the objectives for rebuilding Klamath River chinook salmon.

The active management program to date has, at the very least, scheduled overfishing of this resource until the next century, if not permanently. With the past track record of attempts to manage for terminal run sizes large enough to achieve interim spawning escapement objectives, the probability seems rather remote that large runs can be secured for both optimum spawning and large terminal harvest needs. Establishment of constant ocean fishery regulations violates a primary fishery management need for dynamic regulatory response to annual population fluctuations (e.g., in response to factors such as the 1983 El Niño).

The rationales justifying inaction to date have been: (1) declarations of user group hardship; (2) de facto acceptance of uncontrollable user groups; and (3) in-river fishery needs have higher priority than spawning escapements. Situational man-

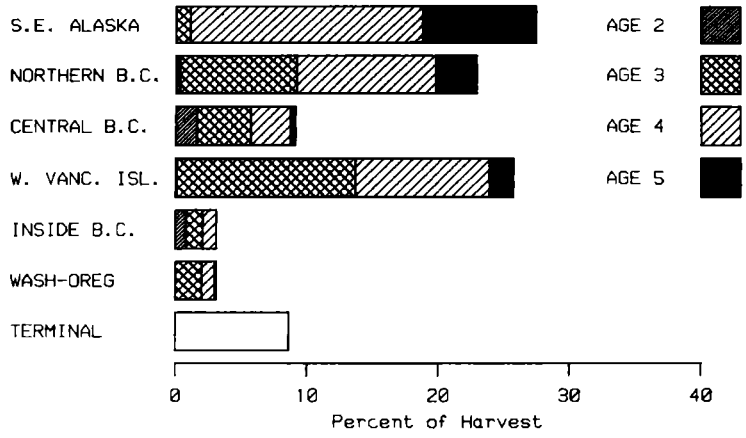

Figure 7. Harvest distribution of Columbia River "bright" fall chinook salmon, as determined from coded-wire tag recovery data available before 1982 and updated to the 1982 regulatory regime using the Washington Department of Fisheries/National Bureau of Standards Catch Regulation Analysis Model (Johnson 1975). Terminal harvest is Indian net combined with non-Indian commercial net and recreational. The remainder are commercial troll and recreational fisheries in the ocean.

agement standards have been adopted for Klamath River chinook salmon where the primary response to failing resource health has been nearly continuous compromising and ultimately ignoring the goals for the stock rather than restricting fisheries to achieve the goals.

Upper Columbia River "Bright" Chinook Salmon (A Case of Conditional Standards)

The last, viable, naturally spawning chinook salmon stock in the upper Columbia River is known locally as upper Columbia River "brights." This name originates from the fact that these fish retain a bright or semi-bright skin condition as they migrate over Bonneville Dam, the first (i.e., downstream) dam at River Mile 146. This contrasts markedly from the dark skin coloration of co-mingled hatchery fish. The natural stock spawns mainly above the fourth dam (McNary Dam) in the last free-flowing portion of the mainstem Columbia River at approximately River Mile 380. This stock has an older age structure with a dominant escapement of 4- and 5-year-old adults. Along with delayed maturity, upriver "brights" are characterized by extensive northward marine migrations, with most of the ocean fishery harvest occurring in northern British Columbia and southeast Alaska (Fig. 7). Through 1983, an in-river harvest allocation requirement (60% Indian—40% non-Indian) has existed for all fall chinook salmon stocks ("brights" plus hatchery fish) migrating above Bonneville Dam. The upriver "bright" optimum spawning escapement goal is 40,000 adults over McNary Dam, and 1983 was the first year since 1973 that the goal was met. Recent coded-wire tag data exist for this stock, and computer modeling capability has been available since 1981 to evaluate alternative ocean regulatory options (Johnson 1975). Juveniles in this stock are impacted adversely by hydroelectric development projects in the Columbia River system. The ocean distribution of this stock subjects it to the management jurisdictions of Canada, the states of Alaska, Washington, and Oregon, and the United States federal government in the FCZ. This stock is directly impacted by the results of United States-Canada salmon interception treaty negotiations. When maturing adults return to the river, "brights" are impacted by decisions made once again by hydroelectric developers and by the terminal area harvest management activities of Washington and Oregon, the Indian tribes of the Columbia River Basin, and the U.S. District Court. Starting in 1980, new adult passage problems were documented for this stock as the run traveled past the four mainstem dams below the

