Economic Effects From Columbia River Basin Anadromous Salmonid Fish Production

Independent Economic Analysis Board

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TABLE OF CONTENTS

MAPS, TABLES AND FIGURE

APPENDICES

EXECUTIVE SUMMARY

The Northwest Power and Conservation Council (NPCC) has requested that the Independent Economic Analysis Board (IEAB) prepare an estimate of the economic value of commercial, tribal, and recreational fisheries' on Columbia River Basin salmon and steelhead, both wild and hatchery (NPCC's IEAB Task Order 87). This report was prepared to describe some of these values. The report focused on current fisheries, their contribution to local economies, and the sources of the salmon and steelhead that support these fisheries. It also provides some historical context and identifies significant changes that have affected fisheries over time.

Fishing has a long history in the Columbia River Basin. To the Indians living along the Columbia River, salmon were their lifeblood, essential to their subsistence, their culture, and their religion. A focal point of this great salmon fishery for many centuries was Wy-am, one of the longest continuously occupied sites on the North American continent. Located near Celilo Falls on the Columbia River, the Wy-am area, before the Dalles Dam in 1957, was a commercial center during the fishing season. In autumn, as many as 5,000 people would gather to trade, feast, and participate in games and religious ceremonies.

Salmon played a key role in developing the West by European settlers. As early as 1828, various trading companies were purchasing and exporting salmon caught by the Indians on the Columbia River. The first commercial use of fishery products in Oregon was the packing of salmon. Development of the canning process in the mid 1800's created a huge demand for salmon. The total harvested pounds of salmon and steelhead in the early 1890's ranged from 21 million pounds to 40 millions pounds. During the late 1880's and early 1920's, the salmon gillnet fishery in the Columbia River pumped a substantial amount of income into communities on the lower Columbia River, such as Astoria.

The history of Columbia River salmon harvest exhibits a transition from hand-held spears and dip nets, to riverboats with purse seines and gillnets, to ocean-going vessels with diesel engines and trolling poles. Originally, harvesters waited until salmon returned to the Columbia River. When salmon became scarcer and gas powered engines allowed fishermen to venture out farther into the ocean, trolling for salmon became an attractive alternative. As ocean fisheries developed, a growing share of the fish produced in the Basin was harvested in the ocean. Today, salmon produced in the Columbia River system are harvested from California to Alaska by trolling gear and by nets set to harvest other species of salmon. The effect of economic development in the Columbia Basin, hatchery production, and mixed stock, open access fisheries has been to reduce the total harvest and change the species and stock composition of salmon returning to the Columbia River. The change in the nature of the harvest patterns and the decline in total Columbia Basin production has resulted in fewer fish available for harvest in the Columbia River. Commercial landings of salmon and steelhead harvested in the Columbia River declined from around 20 million pounds in the late 1940's to a very low level in 1993, when a total of just over one million pounds of salmon was harvested.

Another trend is that, in the last two decades, farmed salmon has grown to provide more than half of the world salmon market. This infusion of new supply has resulted in significant reductions in

salmon prices that, combined with reduced catch, has put substantial economic pressure on commercial salmon fisheries. As returning fish numbers have declined, so have the revenues received by fishermen and the resulting household income generated for inland communities. Some of these trends may be changing. Adult salmon and steelhead numbers have always been volatile, depending on ocean and other conditions. Since 2000, numbers of adult salmon and steelhead available for harvest have increased dramatically. Increased prices for certain salmon products during the 2004 season may indicate increased demand for specialty products, such as "wild caught" salmon. Another recent trend is the rapid decline in the U.S. dollar. This has also increased prices for most salmon products.

This analysis estimates the contribution of salmon and steelhead to coastal and Columbia River communities in recent years. The estimate includes both wild and hatchery fish, and economic value from both commercial harvests and recreational harvests wherever they occur. Tribal harvests for commercial markets are included. Ceremonial and subsistence catch is not included.

The report uses regional economic impacts (REI) as the measure of value. The unit of value is household personal income. REI should be viewed as the income generated by harvesting, and in the case of commercially harvested fish, preparing a marketable product, plus the indirect or secondary impacts on other economic activities, commonly called the "multiplier effect." The contribution of surplus hatchery fish sold to fish processors is included. The REI calculations are for household income generated in communities wherever Columbia River Basin salmon and steelhead are caught, communities extending from Alaska and British Columbia to northern California.

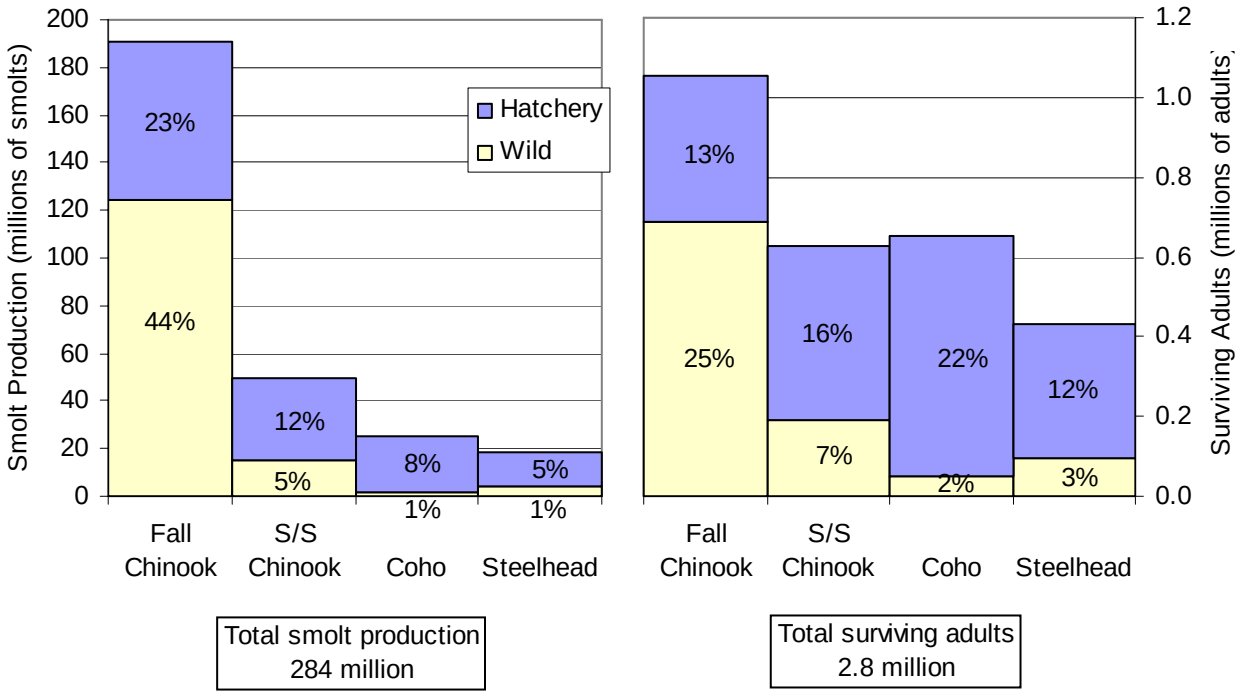
REI measures the amount of income that is related to the fisheries. It measures economic contribution under current conditions and is not a valid measure of the long-term effects on the economy of changes in fish abundance or policy. It provides a measure of the short-term dislocations and adjustments that might be caused by collapse of the fishery.

The REI is not a measure of economic benefit. Economic benefits might include consumer surpluses of recreational fishermen, certain non-use values such as tribal subsistence and ceremonial harvests, certain industry costs or cost savings, and a variety of other economic values not analyzed in this paper. Economic benefits would be a more appropriate measure to show the long term effects from changes in the fishery.

In the early 2000's, the Columbia Basin produced about 284 million smolts (Figure ES.1). Overall, about 48 percent of this production is by hatchery and 52 percent through natural production. The surviving adults, harvested and returning to spawning grounds and hatcheries, total 2.8 million. About 63 percent of these adults are produced by hatcheries and 37 percent by natural production (Figure ES.1). Because of different levels of smolt production by species, different survival rates from smolt to harvestable adults, and different areas and means of harvest, the total income generated from harvesting is supported by about 70 percent by hatcheries and 30 percent by natural production.

The model to generate estimates of REI uses factors for smolt-to-adult survival rates, hatchery production levels, and harvest regulations. As shown in Table ES.1, the estimates varied from

Figure ES.1
Estimated Hatchery and Wild Smolt Production and Resulting Surviving Adults From the Columbia Basin Using Early 2000's Conditions



$40 million to $142 million, depending on the assumptions for these production and harvest factors. The remainder of this summary focuses on Case III, using factors that describe the conditions representative of the early 2000's.

Figure ES.2 shows how the economic impacts are distributed among geographic areas. About 77 percent of the economic contribution occurs from ocean and in-river fisheries in the Pacific Northwest. Most of the rest occurs in Alaska and British Columbia, with a very small contribution in California as well. Significant economic contributions to Alaska and British Columbia come from fall Chinook. About half of the total economic contribution from fall Chinook is captured outside the Pacific Northwest.

Based on preliminary information of adult survival rates for early 2000's brood stock, the Columbia River Basin anadromous salmonid production will contribute about $142 million total personal income annually to communities on the West Coast. In the Pacific Northwest, a full time equivalent job receives about $30,000 annually. The $109 million generated in the Pacific Northwest states of Washington, Oregon, and Idaho of personal income may support about 3,633 jobs. The total income in the Pacific Northwest states is about $400 billion annually. Although the impact from Columbia Basin salmonid production may be relatively small in comparison, this economic impact can be significant in some local communities with close ties to the fishing industry.

Table ES.1
Economic Impacts Per Year For Four Cases of Columbia River Basin Anadromous Fish Production and Harvest Management (Millions of 2003 Dollars of Personal Income)

Policy		Economic Impacts (Millions of 2003$)		
Case	Assumptions	Commercial	Recreational	Total
I	Hatchery production at NMFS cap, SAR and harvests 30 yr historical average	$54.3	$33.4	$87.7
II	Hatchery production at 1995 levels, SAR and harvests at 1980's historical average	$66.4	$47.1	$113.5
III	Hatchery production, SAR, and harvests at early 2000's levels	$91.2	$50.4	$141.6
IV	Hatchery production at 1995 levels, SAR and harvests early 1990's historical average	$26.4	$13.6	$40.0

Notes:
1. Regional economic impacts are total personal income per year in millions of 2003 dollars.
2. Total and subtotals may not equal sum of values due to rounding.
3. SAR is smolt-to-adult survival rate. Adults are harvests and returns to hatcheries for hatchery origin anadromous fish. Adults are harvests and spawners plus in-stream prespawning mortality for wild origin anadromous fish.
4. Commercial includes ocean treaty and non-treaty harvests from California to Alaska, in-river treaty and non-treaty harvests, and hatchery surplus sales. Recreational includes ocean, in-river mainstem, and in-river tributary.
5. The concern about certain species or sub-species of salmon, and the overall effect of hatchery fish on survival of these species, has led to the NMFS placing a cap of 197 million annual smolt releases within the Columbia Basin.

Under early 2000's conditions, about 63 percent of the total economic contribution was generated by the Columbia in-river fishery. Steelhead and spring/summer Chinook are mostly caught in the river. Coho and fall Chinook are mostly caught in the ocean fisheries. Figure ES.3 shows how the four species groups contribute to the economic impact of salmon and steelhead harvest. Although there are only slightly fewer spring/summer Chinook harvested than coho, the higher value of spring/summer Chinook results in a much larger economic impact. The high per fish value of spring/summer Chinook results in them having a higher share of the total economic impact, even though fall Chinook are two-thirds more numerous. Steelhead comprise the smallest number harvested, but they have a high recreational per fish value.

Figure ES.4 shows the relative economic contribution of recreational fishing, commercial fishing and hatchery surplus. Commercial fishing accounts for 59 percent of the economic impact of fishing. Recreational fishing contributes about 36 percent of the total personal income related to salmon and steelhead harvest. Steelhead harvest is largely an in-river recreational activity. A large share of the coho contribution occurs in the ocean recreational fishery.

Figure ES.2
Estimated Percent of Total Economic Impacts of Columbia River Basin Salmon and Steelhead by Region of Catch Using Early 2000's Conditions

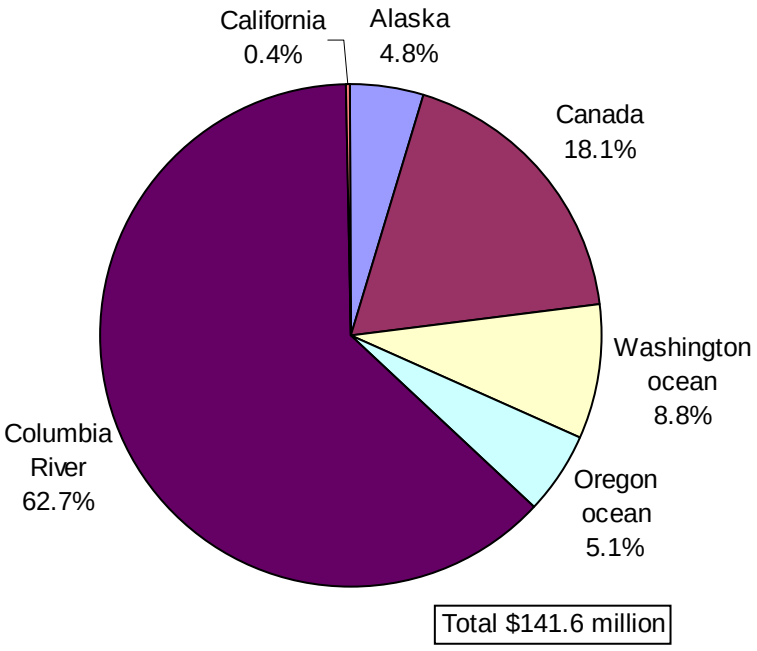


Figure ES.3
Estimated Percent of Total Economic Impacts of Columbia River Basin Salmon and Steelhead by Species Group Using Early 2000's Conditions