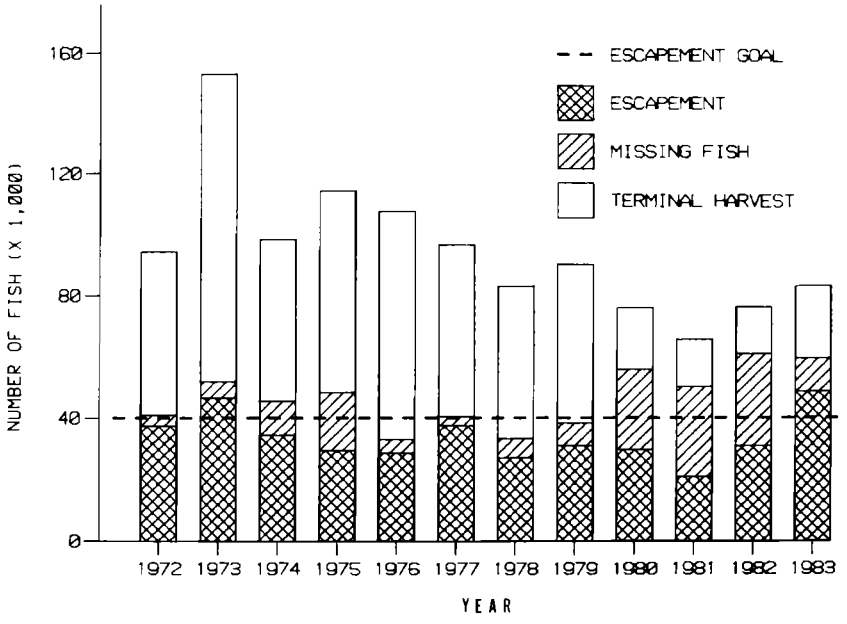

Figure 8. History of Columbia River "bright" fall chinook salmon spawning escapements, terminal harvests, and the "missing fish" phenomenon. The number of "brights" missing between dams in 1972-1976 is overestimated in this figure. Estimates of the number of "brights" spawning in the Deschutes River (a tributary above Bonneville Dam) are not available for these years and are included as missing fish. These tributary "turn-offs" were appropriately accounted for in 1977-1983.

spawning area (Pattillo and McIsaac 1982). These losses are unexplained and this missing-fish phenomenon accounted for about 50% of the run between Bonneville and McNary dams between 1980 and 1982. Along with declining runs, this missing-fish phenomenon has been the primary reason for spawning escapement shortfalls in recent years. Achievement of the spawning escapement objective in 1983 can be attributed to improved adult passage conditions between dams (Fig. 8).

More than 18 separate institutional entities have regulatory impact on this stock at various stages of its life cycle. Logistical problems for a coordinated approach to the wise use of this resource are a substantial challenge. Given the different philosophies of these institutions, the job of maximizing resource benefits for all user groups is extremely difficult. Potential resolution to upriver "bright" conservation problems, from a harvest management perspective, can arise either from joint state action, unilateral or joint state/federal government action, mandated action by court order, or unilateral or joint international action on the part of Canada. Ongoing attention obviously is needed to correct the environmental problems generated by hydroelectric development in the Columbia River. The lead agency directing these environmental efforts is the Northwest Power Planning Council (NPPC) established through Public Law 96-501, the Pacific Northwest Power Planning and Conservation Act of 1980.

The terminal harvest has been restricted gradually since 1973 in response to declining terminal run sizes, with 1982 representing the lowest terminal catch on record (Fig. 8). Efforts designed to minimize the terminal harvest of "brights" have met with mixed results. Innovative approaches designed to shift fishing effort away from the upriver "bright" stock have been successfully implemented for the non-Indian, mixed stock fisheries in the river. Similar proposals for Indian fisheries have been implemented less successfully. The tribal assertion given in U.S. District Court for not changing the geographic scope of

the Indian fisheries has been that Indian rights to fish usual and accustomed fishing areas supersede the objective of eliminating all directed harvest (Arnett et al. 1982). Consequently, some directed Indian fishery harvest has occurred in the river on escapement-bound fish. A central rationale put forward to justify this directed harvest is the concept that prior non-Indian incidental harvest justifies directed Indian fishery harvest as an equitable conservation burden (Arnett et al. 1982). For "brights," the opinions of the U.S. District Court have been in accord with this rationale and also have placed conservation secondary to allocation needs:

> "As I've said before, this court is concerned with the fundamental law of the land that is the Indian fishing rights under the treaties of Governor Stevens; and secondly, the conservation of the salmon fishery, whatever may be the species." (Craig 1981)

Potential savings from management measures on the terminal harvest are now near the practical limit because the primary harvest of this stock is by the ocean fisheries. The important ocean fishery management opportunities for "brights" are in northern British Columbia and southeast Alaska (Fig. 7). Each year since 1981, management recommendations have been formulated based on the needs of this stock as an indicator stock present in the mixed-stock fisheries in northern British Columbia and southeast Alaska (Table 2). Prior to each of these seasons, it was well documented that virtually all natural stocks contributing to the catch in these areas were seriously overfished (Joint Technical Staffs 1981; Washington Department of Fisheries 1981, 1982; Chinook Technical Committee 1983). Actually, other chinook salmon stocks were more seriously overfished than Columbia River "brights" (Table 1). The use of "brights" as an indicator stock for making management recommendations simply reflected the fact that good information and computer modeling capabilities existed for this stock, and little or no information had been compiled for the majority of the stocks in the fishery. Thus, recommendations for the benefit of this stock represented minimum measures required for the total stock base supporting the fisheries.

A framework did not exist for coordinated action between the United States and Canada in 1981 and 1982; therefore, management recommendations were oriented toward reductions in southeast Alaska waters and continued conservation management in the terminal area. The needed ocean fishery reduction relative to the spawning escapement goal in these years was for a 29% southeast Alaska harvest reduction in 1981 and a 52% reduction in 1982, both measured from the previous year's catch (Washington Department of Fisheries 1981, 1982). In contrast to this need, the reductions implemented in southeast Alaska were 15 and 4%, respectively. The main rationales given in these years for this limited reduction in southeast Alaska chinook fisheries were: (1) it's not fair to manage Alaska fishermen when Canadian fishermen are not similarly regulated; (2) it's irrational to manage the whole Alaska chinook salmon fishery for the sole benefit of upriver "brights"; (3) terminal harvests and hydroelectric dams will negate any savings generated by harvest cutbacks in southeast Alaska; (4) high southeast Alaska harvest rates would beget high interception rates on predominant Canadian stocks, thereby exerting pressure on Canada during salmon interception negotiations; and (5) proposed measures would impact the fishing industry too severely. Important elements of this logic were explained by McVey (1982) who described the United States government rationale in 1982:

> "As the representative of the Secretary of Commerce, the [southeast Alaska] quota of 128,000 chinooks has had a lot of appeal, because there's little doubt in my mind that the people who look out for the Secretary's interests would consider this quota more than adequate. Further, I think Judge Craig would be satisfied that the Council [NPFMC] had been responsive to the concerns of the tribes in getting additional fish to the Columbia River. It would help me with my own personal concern about the status of chinook stocks. I think we're on a disaster course. A course we've been on and I hope to see it change. This would be a major move, almost a unilateral move toward coordinated coast wide management. Taking those things into consideration, however, I still must balance that against the effects on the Alaska troll fisherman. This would be a 53 percent reduction on top of 16 percent last year. We have no prospect for counterpart reductions in Canada so that we can be certain the fish saved by this drastic reduction are passed on into the escapement. Therefore, while

Table 2. Conservation needs of upper Columbia River "bright" fall chinook salmon expressed as percentage harvest reductions.