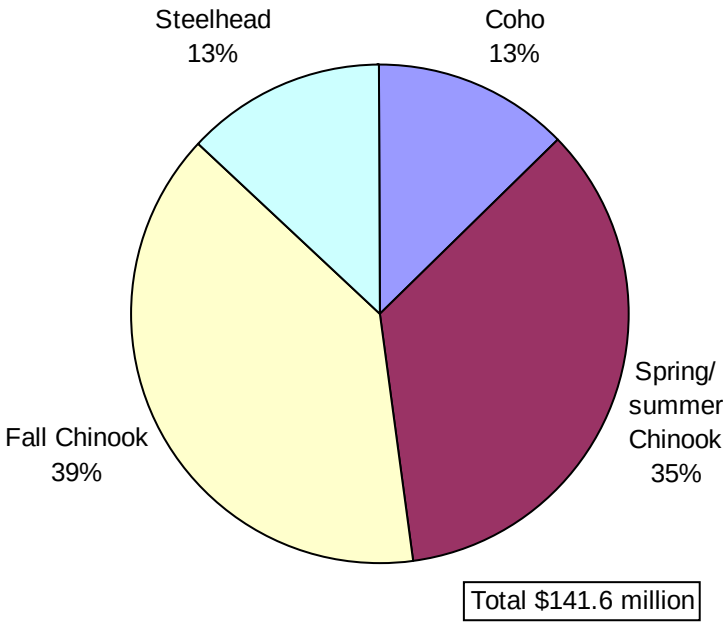
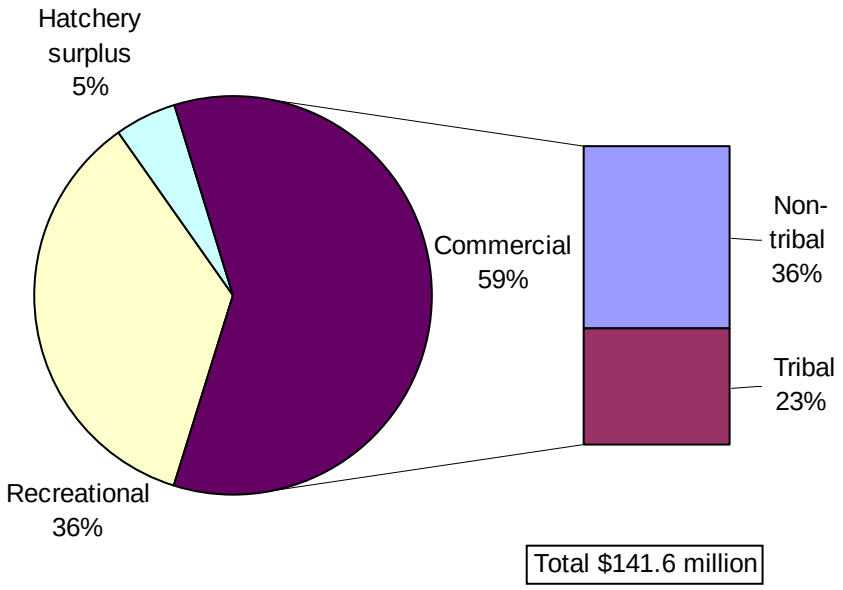


Figure ES.4
Estimated Percent of Total Economic Impacts of Columbia River Basin Salmon and Steelhead by Fishery Types Using Early 2000's Conditions



INTRODUCTION

Background

There are many different fisheries that rely on Columbia River Basin salmon and steelhead anadromous fish production, including commercial, tribal, and recreational user groups. (See Map 1 for the boundaries of the Columbia River Basin ("the Basin")) This report provides an estimate of the contribution that the various fisheries make to economies in locations throughout the fish migration range; economies extending from Alaska to northern California. The economic contribution is due to both wild production and to hatchery production projects.[1]

There has been little research attention given to the economic contribution from basin-wide fish production. A recent publication of the National Research Council (NRC 2004) identifies the fisheries and restates estimates by Fluharty (2000) that the Basin generates about 200 to 400 annual direct commercial fisheries jobs. However, these are only "within Basin" jobs from the non-treaty salmon gillnet fishery. The estimate does not include jobs associated with in-river fisheries or ocean salmon fisheries. Other authors have taken on species-specific and geographic-specific economic analyses. For example, Radtke et al. (1999) developed a model to show the economic contribution of the Basin's anadromous fish production. The U.S. Fish and Wildlife Service (USDI 2002) periodically surveys anglers with at the state level to determine economic impacts, but does not itemize estimates by river basins in their more recent research publications. The Oregon Department of Fish and Wildlife (The Research Group 1991) undertook an economic survey that yielded regional economic contribution estimates that included Columbia River anadromous as well as resident fish, but other states within the Basin do not have comparable economic studies. Idaho sponsored an economic analysis of the Snake River steelhead fishery that described the contribution a restored salmon fishery could make to state and local economies (Ben Johnson Associates 1999). None of these studies includes estimates of economic contribution from all fisheries.

The Northwest Power and Conservation Council's (NPCC's) Fish and Wildlife Program presently spends about $40 million annually on anadromous fish propagation projects. These NPCC directed funds are just a part of total Basin funds supplied by a range of local, state, regional, and federal agencies for anadromous fish propagation projects. Anadromous fish propagation projects help to fulfill basinwide objectives and meet Endangered Species Act (ESA) requirements and other treaty and agreement obligations.

Harvest management has changed; so has the global market for salmon in recent years. There have been new allocations among commercial, tribal, and recreational use of the resource. ESA requirements have altered the way that fish are harvested. A baseline description of the existing

1. Anadromous fish propagation projects generate economic contributions more than just from increasing abundances available to commercial and recreational fisheries. The construction, operation, and maintenance of propagation facilities transfers dollars to local economies. Moreover, it takes many biologists, fishery managers, researchers, enforcement agents, and administrators to set policies, develop plans, and carry out anadromous fish propagation projects. These impacts have not been included in this analysis. A separate analysis would be required to estimate the economic contribution of anadromous fish propagation projects.

Map 1
Columbia River Watershed

Source: The World Commission on Dams (2004).

salmonid production and fishing industry will assist the NPCC in understanding the role that artificial production plays in the regional economy.

Additional purposes of this report are to support NPCC responsibilities for decision making based on sound economic principals, and in particular, assist in Independent Economic Analysis Board (IEAB) work in evaluating and advising the Artificial Production Review and Evaluation (APRE) process on the economic aspects of cultured salmonid production.

Outline of the Report

This report first describes the status of the fishing industry supported by Basin salmonid production. Second, economic analysis methods are described. Third, the static economic model specifications and assumptions are stated. Lastly, estimates of the economic contribution of Columbia Basin salmon and steelhead are shown.

Trends in the Ocean Commercial Salmon Fishery

During the past two decades the major trend affecting the commercial salmon fishery has been the burgeoning supply of fresh salmon from the salmon farming industry. As indicated in Figure 1, the aggregate harvest of Pacific Ocean salmon remained at relatively high levels (mainly in Alaska), while world farmed production of salmon grew to exceed the total fishery harvest. One major consequence of this development was a substantial drop in the price paid to fishermen for salmon: the outward shift in supply revealed that the demand for salmon is negatively related to price. This drop in price has affected both farmed salmon and fishery harvests of salmon, and was made possible by the rapid technological advances in salmon farming that fostered lower production costs and effective marketing techniques. As shown in Figure 2, the average market value of farmed salmon (in nominal prices) dropped from roughly $6,000 per metric ton to less than $3,000 per metric ton between 1987 and 2001. (Adjusted to 2002 prices, this decline would be about double that amount.) This world-wide trend in price is the major cause of reduced earnings and the crisis in salmon fishing communities on the West Coast.

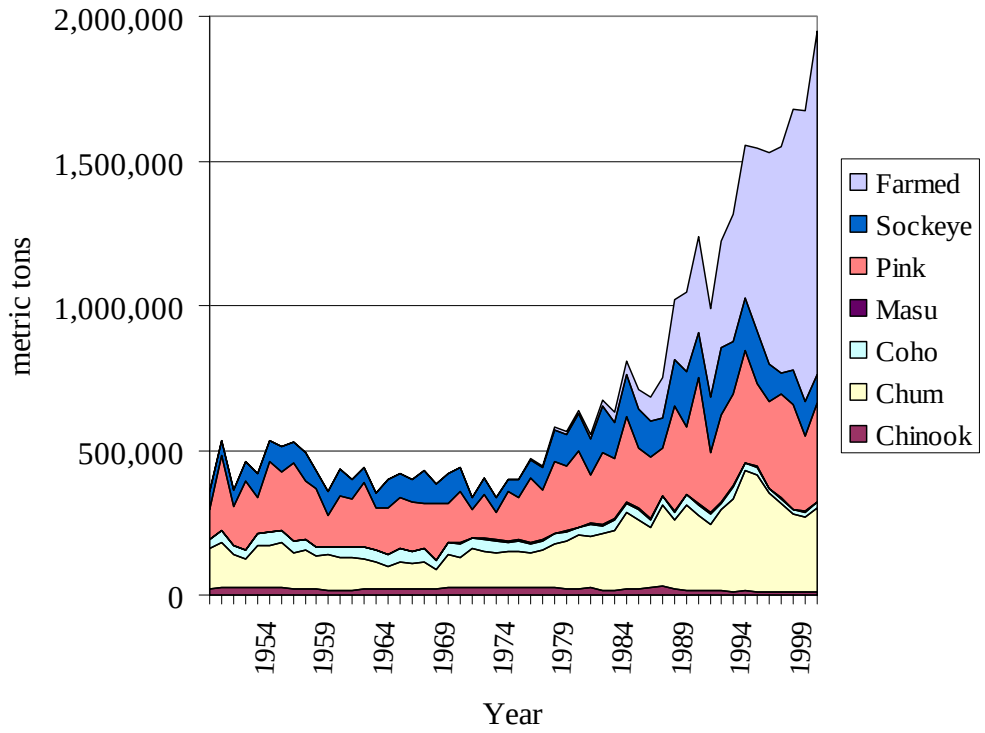
In the ocean salmon fishery north of Cape Falcon, Oregon (the ocean area in which Columbia River fish are most frequently caught), harvests fluctuated widely around a declining trend, until an upturn in catch in recent years (Figure 3). During the period from 1987 to 2002, the average price of salmon to the fishermen in this area (coho and Chinook combined) dropped from roughly $5 per pound (adjusted to 2002 prices) to just over $1 per pound. Similarly, the in-river gillnet commercial salmon fishery (Figure 4) has suffered a substantial decline in total volume of harvests and price since the mid-1980's. The reduced harvests during the mid-1990's did not increase prices because Pacific coast salmon are a small part of the international salmon market. However, increased available harvests in the early 2000's and increasing prices for certain salmon products during the 2004 season may indicate a trend of greater abundance of returning salmon and increased demand for specialty products, such as "wild caught" salmon. Another recent trend is the rapid decline in the U.S. dollar. This has increased prices for imported, as well as domestically produced, salmon products.

Trends in the Tribal Fisheries

The present treaty fisheries consist primarily of set gillnets, but dip net fishing still occurs at several locations. Harvest rates for treaty fisheries are 50 percent of harvestable returning adults as set by the courts in deference to the Belloni Decision (*United States v. Oregon* 1969) and the Boldt Decision (*United States v. Washington* 1974). This has been further interpreted to mean that the tribal harvest shall be 50 percent of all harvestable fish.

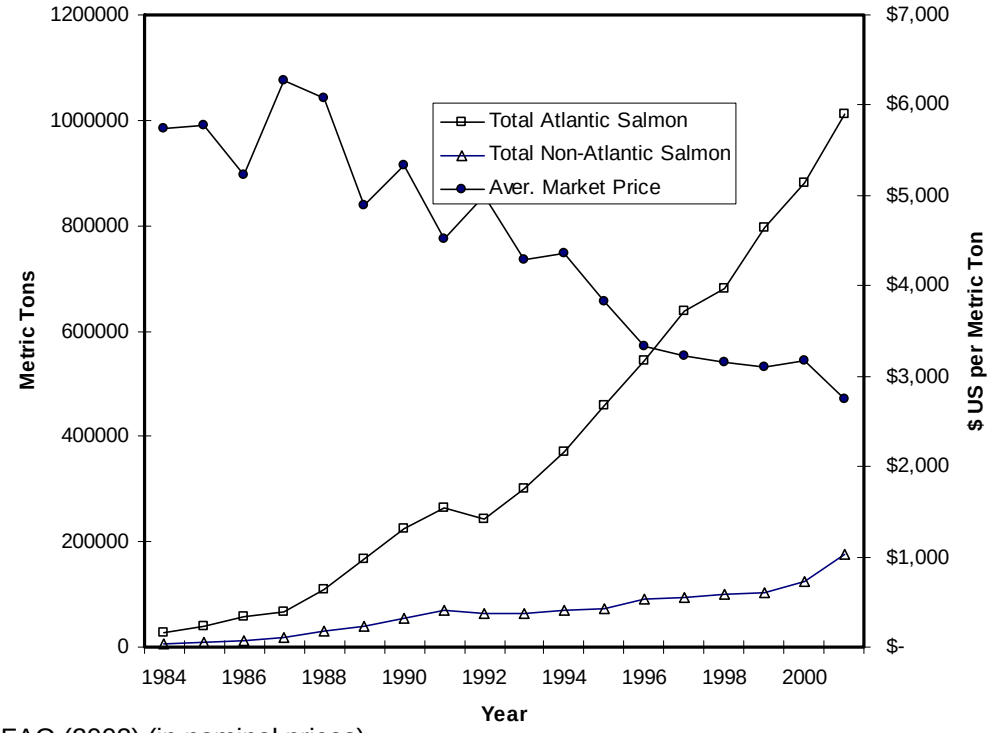
All species of salmon and steelhead are sought. Each year, allowable catch is estimated from run counts at Bonneville. Catch is allocated first to ceremonial, next to subsistence and last to commercial purposes. No fish of any run are sold for commercial purposes until ceremonial and subsistence needs are met. As recently as 1995, spring Chinook were only available for ceremonial purposes. Fall Chinook are routinely harvested for commercial sale. Fish are taken from the mainstem Columbia and a number of tributaries. Almost all of the commercial fish taken are from the mainstem. Total tribal commercial harvest of spring and fall run salmon has averaged about 25,000 and 110,000 fish, respectively, over the last five years (Mann 2004).

Figure 1
Pacific Salmon Harvest and World Farmed Production



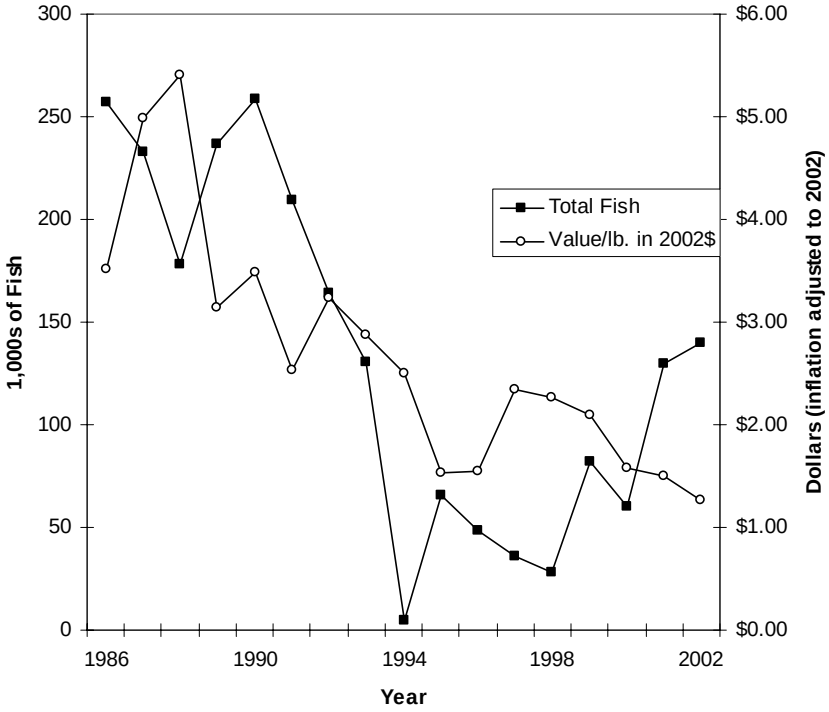
Source: FAO (2003).