Action	Percentage catch reduction by year			
	1981[a]	1982[a]	1983[b]	1984[d]
Recommendation	29[c]	52[c]	25	30
Implemented	15	4	12	12
Fisheries	Southeast Alaska	Southeast Alaska	Southeast Alaska and northern British Columbia	Southeast Alaska and northern British Columbia

[a] Percentage reduction from previous years' harvest.

[b] Percentage reduction from the 1981–1982 average: the 25% figure was a Canadian Government recommendation considering the needs of all depressed stocks in the Georgia Strait, northern British Columbia, and southeast Alaska fishing areas. The 12% figure was the proposed reduction negotiated into the draft United States/Canada treaty. This level of harvest reduction was not implemented as a result of the nations failing to reach agreement.

[c] Washington Department of Fisheries recommendation using "brights" as an indicator stock.

[d] Percentage reduction from the 1983 catch level. The 30% figure was the recommendation of the Chinook Technical Committee (1983). The 12% figure is not a formal agreement between Canada and the United States. At this time (May 1984), this level of harvest reduction represents an informal understanding of 1984 management intent between the nations.

> it would solve a lot of problems for me personally and for the judge and for the Secretary of Commerce, I am unable to support this drastic reduction."

Similar logic also appeared from the State of Alaska as explained by Pennoyer (1983):

> ". . . it was fairly obvious and has been to the [Alaska] Board [of Fisheries], Council [NPFMC] and I guess the public and everyone else for a considerable period of time that Alaska didn't hold the key by itself to the conservation problems of stocks that were measured contributors to the Alaskan fishery. In the south and the Columbia River we did not hold the only key at least to the fate of Columbia River juveniles or adults . . . as long as everybody else kept fishing, what we did was not going to solve conservation problems in the magnitude that are indicated on these charts [presented during testimony]."

In Canada, the 1980–1981 conservation requests by the State of Washington for the benefit of "brights," as well as all the other depressed Canadian and United States stocks, were largely ignored. The two main reasons given for this inaction were (1) questioning the fairness of Canadian management without commensurate Alaska action, and (2) a judgment that restricting Canadian chinook salmon fisheries is not appropriate without an overall interception agreement for all species. The Canadian requirement for commensurate Alaska action was clearly stated by Canada (aide-memoire of March 4, 1983, by the Department of External Affairs in Ottawa):

> "Although the Canadian authorities would still seek to develop cooperative arrangements to rebuild depressed chinook stocks, it would be unreasonable to expect them to take the necessary measures in the sport and commercial fisheries without corresponding action in Alaska."

For the 1983 season, the Canada-United States treaty forum allowed consideration of joint action to address the broad-based chinook salmon conservation problems confronting both countries. A Canadian proposal was made at this forum for a 25% harvest reduction in 1983 (measured from the 1981–1982 average catch) in a selection of identified "conservation-status" fisheries, including the northern British Columbia and southeast Alaska areas. Both Canadian and United States technical staffs reviewed this proposal and jointly concluded this was indeed a significant step toward resolution of many chinook stock problems. For upriver "brights," it was estimated this measure would allow achievement of the optimum spawning escapement goal in 4 years, even with the "missing-fish" phenomenon and unavoidable, incidental terminal harvests. This proposal, however, was finally compromised in the draft treaty to a 12% reduction (Table 2). This reduction of the biological recommendation was in deference to Alaskan concerns that a 25% harvest reduction would excessively impact the troll fishing industry, and that a lesser level would be appropriate until the user groups gain confidence in Canada's resolve to meet its conservation commitments. Before the 1983 fishing season, further State of Alaska con-

cerns regarding the equity of chinook salmon conservation measures was one of the two major obstacles which prevented acceptance of a treaty by the United States, and consequently these conservation measures were not implemented.

Negotiations for the 1984 season did produce "near agreement" for chinook salmon. Both countries agreed on a two-cycle rebuilding program and an initial fishing regimen to start the rebuilding process. For the aggregate of chinook salmon stocks of concern, a joint United States-Canada Chinook Technical Committee recommended a 30% catch reduction from the 1983 levels. Canada made such a proposal but because of continued United States concerns over economic hardships to Alaska fishermen, this proposal was again compromised to a 12% reduction in fisheries north of Vancouver Island (Table 2). These negotiations failed to resolve outstanding issues with other species and the fate of the treaty, of which chinook conservation is only one issue, is unclear. At this time, the reductions contemplated represent an informal understanding of 1984 management intent between the nations.

This process of recognizing political realities also has pervaded the work by the biological staffs. For example, the January 1983 NPFMC Salmon Plan Development Team meeting was started with a recommendation by two members that "the Team confine its discussions to only those management options which are *politically viable.*" Starting the political process deep within the technical ranks of the profession raises serious ethical questions and definitely relegates conservation needs behind the perceived needs of the political process. There is a need to maintain a clear separation between political and biological decision-making processes.

The Northwest Power Planning Council (NPPC), which has a major environmental responsibility to this stock, has approached this problem from another perspective. The NPPC has been formulating comprehensive mitigation plans for the Columbia River anadromous fish stocks adversely impacted by hydroelectric development in the Columbia River Basin (NPPC 1982). These plans will include efforts to improve the freshwater fate of upriver "brights." The Act establishing this endeavor explicitly gives the Bonneville Power Administration authority and responsibility to use its legal and financial resources to "protect, mitigate and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries . . ." (NPPC 1982). The overriding principle of the Act is clear: "hereafter fish and wildlife interests and power interests shall cooperate as partners in the development, operation, and management of the Columbia River hydroelectric system for the benefit of all citizens of the Pacific Northwest" (NPPC 1982). NPPC has developed a plan to fulfill these objectives, but throughout these efforts it has been careful to connect ocean fishery management to its commitments to "protect, mitigate and enhance fish . . . affected by hydroelectric development" (NPPC 1982). The NPPC developed program measures that not only provide for consultation and coordination with appropriate harvest management agencies but also has developed measures that ". . . require adequate ocean harvest regulations to be imposed before the Council will approve funding of certain mitigation and enhancement efforts" (NPPC 1982). The clear intent of the NPPC is that ". . . fisheries management entities must improve survival of these [Columbia River] stocks through effective regulation of harvests" (NPPC 1982).

A common coast-wide rationale for inaction exists in the case of "brights" specifically and all similar stocks generally. The legal and governmental entities that now have responsibility for the health of this stock are essentially asking: "Why should I conserve if the other parties won't?" One group after another has held back its conservation measures until the "other person" makes the first move. The only important party which lacks representation in this debate are the fish themselves. No consistent set of management standards is being applied to this specific stock or to all highly migratory stocks in general. Instead, each regulatory entity is making its standards conditional on the actions of others, meanwhile continuing to adversely impact the resource. There is a coast-wide failure to recognize the individual stewardship responsibility each political and judicial entity has to the long-term health of these stocks. This type of conditional ethics is simply an example of the tragedy of the commons (Hardin 1968), but this time it has been institutionalized by the regulatory agencies. Ironically, these entities have been established to remove such obstacles to professional management and not to use such logic as justification for inaction.

The Challenge

The complexity of chinook salmon management results primarily from the species' propensity for marine wanderings across political boundaries, the present seriously overfished stock condition, and from adverse impacts of competing uses of the freshwater environment. Data and analytical problems remain but current capabilities are adequate to solve the problem. Mixed-stock harvest management programs for marine fisheries on this species have failed to recognize the fundamental management tenet that an adequate surplus of fish is required before a directed fishery is permitted. Instead, the burden has been to conclusively prove overfishing before a fishery closure would be considered. Even in instances where this inappropriate burden has been met, fisheries have very often remained open or insignificantly modified due to mitigating circumstances. Principles have not been established to provide a framework for fundamental management decisions regarding where, how, when, and how much harvest can be allowed. The crux of the management problem is the lack of state, national, and international commitment to resolution of this problem and not any significant technical ambiguities.