Figure 2
World Salmon Aquaculture Production and Average Price



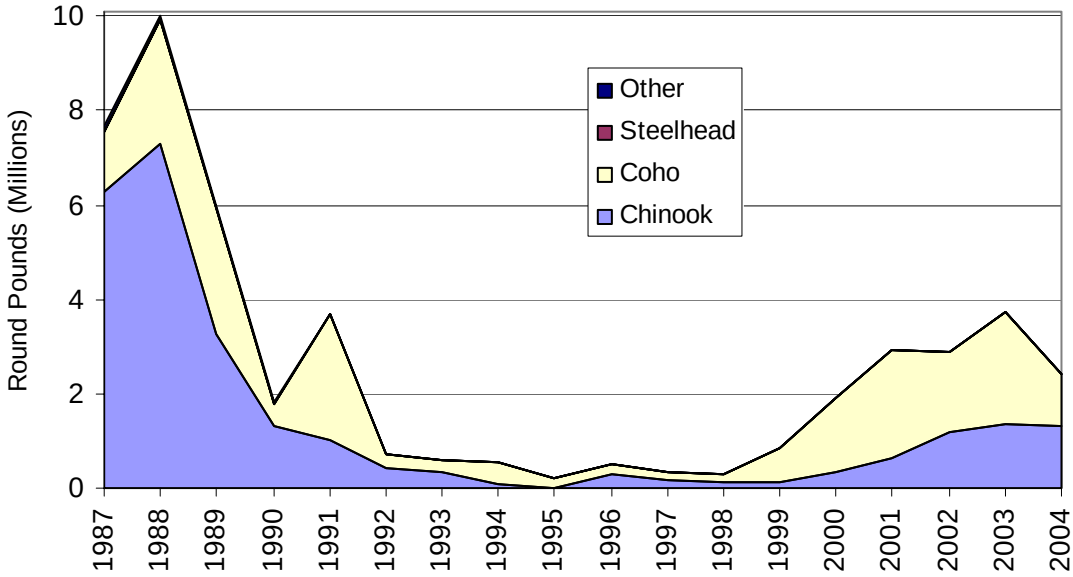
Source: FAO (2003) (in nominal prices).

Figure 3
U.S. Ocean Commercial Salmon Fishery North of Cape Falcon, Total Fish Caught and Ex-vessel Price/lb



Source: PFMC (2003).

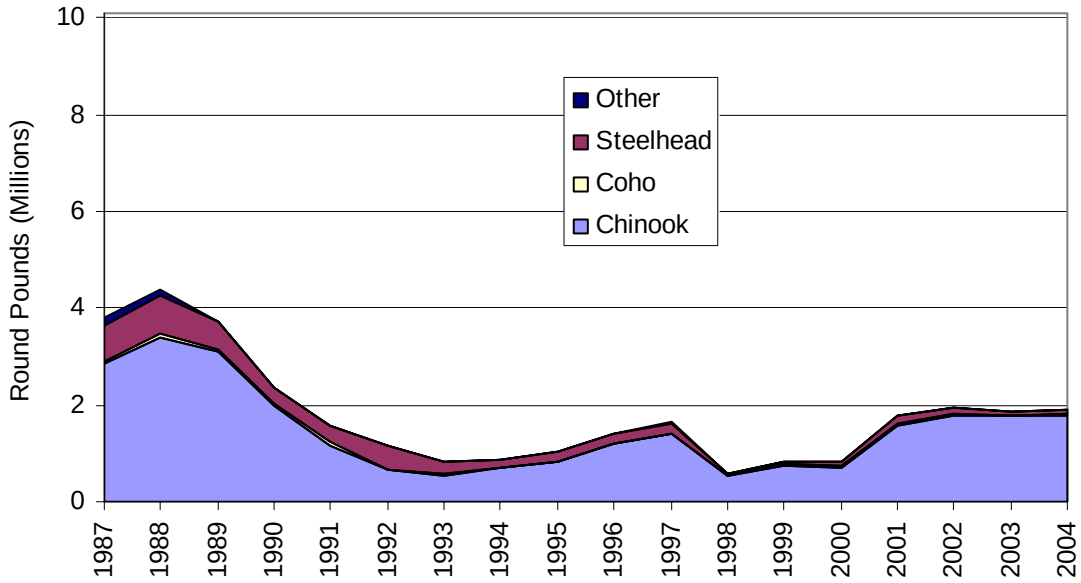
Figure 4a
Columbia River Commercial Salmon Fishery, Harvest Volume Below Bonneville in 1987 to 2004



Notes: 1. The determination of harvest area-of-catch used a filter for tribal fisheries. There is a very minor amount (less than 1%) of tribal fisheries below Bonneville in the earlier shown years, except for 1986 when it was 1% (14,866 pounds).
2. Year 2004 is only through November for Washington and California.

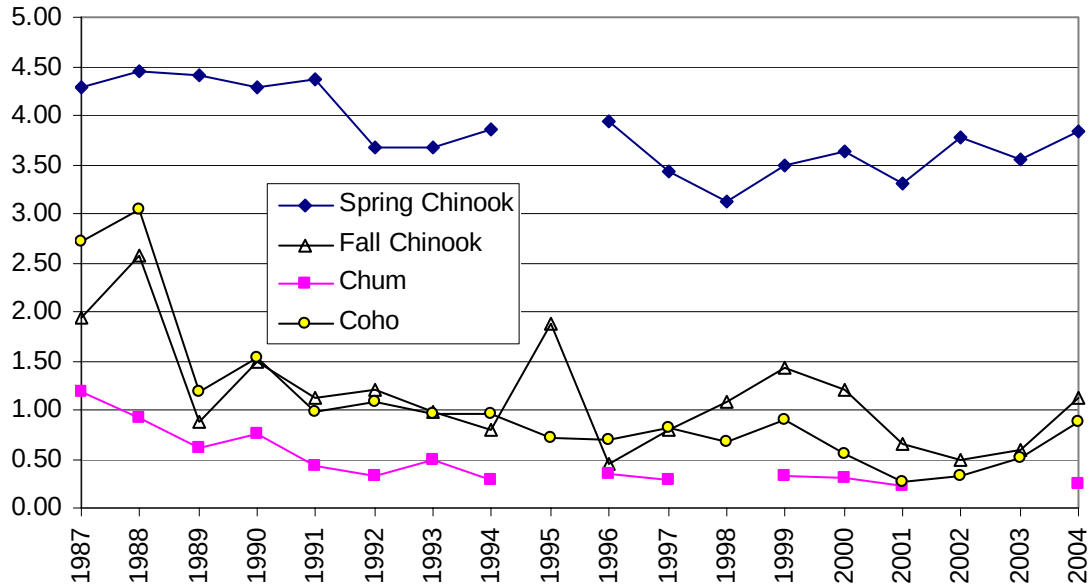
Source: PacFIN December 2004 and February 2005 extractions.

Figure 4b
Columbia River Commercial Salmon Fishery, Harvest Volume Above Bonneville in 1987 to 2004



Notes and source: See Figure 4a.

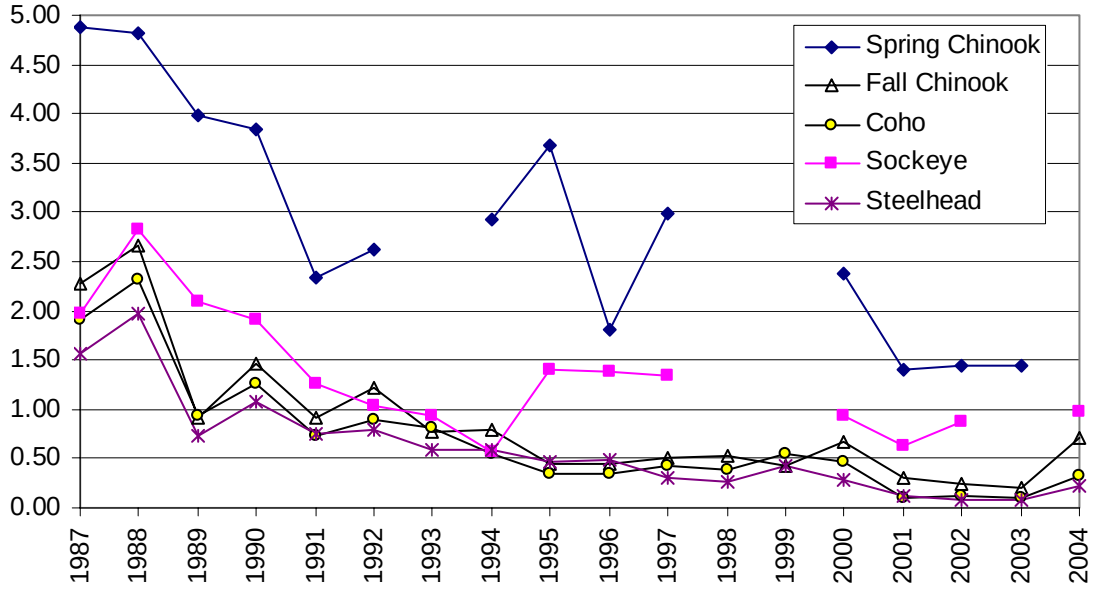
Figure 4c
Columbia River Commercial Salmon Fishery, Price for Harvests Below Bonneville in 1987 to 2004



Notes: 1. Prices adjusted to 2002 dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.
2. Prices not shown in years with less than 250 pounds of landings.
3. Year 2004 is only through November for Washington and California.

Source: PacFIN December 2004 and February 2005 extractions.

Figure 4d
Columbia River Commercial Salmon Fishery, Price for Harvests Above Bonneville in 1987 to 2004

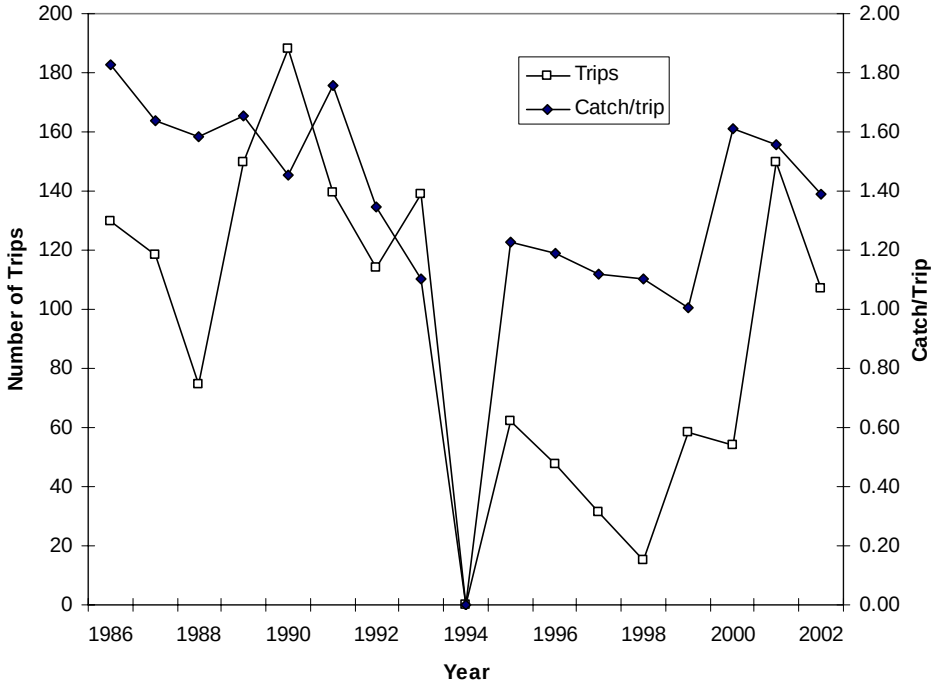


Notes and source: See Figure 4c.

Trends in the Recreational Salmon Fishery

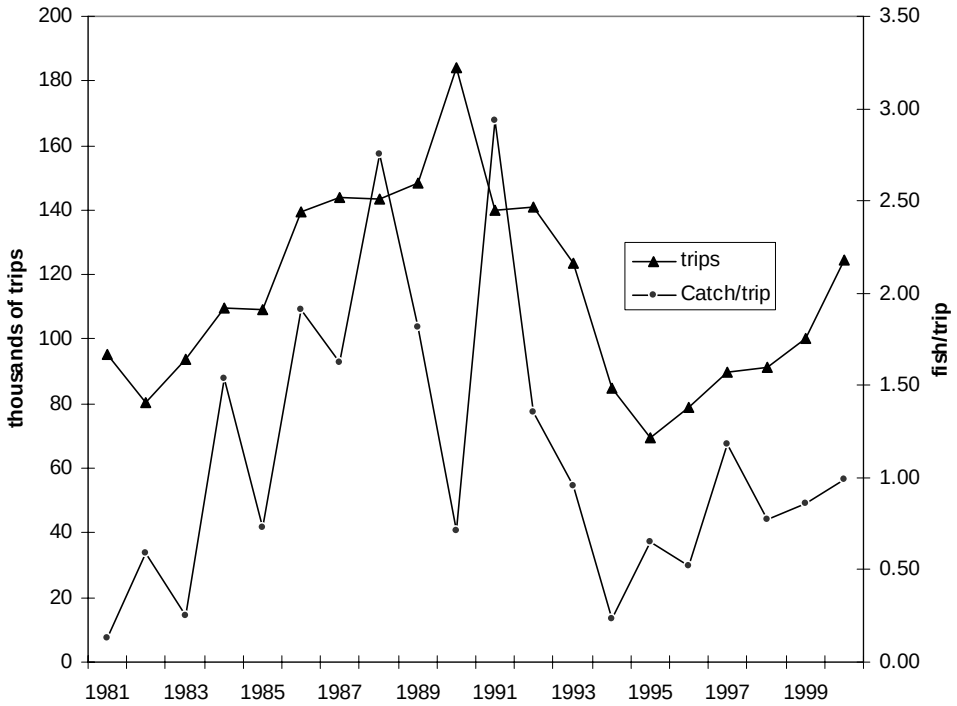
Basin produced salmon are caught recreationally throughout the West Coast. The recreational fishery supported by Columbia River salmon is especially significant in the ocean fishery north of Cape Falcon, the estuary and lower river fishery, and various fisheries farther upstream and in tributaries. The ocean and lower river fisheries have been highly variable, both in terms of catch and level of participation (as measured by annual angler trips taken). In the period1986-2002 the ocean recreational catch averaged 137,000 fish (coho plus Chinook), varying between 150,000 and 200,000 in the late 1980's and early 1990's, dropping to zero in 1994 and recovering to 232,000 in 2001. From 1981 to 2000 recreational catch in the lower river and estuary averaged 142,000 fish. As in the ocean fishery, river fishery catch was relatively high in the late 1980's and early 1990's, dropped to a record low in 1994, and recovered to about half of the earlier high levels in 2000 (Figure 5 and Figure 6). River recreational catch has increased dramatically in recent years, as ocean conditions have improved. Demand for outdoor recreation is expected to increase. resulting from demographic changes (Haynes and Horne 1996). Changes in salmonid production and salmon harvest management may allow for increased regional income generation associated with recreational harvest expenditures.

Figure 5
Recreational Ocean Salmon Harvest North of Cape Falcon



Source: PFMC (2003).

Figure 6
Recreational Salmon Fishery in the Lower Columbia River and Estuary (Buoy 10)



Notes: 1. The trips and catch are for the Buoy 10 fishery.
Source: WDFW and ODFW (2002).

METHODS USED TO CALCULATE ECONOMIC CONTRIBUTION

The study's overall goal is to evaluate the economic contributions from harvesting and primary processing the Columbia and Snake River anadromous salmon and steelhead fish stocks. Columbia Basin produced fish are harvested from Alaska to northern California and the effects on their economies are included in this analysis.

Economic value is generally described in one of two ways: net economic value (NEV) and regional economic impacts (REI). NEV attempts to measure the net benefits received by those that fish and the value people place on the resource, whether or not they intend to actually use the resource in a fishing experience. REI considers how many people participate in fishing and how much they spend while fishing. The spending introduces money into the economies, which finds its way to household income from wages, proprietor's incomes, rents, interest and dividends.

Economic Value Measurements

NEV refers to net benefits from a national or regional perspective. This approach addresses changes in economic welfare (i.e., the changes in consumer and producer surplus from the events being studied). The NEV of the fishery resource is defined as people's net willingness to pay to have the fishery resource. NEV is generally, willingness to pay of consumers above their costs, plus revenues of producers above costs of production. A common mistake is to add the costs associated with using the fishery resource (e.g., travel costs, lodging costs, equipment) to the NEV calculation. These associated costs, or expenditures, are drivers of local business activity that generate jobs and produce income to local households. REI's are the measurement of this activity and are often described in units of jobs, personal income, and business output. REI refers to the estimation of economic activity within a region and are sometimes called "economic impacts." NEV and REI calculations are "apples and oranges," and cannot be added together or even compared in any way.

The NEV must represent the value of the fishery resource itself, and not the value of the related travel and equipment items, because resources are consumed in the creation of value and the NEV estimate is only interested in the net value created. For example, suppose the fishery was threatened by a hydropower development and policy makers wanted to know whether the anglers could "buy out" the hydropower interests. All of the money spent on travel and equipment is not available to buy out the competing hydropower interests. However, the money that is left over, after all the costs of angling have been paid, is the net willingness-to-pay (consumer surplus) for the fishery resource (or fishing at the particular site). If extracted, this surplus could, in principle, be used to buy out the hydropower interests (or vice versa).

Another way to view the difference between NEV and REI is to consider NEV as the net loss to society if the resource were no longer available. Suppose that a specific river fishery were no longer available to anglers, and they had to either fish somewhere else or engage in some other activity. The money spent on travel and equipment would not be lost to the economy - in fact it could be spent on travel and equipment or some other commodities in some other location. But the value anglers received from fishing in that specific river would be lost. Their net value for

the chosen fishery versus other fisheries or activities would be a loss to society, although that loss might be offset by gains elsewhere. Their expenditures or associated impacts on income or jobs would be a loss to the economy in the vicinity of the preferred river, but would be a gain to some other local economy. Regional impacts, therefore, describe the local or regional effects associated with any specific area chosen as the point of interest. The calculations for REI in this report use personal income as the unit of measurement.[1]

It is clear that NEV and REI are two distinct measures, and each is useful for different purposes. NEV's are important if the goal is to allocate resources efficiently. REI's are important in assessing the distributional impacts of the different policies on the economies of local areas. It may often be the case that society will want to invest in a less valuable resource from a national perspective because the local area or economy that holds the resource is in need of economic development. Nevertheless, having the information on economic value will tell society how much it is giving up in order to achieve the redistribution of economic activity or development.

Sometimes an REI gain or employment in one area may be an REI loss to a different area. For example, the expenditures by BPA for hatchery funding may be a transfer from electricity paying consumers in Portland and Seattle to anglers and businesses in coastal communities. These are allocation and equity issues and are not addressed here.

Estimating Regional Economic Impacts With Input/Output Models

REI calculations start with an estimate of the costs or expenditures made in the pursuit of the fish or, in the case of commercial fishing, its subsequent primary processing to ready the product to be shipped out of the harvesting area.[2] These expenditures reverberate throughout the economy as the money is spent and respent by those that supply the fishing industry and then the households that spend their wages on other goods and services. Economic input/output (I/O) models are used to estimate the respending or multiplier effects. The basic premise of the I/O framework is that each industry sells its output to other industries and final consumers and in turn purchases goods and services from other industries and primary factors of production. Therefore, the economic performance of each industry can be determined by changes in both final demand and the specific inter-industry relationships.

The models developed for this project utilize one of the best known secondary I/O models available. The IMPLAN modeling software and database can be used to construct county or multi-county I/O models for any region in the U.S.[3] The regional I/O models provided by

1. Corresponding measures for full time equivalent jobs may be developed by assuming the personal income is a person's average wage and salary or proprietors net income. It can be assumed in the Pacific Northwest that $30,000 is a reasonable estimate for annual per job income. The $30,000 represents a representative income per Pacific Northwest resident for 2002 to 2004.
2. Harvesting as well as primary processing is included in the REI calculations. Some fish, such as salmon caught with troll gear, are partially processed at sea. Net caught fish are harvested and delivered in the round to a "tender" to be taken to a processor. The "ex-vessel" prices do not compare to similar product. Sometimes the ex-vessel price is the price paid to the net harvester, other times it is the price paid to the tender. Primary processing prices, or first wholesale prices, are for a comparable product.
3. The IMPLAN model is now being offered for general use by the Minnesota IMPLAN Group (Olson et al. 1993).

IMPLAN are derived from technical coefficients of a national I/O model and localized estimates of total gross output, income and employment by sectors.[1] IMPLAN adjusts the national level data to fit the economic composition and estimated trade balance of a chosen region. Areas that are any combination of single counties can be constructed using IMPLAN.

The Fishery Economic Assessment Model (FEAM) uses the IMPLAN coefficients to estimate the REI from salmon harvests.[2] The FEAM process starts with IMPLAN data. Fishing related expenditures are then used to develop harvest and primary processing expenditure related impact coefficients. The economic impacts, as measured by personal income or job opportunities, are then estimated by specific geographic areas (Figure 7). Estimates of REI from composite stocks harvested from California to Alaska are determined by the information made available on contributions of Columbia River stocks to the ocean fisheries.

Figure 7
The Fisheries Economic Assessment Model Process

- Based on IMPLAN
- Build I/O coefficients for fishing related expenditures
- Harvest data
- Primary processing data
- Economic impacts measured by personal income
- Translate to full time job equivalents
- Geographic areas

Limitations of Regional Economic Impact Analyses

REI estimates are sometimes indicators of the dislocation costs that may occur from reductions in fisheries, but are not indicators of the net loss to the nation from such reductions, because losses of income and employment in some areas will likely be offset by gains in income and employment elsewhere.[3] If sufficient quantitative information and defensible analytical models are available, net gain or loss to the nation determined through a benefit-cost analysis is the value suggested by Executive Order 12866 and the Regulatory Flexibility Act (5 U.S. C. 601 *et seq.*) for analyzing actions of federally managed fisheries (NMFS 2000).[4,5] In general, there is no particular relationship between changes in NEV derived in a benefit-cost analysis and REI's.

1. The available IMPLAN models are generally three to four years behind calendar years. This is due to data availability and the time it takes to prepare the models. Unless very dramatic changes take place in a regional economy, the sector coefficients will not change dramatically from year to year.
2. The FEAM was developed for the West Coast Fisheries Development Foundation by Hans Radtke and William Jensen in 1986.
3. We recognize, however, that shifts in economic activity are not immediate and inconsequential. In some cases, public policy-makers will want to consider assistance for those whose income is reduced by new environmental restrictions.
4. Other laws, such as the Magnuson-Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, and the Endangered Species Act (ESA) also have economic analysis requirements.
5. The benefit-cost analysis from management actions may include the sum of expected changes in: (1) potential changes in consumer surplus derived from recreational fishing, (2) potential changes in consumer surplus derived from non-consumptive use, (3) existence value, (4) consumer and producer surplus from commercial fishing landings, less (5) less management costs (administration, monitoring, and enforcement).

REI estimates measured in units of personal income provide a value that is comparable to similar values often used to describe activities in non-fishing sectors of the economy. However, if fishing activity is reduced, personal income is not necessarily reduced by a proportional amount. The effect on personal income in local economies will depend on alternative available activities and the location(s) of those activities. If there were a reduction in the ocean salmon fisheries, over the long run, workers in the commercial and recreational fisheries, owners of vessels and processing plants and seafood consumers would be expected to adjust to the reductions by changing the activities in which they engage. Such adjustments would not be costless, of course, but are outside the scope of this study.

The personal income estimates provide information on a representative year basis and are an indicator of the magnitude of the possible redirection of money between nonfishing-dependent and fishing-dependent sectors that may occur with changes in the fishery. The amount of redirection of income and employment represents a dislocation that may have economic and social costs that would not be reflected in a typical NEV analysis.

CHANGING HARVEST PATTERNS

Because Columbia Basin anadromous salmonid production contributes to fisheries throughout West Coast ocean and inland communities, economic contributions are widely dispersed.[1] The economic contribution can be attributed to both the natural production and to hatchery production. The different harvesting groups are non-treaty commercial, treaty commercial, treaty subsistence and ceremonial, and ocean and in-river recreational anglers.

Historically, harvesters waited until adults returned to the Columbia River to harvest salmon with nets and fish wheels. Local processors canned most of the salmon for national and international markets. Today, salmon produced in the Columbia River system are harvested in multi-stock salmon fisheries from California to Alaska by troll gear and nets. Landings are processed into mostly frozen and fresh product forms rather than being canned.

Propagation methods and harvest policies have resulted in a large part of salmon fishing being shifted to communities outside the Basin. Until the 1920's, most of the fish were harvested in the Basin (Figure 8). Basin production historically was highest for spring and summer Chinook that were returning to upriver habitat and harvests occurred at in-river locations (Figure 9a). A major dip net native fishery was located at Celilo Falls until 1957, when the rising pool behind The Dalles Dam inundated the falls and a lump sum payment of $23 million was made to four tribes for a "flowage easement" over the lost fishing site. A major part of today's production is lower river hatchery releases of fall Chinook and coho (Figure 9b). With the advent of efficient seagoing vessel and gear, these species have high ocean harvest rates. Coastal economies in Washington, British Columbia, and southeast Alaska now benefit from Basin production.

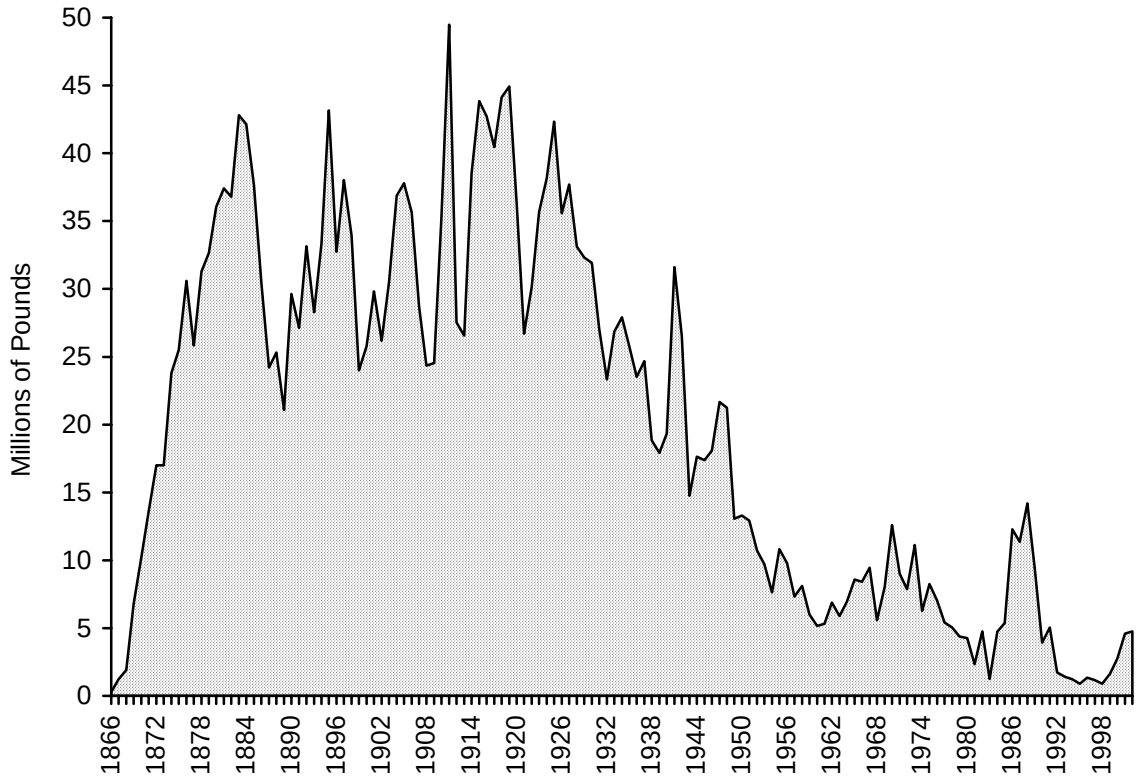
Management Objectives

Past Basin economic development policies, propagation, and harvest management policies have resulted in substantial shifts in area of harvest, species composition of returning adults, and timing of returning adults to the Basin. In 1878, most of the salmon/steelhead returned between May and July (Figure 10). Many of these returning adults destined for upriver spawning areas contained fat reserves and were marketed fresh or frozen as prime fish or destined for specialty markets for canning or smoking.

Presently, most of the returning adults are fall Chinook returning in September (Figure 11). These returning adults are mostly lower river stocks that have been naturally programmed not to contain large body fat reserves. The lower fat content, the natural aging process, and the competing West Coast salmon markets combine to produce fish that do not bring very high harvest prices. The "bunching up" of the runs in a short period also requires harvest, processing,

1. Basin salmonids are defined to be five species of salmon (Chinook, coho, chum, sockeye, and pink) and steelhead. Some of these salmonid species have a non-anadromous form, like sockeye, called kokanee. The non-anadromous form of steelhead is the rainbow trout. Sturgeon and Pacific lamprey eels both spend a portion of their life cycle in the ocean. Some of the Basin sturgeon fish resources are land locked. Resident fish are defined to be all non-anadromous fish. Small Pacific lamprey eel and bait (anchovy and herring) commercial fisheries are not included in the estimates. Starry flounder are caught incidentally in the lower Columbia River and, while sometimes are sold, they are also not included in the estimates.