Most of the harvest management measures developed to date have been directed at the short-term fishery or political needs, i.e., minimizing short-term fishery impacts and maintaining high interception rates on fish originating in another political jurisdiction. Sound management would act to minimize fishery impacts on depressed stocks, thereby according highest priority to the long-term health and productivity of the stocks. Present-day examples of management response to short-term needs in the face of overfished runs include: (1) failure to address purely internal but politically sensitive conservation problems under justifications such as: "a solution is not politically viable" (e.g., Georgia Strait chinook salmon); (2) adoption of interim spawning escapement goals or excessively deferring achievement of goals justified by unquantified user group hardship rationales (e.g., Klamath River fall chinook salmon); and (3) failure to implement consistent management standards for proper harvest of highly migratory stocks, justifying this with a "two wrongs make a right" type of logic (e.g., upper Columbia River "bright" chinook salmon). While we have used specific stock examples here, the generic problem they reveal should be the focus of attention given to resolution of chinook salmon management issues.

The ongoing United States-Canada negotiations on salmon interceptions are the most significant event affecting the future of many depressed chinook salmon stocks. Even this event, however, represents a heavily politicized compromise solution which will have a substantial resource cost associated with its implementation. An agreement was nearly reached in 1983 but concerns regarding the equity of chinook conservation measures was one of the two major reasons given by the State of Alaska in rejecting the treaty. These concerns prevented acceptance of the treaty in the United States, thereby delaying implementation of conservation measures in 1983. Further negotations in 1984 came close to an accord on chinook conservation but, at this time (May 1984), the fate of this progress is unclear due to a failure to resolve issues other than chinook conservation.

The apparent priority system assigned by U.S. Federal Court also fails to provide clear direction upon which the various political entities can build a professional management program. The "allocation first" priority applied by the court does not direct litigation toward the people adversely impacting the resource but directs it instead towards securing additional fishing on already depressed stocks. Such a priority system will not impact entities desirably outside of the court's jurisdiction (e.g., the Government of Canada). A valid question yet to be asked is: what are the long-term needs of the resource? Only through long-term stewardship responsibility to the resource can benefits to all present and future users be maximized. Present policies clearly capitulate to the short-term desires of those who now exploit the resource for political or economic goals.

Successful chinook salmon management must embody the fundamental objective of providing enough fish for optimum spawning escapements. It is equally clear that the fundamental environmental objective must be recognition of a requirement to not diminish the resource through development activities. The decision-making process will be difficult because there are no easy ways out. Individual acceptance of responsibility to the resource will be required. Each political and judicial entity, however, has a very real opportunity to help significantly through professional management aimed at increasing spawning escapements and by protecting the resource

from alternative habitat use. The only viable fishery management solution will be significant cutbacks in the allowable harvests and these reductions will generate substantial controversy. These decisions will show whether or not governmental agencies and judicial entities are willing to put the long-term health and well-being of the resource in front of pressures to keep overfishing.

Unfortunately for our profession and for natural chinook salmon runs, too many fish biologists along the west coast have passively accepted or even actively supported abrogation of professional standards for the various socio-political alternatives described here (e.g., the NPFMC Salmon Plan Development Team and upriver "bright" case). Whether or not these alternatives were "recognizing political realities" or responding to "social and economic circumstances" or for "other mitigating circumstances," they have been advocated without explicit assessment of their impacts and have inappropriately extended the political process to the biological staff level. The application of political pressure tactics aimed at technical groups (e.g., the California State Senate in the Klamath River case) has also hindered resolution of these conservation problems. Deviation from professional standards has no place in the biological arena. Biological staffs must operate under a clear mandate to apply professional, not political, standards to their work. When compromised biological recommendations have surfaced, the political processes have further watered them down using the same socio-political justifications. The needs of the chinook stocks too frequently have been relegated to a priority lower than the perceived needs of the political process or groups exploiting the resource or habitat. The obligation for providing technically sound management options must rest with the biological staffs.

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