Figure 8
Columbia River Commercial Landings of Salmon and Steelhead, 1866-2002

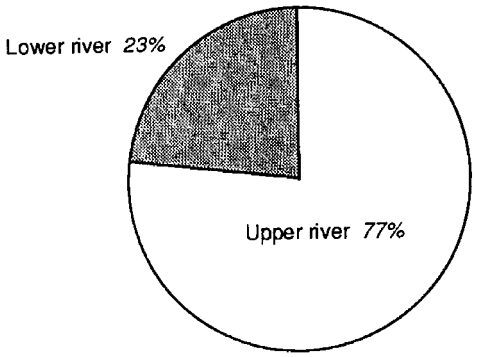


Source: ODFW (2004).

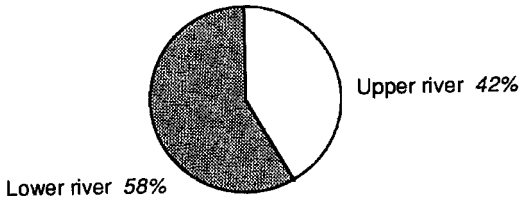
and marketing capabilities that are unused for most of the year. This may also result in seasonal "boom or bust" fluctuations for communities that rely on the income from these fisheries. Within the context of treaty obligations and other legal, social, and economic constraints, management goals may include adjusting these runs to smooth out the returning runs over a longer period (Figure 11).

However, this goal of smoothing out the runs should also consider the economic attributes of species composition, method and area of harvest, and markets. The amount of economic contribution, in total and by species, can be one indicator of positive or negative results from policies to change the composition of Basin salmonid production.

Figure 9a
Distribution of Columbia River Salmon, Showing Abundance Above and Below the Site of Bonneville Dam (Area of Circles is Proportional to Estimated Population Sizes)



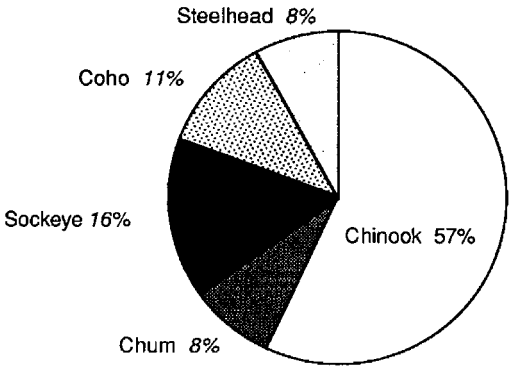
(a) Predevelopment: 11 million per year



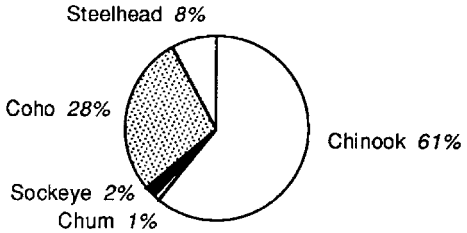
(b) 1977–1981 average: 2.9 million per year

Note: Lower river is below Bonneville.
Source: Lee (1993).

Figure 9b
Species Composition of Columbia River Salmon
(Area of Circles is Proportional to Estimated Population Sizes)



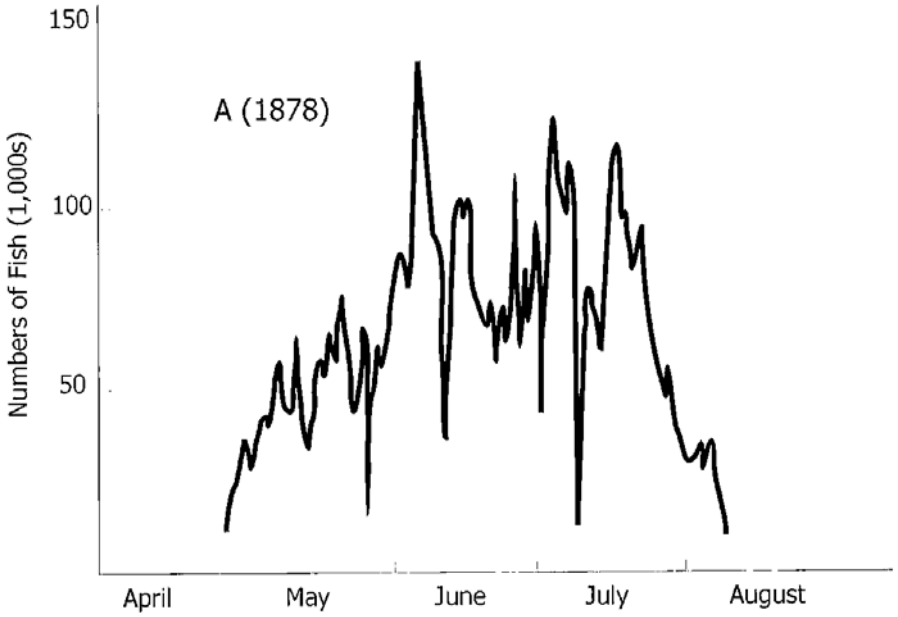
a. Predevelopment (before 1850): 11 million per year



b. 1977–1981 average: 2.9 million per year

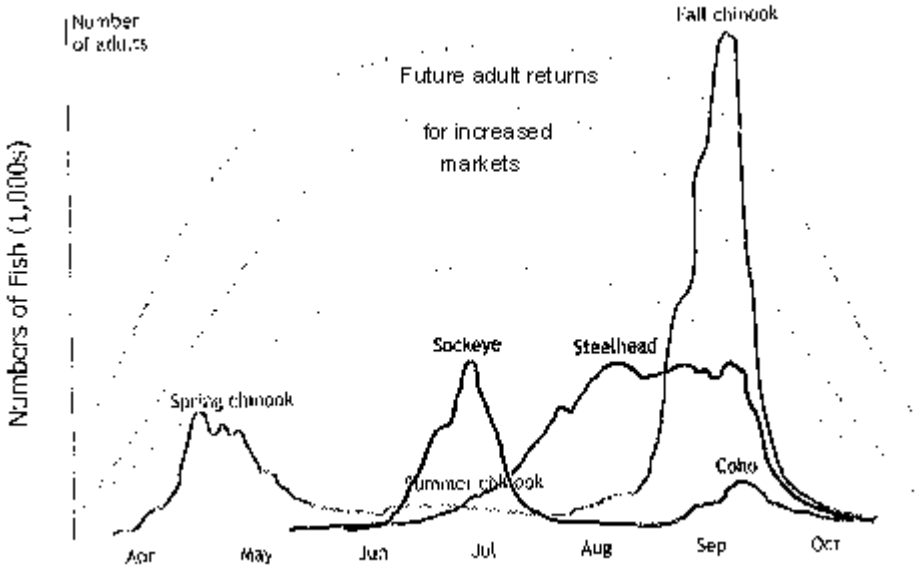
Source: Lee (1993).

Figure 10
Estimated Daily Historical Adult Returns to the Columbia River Basin Circa 1878



Source: Suzumoto (2003).

Figure 11
Recent Actual Daily Adult Returns and Returns Needed for Increased Markets to Bonneville Dam



Note: Future adult returns may consist of a variety of species composition.
Source: Suzumoto (2003).

ECONOMIC CONTRIBUTION ESTIMATES

Economic Contribution Model Specification

The low rate of returning wild spawners in the 1990's raised concerns about maintaining and recovering wild anadromous fish species in the Basin. In a broader context, if major changes or curtailment take place in production and harvest management, the economic values at risk may extend to all harvests of Basin anadromous fish. To model the economic effects for an extensive curtailment of harvest, Radtke et al. (1999) used four production and harvest management scenarios to pattern historical periods and what may happen if there are successful salmon recovery efforts. The four cases were specifically designed to show a range of economic effects of harvest levels. For this project, the same basic four cases from Radtke et al. (1999) are used. However, Case III was modified to address the harvest levels that are most likely to have occurred recently.[1] The four scenarios are as follows:

Case I	Hatchery production at NMFS cap; smolt-to-adult survival (SAR) and harvests at 30 year historical average
Case II	Hatchery production at 1995 levels; SAR's and harvests at 1980's historical average
Case III	Hatchery production at actual 2002-2004 releases; SAR's at early 2000's levels; harvests projected to be double the 1980's average
Case IV	Hatchery production at 1995 levels; SAR's and harvests at 1990's historical average

The economic model has two separate stages. The first stage generates commercially harvested per fish economic impacts and recreationally harvested per angling day economic impacts for various U.S. West Coast, Alaska, and British Columbia economies. The second stage generates numbers of fish that may be commercially harvested and recreational fishery effort that may result from changes in fish populations. The product of Stage 1 multiplied by Stage 2 is an estimate of total economic contribution.

The Stage 1 model relies on harvest and catch per unit effort (CPUE) information from the Alaska Department of Fish and Game, Fisheries and Oceans Canada, the Pacific Salmon Commission, several agencies for U.S. West Coast ocean fisheries (Pacific States Marine Fisheries Commission PacFIN and RecFIN databases, PFMC annual reviews of salmon fisheries, and NOAA Fisheries Marine Recreational Fisheries Statistics Survey information), and several agencies for inland fisheries (Columbia River Compact status reports, Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife special reports, and

1. For this project, the four scenarios simply portray different situations that either have occurred in the past or hypothetically may occur in the future. Case III should be considered the portrayal of what may be expected from the early brood years of the 2000's. "The concern about certain species or sub-species of salmon, and the overall effect of hatchery fish on the survival of these species, has led to the NMFS placing a cap on the total hatchery releases in the Columbia River system. The NMFS cap for smolt production from the Columbia River Basin at 197 million smolts is to protect the salmon runs that have been declared threatened or endangered (Radtke et al. 1999, Part 2, Chapter III, Page 8).

Columbia River Inter-Tribal Fish Commission information). For commercially caught fish, average weights by region are used (Table 1). The business activity and resulting impacts per fish generated by the commercial harvest are calculated by the FEAM. The impacts for recreational effort use trip expenditure information and personal income coefficients derived from IMPLAN. These estimates have been developed by the Oregon Department of Fish and Wildlife (ODFW) and the Pacific Fishery Management Council (PFMC) and other agencies to analyze the economic contribution of recreational fishing (Radtke et al. 1999, Part 2, Chapter II, Page 13). It is recognized that more detailed recreation information could be developed using data collected by fish management agencies and recent economic studies specifically for the Columbia River system recreational fishery. These data could not be developed within the scope of this study.

The estimated REI values per commercial harvested fish are shown in Table 1. The ex-vessel prices per pound on Table 1 are from 1995 data and expressed in 2003 dollars.[1] Table 1 also shows the REI values per angler day.

The Stage 2 model has separate variable inputs for:

1) Hatchery and Wild Production. Systemwide salmonid smolt downstream migration from hatchery and wild components has been estimated to be close to 200 million (Hankin and Richards 2000). However, the APRE (2003) shows projected hatchery related releases alone (i.e., excluding wild spawners) at 208 million for the 2004 year. Depending on the number of estimated naturally spawning adults, the total amount of smolts that are entering the Columbia/Snake River according to the APRE (2003) estimate may be as high as 330 million. The Columbia River Fish Passage Center estimates the actual hatchery smolt releases at about 140 million (Sando 2003). Therefore, including the estimated natural produced smolts, the total smolt downstream migration would be about 330 million. The economic contribution model uses estimates for the two smolt origin components (wild and hatchery) itemized for four species complexes (coho, spring/summer Chinook, fall Chinook, and summer/winter steelhead) from five production provinces (Snake River, Upper Columbia, Middle Columbia, Lower Columbia, and Willamette). The total estimated hatchery smolts are estimated to be 139 million for Case III (Table 2). When wild production is included, the estimated total production is 284 million.

2) Smolt-to-Adult Survival Rates (SAR). Several historical periods are used to give a range of rates [30-year average ending in 1993 (Case I), 1980's decade average (Case II), a hypothetical rate used to model anticipated 2002 to 2004 runs (Case III), and early 1990's average ending in 1995 (Case IV)]. The rates are disaggregated by species complexes and the five production provinces. It is

1. There have been price shifts between the mid 1990's and the early 2000's. Prices declined to historic levels by 2003, but by 2004 a significant general salmon price increase took place. Prices in 2004 are generally equal to mid 1990's level. Therefore, the 1995 prices are used as representative of what may be expected from the outgoing smolts from the early 2000's.

assumed that the two smolt origin components (hatchery and wild) have the same harvest rates.

Table 1
Anadromous Fish Regional Economic Impact Modeling Assumptions

	Commercial REI Per Fish	Ex-Vessel Price Per Pound	Pounds Per Fish	Recreational REI Per Day	Days Per Fish	Recreational REI Per Fish
Species: Coho						
Ocean						
Alaska	23.39	1.60	6.5	60.00	1.00	60.00
British Columbia	19.94	1.60	5.5	60.00	1.00	60.00
Washington ocean	13.72	1.65	3.8	60.00	1.00	60.00
Washington Puget Sound	18.57	1.15	6.8	60.00	1.00	60.00
Oregon	19.15	1.70	5.8	60.00	1.00	60.00
California	22.69	1.70	5.9	60.00	1.00	60.00
Columbia Basin inland						
Freshwater sport						
Mainstem	--	--	--	60.00	1.00	60.00
Tributary	--	--	--	60.00	1.00	60.00
Gillnet	16.65	0.85	7.5	--	--	--
Tribal	16.65	0.85	7.5	--	--	--
Other	--	--	--	--	--	--
Hatchery surplus market	13.12	0.60	7.5	--	--	--
Hatchery carcass	2.20	0.10	7.5	--	--	--
Species: Spring/Summer Chinook						
Ocean						
Alaska	75.98	2.20	17.5	60.00	1.00	60.00
British Columbia	76.90	2.20	17.7	60.00	1.00	60.00
Washington ocean	53.08	1.95	12.2	60.00	1.00	60.00
Washington Puget Sound	45.29	1.15	16.5	60.00	1.00	60.00
Oregon	46.20	1.95	11.2	60.00	1.00	60.00
California	--	--	11.6	60.00	1.00	60.00
Columbia Basin inland						
Freshwater sport						
Mainstem	--	--	--	60.00	2.00	120.00
Tributary	--	--	--	60.00	2.00	120.00
Gillnet	108.32	2.05	18.4	--	--	--
Tribal	108.32	2.05	--	--	--	--
Other	--	--	--	--	--	--
Hatchery surplus market	53.97	1.45	--	--	--	--
Hatchery carcass	2.20	0.10	--	--	--	--
Species: Fall Chinook						
Ocean						
Alaska	75.98	2.20	17.5	60.00	1.00	60.00
British Columbia	76.90	2.20	17.7	60.00	1.00	60.00
Washington ocean	53.08	1.95	12.2	60.00	1.00	60.00
Washington Puget Sound	45.29	1.35	16.5	60.00	1.00	60.00
Oregon	46.20	1.95	11.2	60.00	1.00	60.00
California	59.11	2.25	11.6	60.00	1.00	60.00
Columbia Basin inland						
Freshwater sport						
Mainstem	--	--	--	60.00	1.50	90.00
Tributary	--	--	--	60.00	2.00	120.00
Gillnet	45.29	1.15	18.4	--	--	--
Tribal	45.29	1.15	--	--	--	--
Other	--	--	--	--	--	--
Hatchery surplus market	32.69	0.70	--	--	--	--
Hatchery carcass	2.20	0.10	--	--	--	--
Species: Summer/Winter Steelhead						
Ocean						
Alaska	--	--	7.0	60.00	1.00	60.00
British Columbia	24.48	1.50	7.0	--	--	--
Washington ocean	--	--	--	--	--	--
Washington Puget Sound	--	--	--	--	--	--
Oregon	--	--	--	60.00	1.00	60.00
California	--	--	--	--	--	--
Columbia Basin inland						
Freshwater sport						
Mainstem	--	--	--	60.00	2.00	120.00
Tributary	--	--	--	60.00	2.00	120.00
Gillnet	--	--	--	--	--	--
Tribal	18.56	1.00	--	--	--	--
Other	--	--	--	--	--	--
Hatchery surplus market	15.61	0.85	--	--	--	--
Hatchery carcass	2.20	0.10	--	--	--	--

Notes:
1. Pounds per fish and ex-vessel prices shown in this table should be considered as representative data used in the analysis. Commercial harvest prices reflect representative prices expected from the 2000 to 2004 releases. The downward price trends of 2000 to 2003 have been replaced with a small upward trend in 2004. Listed regional economic impacts per unit are for state and province level economies.
2. Hatchery sales include carcass and egg sales. Carcass sale value estimated to be $0.10 per pound for whole body fish less eggs.
3. Two days per fish harvested include released wild and retained hatchery fish. For steelhead retained fish only, the CPUE is 0.17 fish per day (or 5.88 days per fish).
4. This table represents information gathered for a lengthy process funded by the U.S. Army Corps of Engineers (Radtke et al. 1999). The per fish economic impacts generally reflect the situation of the present. For more detailed analysis, a comprehensive study on economic value (NEV) as well as REI is warranted.

Source: Radtke et al. (1999) and Project.

Table 2
Hatchery and Wild Fish Production

	Cases I, II				Case III				Case IV			
			Estimated	Total			Estimated	Total			Estimated	Total
	Waterway	Hatchery	Wild Smolt	Smolt	Hatchery	Hatchery	Wild Smolt	Smolt	Waterway	Hatchery	Wild Smolt	Smolt
	Share	Releases	Production	Production	Share	Releases	Production	Production	Share	Releases	Production	Production
Coho		35,325,745	1,859,250	37,184,995		23,194,600	1,880,643	25,075,243		29,365,369	1,545,546	30,910,915
Snake River	0.0%	--	--	--	92.5%	1,244,676	100,920	1,345,596	0.0%	--	--	--
Upper Columbia	2.4%	843,373	44,388	887,761	92.5%	2,058,340	166,892	2,225,232	2.4%	700,000	36,842	736,842
Middle Columbia	7.0%	2,462,651	129,613	2,592,264	92.5%	5,938,039	481,463	6,419,502	7.0%	2,044,000	107,579	2,151,579
Lower Columbia	87.0%	30,742,613	1,618,032	32,360,645	92.5%	13,615,637	1,103,971	14,719,608	87.0%	25,561,369	1,345,335	26,906,704
Willamette	3.6%	1,277,108	67,216	1,344,324	92.5%	337,907	27,398	365,305	3.6%	1,060,000	55,789	1,115,789
Spring/summer Chinook		27,392,626	11,739,697	39,132,323		34,412,382	14,748,164	49,160,546		25,749,069	11,035,315	36,784,384
Snake River	8.6%	2,342,791	1,004,053	3,346,844	70%	12,517,116	5,364,478	17,881,595	8.6%	2,202,224	943,810	3,146,034
Upper Columbia	21.9%	5,990,957	2,567,553	8,558,510	70%	6,992,970	2,996,987	9,989,958	21.9%	5,631,500	2,413,500	8,045,000
Middle Columbia	22.9%	6,264,260	2,684,683	8,948,943	70%	5,477,483	2,347,493	7,824,975	22.9%	5,888,404	2,523,602	8,412,006
Lower Columbia	19.2%	5,253,481	2,251,492	7,504,973	70%	4,189,200	1,795,371	5,984,571	19.2%	4,938,272	2,116,402	7,054,674
Willamette	27.5%	7,541,137	3,231,916	10,773,053	70%	5,235,613	2,243,834	7,479,447	27.5%	7,088,669	3,038,001	10,126,670
Fall Chinook		113,802,184	113,802,184	227,604,368		66,321,986	124,703,634	191,025,620		100,109,021	100,109,021	200,218,042
Snake River	0.5%	612,797	612,797	1,225,594	70%	3,445,924	1,476,825	4,922,749	0.5%	533,134	533,134	1,066,268
Upper Columbia	10.8%	12,329,885	12,329,885	24,659,770	10%	11,784,085	106,056,765	117,840,850	10.7%	10,727,000	10,727,000	21,454,000
Middle Columbia	21.1%	24,002,299	24,002,299	48,004,598	70%	24,623,481	10,552,920	35,176,401	20.9%	20,882,000	20,882,000	41,764,000
Lower Columbia	67.5%	76,857,203	76,857,203	153,714,406	80%	26,468,496	6,617,124	33,085,620	67.9%	67,966,887	67,966,887	135,933,774
Willamette	0.0%	--	--	--	0%	--	--	--	0.0%	--	--	--
Steelhead		20,042,061	8,589,455	28,631,516		14,588,711	4,136,895	18,725,606		17,607,015	7,545,864	25,152,879
Snake River	64.4%	12,900,795	5,528,912	18,429,707	75%	9,469,817	3,156,606	12,626,422	64.5%	11,352,700	4,865,443	16,218,143
Upper Columbia	6.8%	1,363,636	584,415	1,948,051	75%	1,262,177	420,726	1,682,903	6.8%	1,200,000	514,286	1,714,286
Middle Columbia	2.7%	536,886	230,094	766,980	75%	589,679	196,560	786,238	2.7%	472,460	202,483	674,943
Lower Columbia	18.8%	3,775,119	1,617,908	5,393,027	90%	2,341,892	260,210	2,602,102	18.9%	3,322,105	1,423,759	4,745,864
Willamette	7.3%	1,465,625	628,125	2,093,750	90%	925,147	102,794	1,027,941	7.2%	1,259,750	539,893	1,799,643
Total		196,562,616	135,990,585	332,553,201		138,517,679	145,469,336	283,987,016		172,830,474	120,235,746	293,066,220
Snake River	8.1%	15,856,383	7,145,762	23,002,145	73%	26,677,534	10,098,828	36,776,362	8.2%	14,088,058	6,342,387	20,430,445
Upper Columbia	10.4%	20,527,851	15,526,241	36,054,092	17%	22,097,572	109,641,370	131,738,943	10.6%	18,258,500	13,691,628	31,950,128
Middle Columbia	16.9%	33,266,096	27,046,689	60,312,785	73%	36,628,682	13,578,435	50,207,117	16.9%	29,286,864	23,715,664	53,002,528
Lower Columbia	59.3%	116,628,416	82,344,635	198,973,051	83%	46,615,225	9,776,676	56,391,901	58.9%	101,788,633	72,852,384	174,641,017
Willamette	5.2%	10,283,870	3,927,257	14,211,127	73%	6,498,667	2,374,026	8,872,693	5.4%	9,408,419	3,633,683	13,042,102

Notes:
1. According to the National Marine Fisheries Service's recent Biological Opinion on Artificial Propagation, for example, adult hatchery fish comprise approximately 50 percent of the fall Chinook, 70 to 80 percent of the spring/summer Chinook, 70 percent of the steelhead, and 95 percent of the coho salmon (NMFS 1999). Some of these estimates are changed to reflect the opinions of managers knowledgeable about Basin salmon management (Appendix A).
2. For Case III, hatchery releases are estimated to be 139 million, while wild production releases about 146 million, for a total of 284 million. About a 50/50 split. Most of the wild production (106 million) are fall Chinook from the upper Columbia system.

The model relies on survival rates using several representative hatcheries for certain species and river reaches. Experience has shown that statistical averaging or regression analysis is not very useful for predicting SAR's (Radtke et al. 1999, Part 2, Chapter II). This is why a broad range of historical periods has been used in the model. Table 3a shows the survival rates used in the model for all four cases.[1] The smolt releases, survival rates, and survived adults for Case III are displayed in Table 3b.

3) Contribution to Fisheries. The model relies on information in the missing production reports for coded wire tag (CWT) recovery estimates.[2] The fisheries are aggregated geographically and by user group. Table 4 shows estimates of contributions to fisheries used to model Case III.[3] These change as smolt releases, ESA requirements, treaty obligations, and other harvest management techniques are imposed.

Although anadromous fish are harvested on a mixed species basis, historical records and information gathered from sources such as CWT captures do provide some estimates of numbers of fish by species and geographical place of origin. These data are then used in this modeling process to generate the number of fish caught with origins from the Basin. SAR's are one critical factor in the modeling equation. Indicator stocks provide a basis for the denominator (e.g., total smolts released from a hatchery). The numerator is the amount of species-specific adults harvested in any given geographic area, returns to hatcheries, or wild spawners. For example, in the 1980's an estimated 48 million smolts (fall Chinook hatchery and wild) were produced from the middle Columbia. The number of such smolts surviving to adults was 0.73 percent or about 348,000 smolts. Twenty-seven percent or about 94,000 of these were harvested in the British Columbia commercial and recreational fishery.

1. These are estimates of expected survival rates developed from past Integrated Hatchery Operations Team (IHOT) documents, the NPCC-APRE process, literature review, and discussion with salmon managers throughout the region (Appendix C).
2. As a title, "missing production reports" is a misnomer leading to misunderstanding. These are reports about hatcheries that describe production and coded wire tag (CWT) capture results. The estimates of harvests in this project are based on these IHOT data, because they are the basis for much of anadromous salmonid management of Basin production.
3. Detailed information on distribution of harvests, total expected harvests, and economic contribution estimates for all four cases are included in Appendix A. (Section I lists distributional assumptions, Section II provides numbers of total expected harvests by region, and Section III shows regional economic impacts by geographic areas. and waterways)

Table 3a
Smolt-to-Adult Survival Rate Model Assumptions by Production Area and Species Complex Used for Four Cases of Production and Harvest Management Policies in the Columbia River Basin

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Weighted Average
Coho						
NMFS Cap (1970's-1990's Actual)	NA	1.20%	1.20%	2.50%	1.20%	2.33%
80's Actual Runs	NA	1.49%	1.49%	2.90%	1.49%	2.72%
Representative Early 2000's	0.50%	1.50%	2.50%	3.00%	3.00%	2.60%
Early 90's Runs	NA	0.15%	0.15%	1.00%	0.40%	0.90%
Spring/Summer Chinook						
NMFS Cap (1970's-1990's Actual)	0.37%	0.37%	0.37%	0.97%	0.97%	0.65%
80's Actual Runs	0.39%	0.39%	0.39%	1.01%	1.02%	0.69%
Representative Early 2000's	1.00%	1.20%	1.20%	1.20%	2.20%	1.28%
Early 90's Runs	0.10%	0.10%	0.10%	0.35%	0.35%	0.22%
Fall Chinook						
NMFS Cap (1970's-1990's Actual)	0.60%	0.60%	0.60%	0.32%	NA	0.41%
80's Actual Runs	0.73%	0.73%	0.73%	0.38%	NA	0.49%
Representative Early 2000's	0.60%	0.60%	0.60%	0.32%	NA	0.55%
Early 90's Runs	0.40%	0.40%	0.40%	0.25%	NA	0.30%
Steelhead						
NMFS Cap (1970's-1990's Actual)	0.70%	0.70%	0.70%	0.40%	0.40%	0.62%
80's Actual Runs	1.56%	1.56%	1.56%	0.89%	0.89%	1.38%
Representative Early 2000's	2.00%	2.00%	5.00%	1.00%	8.00%	2.32%
Early 90's Runs	0.50%	0.50%	0.50%	0.20%	0.20%	0.42%

Notes: 1. Rates expressed as representative percents of smolts released. Survival rates are best estimates based on information provided by the "Annual Coded Wire Program - Missing Production Groups" annual reports. Prepared for U.S. Department of Energy. Bonneville Power Administration and State of Oregon Reports (see text, section on survival rates and contribution to fisheries).

2. Survival rate assumptions for 1970's to 1990's are based on historical review of actual survival rates. The early 1990's survival rates are also based on historical review. The survival rates used for 2002 to 2004 are based on consensus of salmon managers.

Source: Radtke et al. (1999) and Project.

Table 3b
Estimated Annual Total Released Hatchery Smolts (2002-2004 Average) Based on Fish Passage Center Count of Approximately 139 Million and Representative Early 2000's Survival Rates

Fall Chinook

Area of Release	% Hatchery Releases	Number of Smolts	Estimated Survival Rate	Adult Survival
Snake	70%	3,445,924	0.60%	20,676
Upper Columbia	10%	11,784,085	0.60%	70,705
Middle Columbia	70%	24,623,481	0.60%	147,741
Lower Columbia	80%	26,468,496	0.32%	84,699
Willamette	0%	0	--	--
Total		66,321,986		323,820

Spring/Summer Chinook

Area of Release	% Hatchery Releases	Number of Smolts	Estimated Survival Rate	Adult Survival
Snake	70%	12,517,116	1.00%	125,171
Upper Columbia	70%	6,992,970	1.20%	83,916
Middle Columbia	70%	5,477,483	1.20%	65,730
Lower Columbia	70%	4,189,200	1.20%	50,270
Willamette	70%	5,235,613	2.20%	115,183
Total		34,412,382		440,270

Coho

Area of Release	% Hatchery Releases	Number of Smolts	Estimated Survival Rate	Adult Survival
Snake	92.5%	1,244,676	0.50%	6,223
Upper Columbia	92.5%	2,058,340	1.50%	30,875
Middle Columbia	92.5%	5,938,039	2.50%	148,451
Lower Columbia	92.5%	13,615,637	3.00%	408,469
Willamette	92.5%	337,907	3.00%	10,137
Total		23,194,600		604,156

Steelhead

Area of Release	% Hatchery Releases	Number of Smolts	Estimated Survival Rate	Adult Survival
Snake	75%	9,469,817	2.00%	189,396
Upper Columbia	75%	1,262,177	2.00%	25,244
Middle Columbia	75%	589,679	5.00%	29,484
Lower Columbia	90%	2,341,892	1.00%	23,419
Willamette	90%	925,147	8.00%	74,012
Total		14,588,711		341,554

Total		138,517,679		1,709,801

Sockeye

Area of Release	Number of Smolts
Snake	120,725
Upper Columbia	277,606
Total	398,331

Notes:
1. Sockeye are not included in the economic effects estimates.
2. Number of smolt releases provided by Fish Passage Center, Portland, Oregon, October 2004.
3. Percentage of hatchery releases and survival rates that represent the species by regions are the result of reviews of historical studies and best estimates of scientists and agency managers. A list of sources and people contacted are included as Appendix B. The information used in this table is a compilation of all of these sources.
4. Because of supplementation programs, some wild to hatchery ratios may change in the future.

Table 4
Contribution to Fisheries Model Assumptions for Case III - Early 2000's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Coho					
West Coast Ocean					
Alaska					
a) Commercial	NA	--	--	0.001%	--
b) Sport	NA	--	--	--	--
British Columbia					
a) Commercial	NA	2.000%	2.000%	4.500%	2.000%
b) Sport	NA	0.200%	0.200%	0.500%	0.200%
Subtotal Alaska/B.C. harvest	NA	2.200%	2.200%	5.001%	2.200%
Washington ocean					
a) Commercial (0.33% tribal)	NA	0.534%	0.534%	2.066%	1.068%
- Westport (28%)	NA	0.150%	0.150%	0.578%	0.299%
- Other commercial (68%)	NA	0.363%	0.363%	1.405%	0.726%
- Tribal (4%)	NA	0.021%	0.021%	0.083%	0.043%
b) Sport	NA	10.681%	10.681%	15.454%	21.362%
- Westport (41%)	NA	4.379%	4.379%	6.336%	8.758%
- Other sport (59%)	NA	6.302%	6.302%	9.118%	12.604%
Washington Puget Sound					
a) Commercial	NA	--	--	0.052%	--
b) Sport	NA	--	--	0.052%	--
Oregon					
a) Commercial	NA	5.341%	5.341%	12.363%	10.681%
- Astoria (3%)	NA	0.160%	0.160%	0.371%	0.320%
- Other commercial (97%)	NA	5.180%	5.180%	11.992%	10.361%
b) Sport	NA	6.943%	6.943%	12.363%	13.885%
- Astoria & Buoy 10 (16%)	NA	1.111%	1.111%	1.978%	2.222%
- Other sport (84%)	NA	5.832%	5.832%	10.385%	11.664%
California					
a) Commercial	NA	1.602%	1.602%	1.030%	3.204%
b) Sport	NA	1.068%	1.068%	0.515%	2.136%
Available for allocation inriver	NA	93.780%	93.780%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	NA	0.534%	0.534%	5.151%	1.068%
- Astoria (50%)	NA	0.267%	0.267%	2.576%	0.534%
- Other (50%)	NA	0.267%	0.267%	2.576%	0.534%
Tributary	NA	--	--	--	--
b) Gillnet	NA	5.341%	5.341%	28.218%	10.681%
- Astoria (100%)	NA	5.341%	5.341%	28.218%	10.681%
c) Tribal (50% of allocation)	NA	46.890%	46.890%	--	--
Other	NA	0.427%	0.427%	--	0.854%
Total Harvest	NA	81.560%	81.560%	82.265%	67.141%
Hatchery requirement	NA	4.020%	4.020%	2.070%	4.020%
Hatchery surplus market	NA	7.210%	7.210%	7.833%	14.419%
Hatchery surplus carcass	NA	7.210%	7.210%	7.833%	14.419%

Table 4 (cont.)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Spring/Summer Chinook					
West Coast Ocean					
Alaska					
a) Commercial	2.500%	2.500%	2.500%	9.000%	9.000%
b) Sport	--	--	--	0.100%	0.100%
British Columbia					
a) Commercial	5.000%	5.000%	5.000%	11.000%	11.000%
b) Sport	0.500%	0.500%	0.500%	1.000%	1.000%
Subtotal Alaska/B.C. harvest	8.000%	8.000%	8.000%	21.100%	21.100%
Washington ocean					
a) Commercial	1.000%	1.000%	1.000%	4.000%	4.000%
- Westport (40%)	0.400%	0.400%	0.400%	1.600%	1.600%
- Other commercial (59%)	0.590%	0.590%	0.590%	2.360%	2.360%
- Tribal (1%)	0.010%	0.010%	0.010%	0.040%	0.040%
b) Sport	1.000%	1.000%	1.000%	1.000%	1.000%
- Westport (71%)	0.710%	0.710%	0.710%	0.710%	0.710%
- Other sport (29%)	0.290%	0.290%	0.290%	0.290%	0.290%
Washington Puget Sound					
a) Commercial	0.500%	0.500%	0.500%	0.010%	0.010%
b) Sport	--	--	--	0.030%	0.030%
Oregon					
a) Commercial	0.500%	0.500%	0.500%	1.000%	1.000%
- Astoria (2%)	0.010%	0.010%	0.010%	0.020%	0.020%
- Other commercial (98%)	0.490%	0.490%	0.490%	0.980%	0.980%
b) Sport	0.500%	0.500%	0.500%	1.000%	1.000%
- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	0.010%
- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	0.990%
California					
a) Commercial	--	--	--	--	--
b) Sport	--	--	--	--	--
Available for allocation inriver	77.583%	77.583%	77.583%	67.634%	67.668%
Columbia Basin inland					
a) Freshwater sport					
Mainstem	23.009%	23.009%	23.009%	10.000%	10.000%
- Astoria (50%)	11.504%	11.504%	11.504%	5.000%	5.000%
- Other (50%)	11.504%	11.504%	11.504%	5.000%	5.000%
Tributary	7.670%	7.670%	7.670%	--	--
b) Gillnet	5.113%	5.113%	5.113%	10.000%	10.000%
- Astoria (100%)	5.113%	5.113%	5.113%	10.000%	10.000%
c) Tribal (50% of allocation)	38.791%	38.791%	38.791%	--	--
Other	3.000%	3.000%	3.000%	--	--
Total Harvest	89.083%	89.083%	89.083%	48.140%	48.140%
Hatchery requirement	10.917%	10.917%	10.917%	4.226%	4.192%
Hatchery surplus market	0.000%	-0.000%	-0.000%	23.817%	23.834%
Hatchery surplus carcass	0.000%	-0.000%	-0.000%	23.817%	23.834%

Table 4 (cont.)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Fall Chinook					
West Coast Ocean					
Alaska					
a) Commercial	6.000%	6.000%	6.000%	1.500%	NA
b) Sport	0.010%	0.010%	0.010%	--	NA
British Columbia					
a) Commercial	25.000%	25.000%	25.000%	20.000%	NA
b) Sport	2.000%	2.000%	2.000%	3.000%	NA
Subtotal Alaska/B.C. harvest	33.010%	33.010%	33.010%	24.500%	NA
Washington ocean					
a) Commercial (3.00% tribal)	5.215%	5.215%	5.215%	15.843%	NA
- Westport (40%)	2.086%	2.086%	2.086%	6.337%	NA
- Other commercial (59%)	3.077%	3.077%	3.077%	9.348%	NA
- Tribal (1%)	0.052%	0.052%	0.052%	0.158%	NA
b) Sport	2.318%	2.318%	2.318%	13.203%	NA
- Westport (71%)	1.646%	1.646%	1.646%	9.374%	NA
- Other sport (29%)	0.672%	0.672%	0.672%	3.829%	NA
Washington Puget Sound					
a) Commercial	0.001%	0.001%	0.001%	--	NA
b) Sport	0.001%	0.001%	0.001%	--	NA
Oregon					
a) Commercial	1.738%	1.738%	1.738%	3.961%	NA
- Astoria (2%)	0.035%	0.035%	0.035%	0.079%	NA
- Other commercial (98%)	1.704%	1.704%	1.704%	3.882%	NA
b) Sport	0.579%	0.579%	0.579%	1.320%	NA
- Astoria & Buoy 10 (1%)	0.006%	0.006%	0.006%	0.013%	NA
- Other sport (99%)	0.574%	0.574%	0.574%	1.307%	NA
California					
a) Commercial	0.001%	0.001%	0.001%	0.660%	NA
b) Sport	0.001%	0.001%	0.001%	0.132%	NA
Available for allocation inriver	61.082%	61.082%	61.082%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	1.159%	1.159%	1.159%	6.601%	NA
- Astoria (50%)	0.579%	0.579%	0.579%	3.301%	NA
- Other (50%)	0.579%	0.579%	0.579%	3.301%	NA
Tributary	--	--	--	--	NA
b) Gillnet	13.907%	13.907%	13.907%	14.523%	NA
- Astoria (100%)	13.907%	13.907%	13.907%	14.523%	NA
c) Tribal (50% of allocation)	30.541%	30.541%	30.541%	--	NA
Other	0.168%	0.168%	0.168%	--	NA
Total Harvest	88.639%	88.639%	88.639%	80.744%	NA
Hatchery requirement	5.908%	5.908%	5.908%	11.183%	NA
Hatchery surplus market	2.727%	2.727%	2.727%	4.036%	NA
Hatchery surplus carcass	2.727%	2.727%	2.727%	4.036%	NA

Table 4 (cont.)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Summer/Winter Steelhead					
West Coast Ocean					
Alaska					
a) Commercial	--	--	--	--	--
b) Sport	0.030%	0.030%	0.030%	0.030%	0.030%
British Columbia					
a) Commercial	1.000%	1.000%	1.000%	1.000%	1.000%
b) Sport	--	--	--	--	--
Subtotal Alaska/B.C. harvest	1.030%	1.030%	1.030%	1.030%	1.030%
Washington ocean					
a) Commercial	--	--	--	--	--
b) Sport	--	--	--	--	--
Washington Puget Sound					
a) Commercial	--	--	--	--	--
b) Sport	--	--	--	--	--
Oregon					
a) Commercial	--	--	--	--	--
b) Sport	0.030%	0.030%	0.030%	0.030%	0.030%
California					
a) Commercial	--	--	--	--	--
b) Sport	--	--	--	--	--
Available for allocation inriver	95.082%	95.082%	95.082%	92.188%	92.188%
Columbia Basin inland (50/50)					
a) Freshwater sport (25% of allocation)					
Mainstem	5.943%	5.943%	5.943%	45.000%	45.000%
- Astoria (25%)	1.486%	1.486%	1.486%	11.250%	11.250%
- Other (75%)	4.457%	4.457%	4.457%	33.750%	33.750%
Tributary	17.828%	17.828%	17.828%	--	--
b) Gillnet	--	--	--	--	--
- Astoria (100%)	--	--	--	--	--
c) Tribal (25% of allocation)	23.770%	23.770%	23.770%	--	--
Other	--	--	--	--	--
Total Harvest	48.601%	48.601%	48.601%	46.060%	46.060%
Hatchery requirement	3.858%	3.858%	3.858%	6.752%	6.752%
Hatchery surplus market	23.770%	23.770%	23.770%	23.594%	23.594%
Hatchery surplus carcass	23.770%	23.770%	23.770%	23.594%	23.594%

Notes: 1. Expressed as percent of fish surviving-to-fisheries based on reviews of available data for 1971-1993 brood years.

2. Hatchery requirements:
   a) Rates expressed as percent of smolts released.
   b) For hatchery purposes, at least two spawners (one male and one female) are required for future egg and smolt production. Each coho and steelhead female spawner produces about 2,500 eggs, while Chinook produce 3,500 or more eggs. Hatchery egg to smolt survival tends to be about 80 percent. In order to provide some flexibility in hatchery spawner requirements, three future spawners per spawning pair are used in these calculations. Example for coho at 0.01 survival rate equals 25 surviving adults; divide 3 required spawners by 25 equals 12 percent of adults required for hatchery purposes, etc. At 0.012, the requirement is 10 percent (3 ÷ [0.012 x 2,500] = 0.10). At 0.0012, the requirement is 100 percent.

Source: Radtke et al. (1999) and Project.

The following equation is used to calculate REI values in total:

$$\sum_{i,j,k,l} EUG_{i,j,k} \cdot SAR_{i,j,k,l} \cdot PR_{j,l}$$

where i = Ocean, in-river, and hatchery geographic areas
j = Species (coho, spring/summer Chinook, fall Chinook, summer/winter steelhead)
k = Geographic harvest areas
l = Columbia River Basin provinces
EUG = Economic factor for spatially defined user group itemized for recreational and commercial fisheries; factor is REI or net benefits per fish for commercial fisheries and per angler day for recreational fisheries
SAR = Smolt-to-adult survival rates, including harvests, hatchery returns, and adjusted to exclude spawners; normalized for ocean fisheries, in-river fisheries, and hatchery returns
PR = Smolt production measured by hatchery releases or wild downstream migrants

The above three inputs are mixed and matched to generate four cases in order to provide a range of possible economic contributions for any given set of assumptions regarding hatchery production, SAR's, and harvest regime. Table 5 shows the variable input assignments for the cases.

The modeling process may be summarized verbally as follows:

1) Start with hatchery smolt releases and estimates of wild smolts (by species and production area)
2) Apply survival rates (SAR's) to estimate the number of adults available for harvest or return to hatchery (by species and production area)
3) Apply assumptions about how these adults contribute to various fisheries or return to hatcheries (or to spawn naturally)(by species, production area, and fishery)
4) Apply estimates of REI per fish to calculate personal income impacts (by species and fishery)

Economic Contribution Estimates

The economic contribution for the period of 2002 to 2004 adult harvests (early 2000's brood years) (Case III) is estimated to be about $142 million (Table 6). The early 1990's (Case IV) experienced very low survival rates, which resulted in low harvests and therefore low economic contribution of $40 million. During the 1980's (Case II), a period of relatively good survival rates, the economic contribution averaged about $113 million per year.

Respective REI's for the four cases and the distribution of income generated are shown in Table 7 and Table 8. Detailed estimates of REI by region, species, and user groups are provided in

Table 5
Hatchery Release, Smolt-to-Adult Survival Rates, and Harvest Level Assumptions for Four Cases Considered for Estimating Adult Salmonid Returns-to-Fisheries

	Assumptions		
Cases	Hatchery Production	SAR	Harvest Regime
I	NMFS Cap	30-year average	30-year average
II	Actual 1995	1980's average	1980's average
III	Actual 2002-2004 releases	Adjusted to reflect 2002-2004 expectations	Double 1980's average
IV	Actual 1995	Early 1990's average	Early 1990's average

Notes:
1. Hatchery production National Marine Fisheries Service (NMFS) cap is 197 million.
2. SAR is smolt-to-adult survival rates for hatchery and wild origin anadromous fish. Hatchery origin adults are harvests and returns to hatcheries. Wild adults are harvests and spawners plus prespawning mortality.
3. Average brood year periods SAR used for "30 years" ended in 1993; "early 1990's" was 1991 to 1995; and "1980's" was 1981 to 1989. SAR assumptions for Case III are partially based on managers' expectations for this period.
4. Commercial harvests include ocean and inland treaty and non-treaty allocations from California to Alaska, and hatchery surplus sales. Recreational harvests includes ocean and inland (mainstem and tributary). Harvest estimates are based on Integrated Hatchery Operations Team (IHOT) and CWT data.
5. These four cases may be viewed as situations or goals for Columbia River anadromous fish management. The four cases simply portray different situations that either have occurred in the past or hypothetically may occur in the future.

Source: Radtke et al. (1999) and Project.

Appendix C. The lower bounds ($40 million per year for Case IV) may be viewed as the amount of total personal income generated by Basin anadromous fish production when overall survival is at historic low rates. The highest amount ($142 million for Case III) may be attained if the survival rates continue as they have in the early 2000's.

A breakout of areas that may be affected by the production of anadromous salmonid harvesting from Basin production is provided in Table 8. At low production and available harvests (Case IV), recreational harvests are about 50 percent of total economic income generated. At higher production levels, the increases are higher for the commercial fisheries than for the recreational sector (Table 7). This is because the ocean commercial fisheries and the in-river commercial (tribal as well as non-tribal) fisheries are able to access and harvest increasing numbers. At lower overall stocks, the commercial fisheries are constrained by treaties and management agreements. The regions within the Basin are the beneficiaries of increased smolt production and resulting available harvests (Table 8).

Higher amounts of regional personal income may be attained by development of commercial markets for fish harvested at hatcheries, or by shifting the emphasis to higher valued commercial species, such as spring/summer Chinook. Better market development may also involve consistent supply throughout the year. Shifting management policies between users from commercial to recreational use may also generate more regional income. For example, a returning fall Chinook surplus hatchery fish may only generate $32.69 of total income (REI) per

Table 6
Regional Economic Impacts of Columbia River Basin Produced Salmon/Steelhead by Geographic Areas
For Four Cases of Production and Harvest Management Policies (2003 Dollars of Personal Income)

	I. NMFS Cap	%	II. 1980's Average	%	III. Early 2000's	%	IV. Early 1990's	%
Species: Coho								
Alaska	189	0.0%	219	0.0%	103	0.0%	63	0.0%
British Columbia	998,744	4.0%	1,160,702	3.9%	635,025	3.5%	326,742	4.4%
Washington ocean								
- Westport	3,231,119	12.9%	3,793,319	12.9%	2,285,246	12.6%	951,946	12.7%
- Other	4,712,743	18.7%	5,532,514	18.8%	3,327,590	18.3%	1,388,896	18.6%
- Tribal	9,107	0.0%	10,659	0.0%	5,640	0.0%	2,746	0.0%
Washington Puget Sound	31,782	0.1%	37,125	0.1%	17,873	0.1%	9,726	0.1%
Oregon ocean								
- Astoria	1,036,080	4.1%	1,215,266	4.1%	705,915	3.9%	307,365	4.1%
- Other	7,007,618	27.9%	8,217,951	27.9%	4,734,869	26.0%	2,082,014	27.9%
California	495,868	2.0%	586,427	2.0%	456,439	2.5%	137,759	1.8%
Columbia Basin inland								
Freshwater sport								
Mainstem								
- Astoria	1,224,628	4.9%	1,431,670	4.9%	717,005	3.9%	372,549	5.0%
- Other	1,224,628	4.9%	1,431,670	4.9%	717,005	3.9%	372,549	5.0%
Tributary	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Gillnet	3,750,008	14.9%	4,386,857	14.9%	2,266,021	12.5%	1,135,256	15.2%
Tribal	305,164	1.2%	387,989	1.3%	1,513,159	8.3%	6,419	0.1%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hatchery								
Hatchery surplus market	872,432	3.5%	1,025,883	3.5%	657,851	3.6%	253,818	3.4%
Hatchery carcass	244,191	1.0%	269,895	0.9%	148,371	0.8%	124,026	1.7%
Total with hatchery surplus utilization	25,144,301	100.0%	29,488,148	100.0%	18,188,111	100.0%	7,471,874	100.0%
Total without hatchery surplus utilization	24,027,678		28,192,370		17,381,889		7,094,030	
Species: Spring/Summer Chinook								
Alaska	1,369,549	11.5%	1,440,177	11.4%	2,376,129	4.8%	452,041	13.9%
British Columbia	1,925,970	16.1%	2,026,491	16.1%	3,768,529	7.6%	626,017	19.3%
Washington ocean								
- Westport	275,356	2.3%	289,764	2.3%	552,029	1.1%	89,201	2.7%
- Other	290,537	2.4%	305,588	2.4%	528,475	1.1%	95,343	2.9%
- Tribal	4,174	0.0%	4,389	0.0%	7,102	0.0%	1,381	0.0%
Washington Puget Sound	21,467	0.2%	22,734	0.2%	94,228	0.2%	5,794	0.2%
Oregon ocean								
- Astoria	3,290	0.0%	3,462	0.0%	6,594	0.0%	1,066	0.0%
- Other	225,975	1.9%	237,800	1.9%	452,899	0.9%	73,208	2.3%
California	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland								
Freshwater sport								
Mainstem								
- Astoria	1,063,781	8.9%	1,117,442	8.9%	6,838,042	13.8%	360,808	11.1%
- Other	1,063,781	8.9%	1,117,442	8.9%	6,838,042	13.8%	360,808	11.1%
Tributary	0	0.0%	0	0.0%	3,613,244	7.3%	0	0.0%
Gillnet	1,920,551	16.1%	2,017,430	16.0%	4,734,826	9.5%	651,403	20.0%
Tribal	273,043	2.3%	295,594	2.3%	16,496,978	33.3%	592	0.0%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hatchery								
Hatchery surplus market	3,288,270	27.6%	3,516,359	27.9%	3,039,695	6.1%	444,144	13.7%
Hatchery carcass	207,595	1.7%	216,882	1.7%	239,779	0.5%	87,369	2.7%
Total with hatchery surplus utilization	11,933,339	100.0%	12,611,556	100.0%	49,586,590	100.0%	3,249,175	100.0%
Total without hatchery surplus utilization	8,437,474		8,878,315		46,307,116		2,717,662	

Table 6 (cont.)

	I. NMFS Cap	%	II. 1980's Average	%	III. Early 2000's	%	IV. Early 1990's	%
Species: Fall Chinook								
Alaska	2,584,269	5.9%	3,117,981	5.8%	4,446,296	8.0%	1,561,034	6.1%
British Columbia	17,505,874	40.3%	21,068,182	38.9%	21,174,531	38.3%	11,090,416	43.4%
Washington ocean								
- Westport	4,149,984	9.6%	5,388,350	10.0%	2,936,683	5.3%	2,359,116	9.2%
- Other	3,483,479	8.0%	4,518,637	8.3%	2,698,498	4.9%	1,971,384	7.7%
- Tribal	41,921	0.1%	54,329	0.1%	35,137	0.1%	23,623	0.1%
Washington Puget Sound	233	0.0%	295	0.0%	578	0.0%	117	0.0%
Oregon ocean								
- Astoria	24,062	0.1%	31,127	0.1%	23,231	0.0%	13,443	0.1%
- Other	1,393,097	3.2%	1,802,151	3.3%	1,345,000	2.4%	778,312	3.0%
California	175,159	0.4%	228,789	0.4%	50,356	0.1%	102,361	0.4%
Columbia Basin inland								
Freshwater sport								
Mainstem								
- Astoria	1,306,247	3.0%	1,698,174	3.1%	808,737	1.5%	746,936	2.9%
- Other	1,306,247	3.0%	1,698,174	3.1%	808,737	1.5%	746,936	2.9%
Tributary	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Gillnet	4,859,963	11.2%	6,250,472	11.5%	6,665,244	12.1%	2,640,441	10.3%
Tribal	5,291,179	12.2%	6,696,763	12.4%	13,107,682	23.7%	2,652,967	10.4%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hatchery								
Hatchery surplus market	832,465	1.9%	1,073,560	2.0%	984,248	1.8%	458,249	1.8%
Hatchery carcass	484,666	1.1%	500,874	0.9%	215,216	0.4%	407,926	1.6%
Total with hatchery surplus utilization	43,438,844	100.0%	54,127,857	100.0%	55,300,173	100.0%	25,553,261	100.0%
Total without hatchery surplus utilization	42,121,713		52,553,423		54,100,709		24,687,086	
Species: Summer/Winter Steelhead								
Alaska	3,203	0.0%	7,116	0.0%	7,808	0.0%	1,910	0.1%
British Columbia	43,564	0.6%	96,780	0.6%	106,182	0.6%	25,980	0.7%
Washington ocean	0	0.0%	0	0.0%	0	0.0%	0	0.0%
- Westport								
- Other								
- Tribal								
Washington Puget Sound	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Oregon ocean	3,203	0.0%	7,116	0.0%	7,808	0.0%	1,910	0.1%
- Astoria								
- Other								
California	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland								
Freshwater sport								
Mainstem								
- Astoria	676,695	9.5%	1,573,061	9.1%	2,041,753	11.0%	294,330	7.9%
- Other	2,030,084	28.4%	4,719,184	27.3%	6,125,258	33.0%	882,989	23.7%
Tributary	3,268,905	45.7%	8,098,924	46.9%	6,963,511	37.5%	1,882,489	50.5%
Gillnet	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Tribal	449,355	6.3%	1,113,307	6.4%	1,435,844	7.7%	258,774	6.9%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hatchery								
Hatchery surplus market	528,536	7.4%	1,380,828	8.0%	1,606,800	8.7%	276,168	7.4%
Hatchery carcass	149,889	2.1%	269,846	1.6%	269,810	1.5%	105,197	2.8%
Total with hatchery surplus utilization	7,153,435	100.0%	17,266,163	100.0%	18,564,773	100.0%	3,729,747	100.0%
Total without hatchery surplus utilization	6,475,010		15,615,489		16,688,163		3,348,382	

Table 6 (cont.)

	I. NMFS Cap	%	II. 1980's Average	%	III. Early 2000's	%	IV. Early 1990's	%
Species: Total								
Alaska	3,957,210	4.5%	4,565,494	4.0%	6,830,335	4.8%	2,015,049	5.0%
British Columbia	20,474,153	23.4%	24,352,155	21.5%	25,684,267	18.1%	12,069,154	30.2%
Washington ocean								
- Westport	7,656,459	8.7%	9,471,433	8.3%	5,773,957	4.1%	3,400,263	8.5%
- Other	8,486,759	9.7%	10,356,739	9.1%	6,554,563	4.6%	3,455,623	8.6%
- Tribal	55,202	0.1%	69,377	0.1%	47,879	0.0%	27,750	0.1%
Washington Puget Sound	53,482	0.1%	60,155	0.1%	112,678	0.1%	15,637	0.0%
Oregon ocean								
- Astoria	1,063,432	1.2%	1,249,855	1.1%	735,740	0.5%	321,874	0.8%
- Other	8,629,893	9.8%	10,265,018	9.0%	6,540,575	4.6%	2,935,443	7.3%
California	671,027	0.8%	815,216	0.7%	506,794	0.4%	240,120	0.6%
Columbia Basin inland								
Freshwater sport								
Mainstem								
- Astoria	4,271,350	4.9%	5,820,348	5.1%	10,405,537	7.3%	1,774,623	4.4%
- Other	5,624,740	6.4%	8,966,470	7.9%	14,489,043	10.2%	2,363,283	5.9%
Tributary	3,268,905	3.7%	8,098,924	7.1%	10,576,755	7.5%	1,882,489	4.7%
Gillnet	10,530,521	12.0%	12,654,760	11.2%	13,666,091	9.6%	4,427,100	11.1%
Tribal	6,318,741	7.2%	8,493,654	7.5%	32,553,663	23.0%	2,918,751	7.3%
Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Hatchery								
Hatchery surplus market	5,521,703	6.3%	6,996,631	6.2%	6,288,594	4.4%	1,432,379	3.6%
Hatchery carcass	1,086,341	1.2%	1,257,497	1.1%	873,177	0.6%	724,517	1.8%
Total with hatchery surplus utilization	87,669,918	100.0%	113,493,724	100.0%	141,639,648	100.0%	40,004,057	100.0%
Total without hatchery surplus utilization	81,061,875		105,239,597		134,477,877		37,847,161	

fish. The same fish may generate between $45 and $77 in the commercial fishery and about $60 in the recreational fishery. However, many of these shifts, although they could generate more income, may be unattainable due to recovery policies, past treaties, or allocation agreements.

Economic Contribution in Historical Context

Salmon were the lifeblood of the Indians living along the Columbia River, essential to their subsistence, their culture, and their religion. A focal point of this great salmon fishery for many centuries was Wy-am, one of the longest continuously occupied sites on the North American continent. Located near Celilo Falls on the Columbia River, the Wy-am area, before the Dalles Dam in 1957, was a commercial center during the fishing season. In autumn, as many as 5,000 people gathered to trade, feast, and participate in games and religious ceremonies (Spranger and Anderson 1988).

The history of Columbia River salmon harvest has been one of transition from spears and dip nets, to seine and gillnets, to diesel engines and ocean trolling poles. Historically, harvesters waited until salmon returned to the Columbia River. Today, salmon produced in the Columbia River system are harvested from California to Alaska by trolling gear and by nets set to harvest other species of salmon.

Table 7
Economic Impacts Per Year For Four Cases of Columbia River Basin Anadromous Fish Production and Harvest Management (Millions of 2003 Dollars of Personal Income)

Policy		Economic Impacts (Millions of 2003$)		
Case	Assumptions	Commercial	Recreational	Total
I	Hatchery production at NMFS cap, SAR and harvests 30 yr historical average	$54.3	$33.4	$87.7
II	Hatchery production at 1995 levels, SAR and harvests at 1980's historical average	$66.4	$47.1	$113.5
III	Hatchery production, SAR, and harvests at early 2000's levels	$91.2	$50.4	$141.6
IV	Hatchery production at 1995 levels, SAR and harvests early 1990's historical average	$26.4	$13.6	$40.0

Notes:
1. Regional economic impacts are total personal income per year in millions of 2003 dollars.
2. Total and subtotals may not equal sum of values due to rounding.
3. SAR is smolt-to-adult survival rate. Adults are harvests and returns to hatcheries for hatchery origin anadromous fish. Adults are harvests and spawners plus in-stream prespawning mortality for wild origin anadromous fish.
4. Commercial includes ocean treaty and non-treaty harvests from California to Alaska, in-river treaty and non-treaty harvests, and hatchery surplus sales. Recreational includes ocean, in-river mainstem, and in-river tributary.
5. The concern about certain species or sub-species of salmon, and the overall effect of hatchery fish on survival of these species, has led to the NMFS placing a cap of 197 million annual smolt releases within the Columbia Basin.

Source: Project.

Salmon played a key role in developing the West by European settlers. As early as 1828, various trading companies were purchasing and exporting salmon caught by the Indians on the Columbia River. The first commercial use of fishery products in Oregon was the packing of salmon. Development of the canning process in the mid 1800's created a huge demand for salmon. The total harvested pounds of salmon and steelhead in the early 1890's ranged from 21 million pounds to 40 millions pounds (Figure 8). During the late 1880's and early 1920's, the salmon gillnet fishery in the Columbia River contributed a substantial amount of income to communities on the lower Columbia River, such as Astoria. At today's prices, these runs contributed as much as $300 million REI into the lower Columbia communities per year (Figure 12) (Radtke et al. 1999 and Project).

When salmon became scarcer and gas powered engines allowed fishermen to venture out farther into the ocean, trolling for salmon became an attractive alternative. As ocean fisheries developed, a majority of the fish produced in the Basin were harvested in marine waters from California to Alaska. The effect of economic development, hatchery production, and mixed stock, open access fisheries has been to reduce the total, and change the species and stock composition, of returning salmon to the Columbia River.

Table 8
Economic Contribution From Columbia River Basin Fish Production
(Millions of 2003 Dollars of Personal Income)

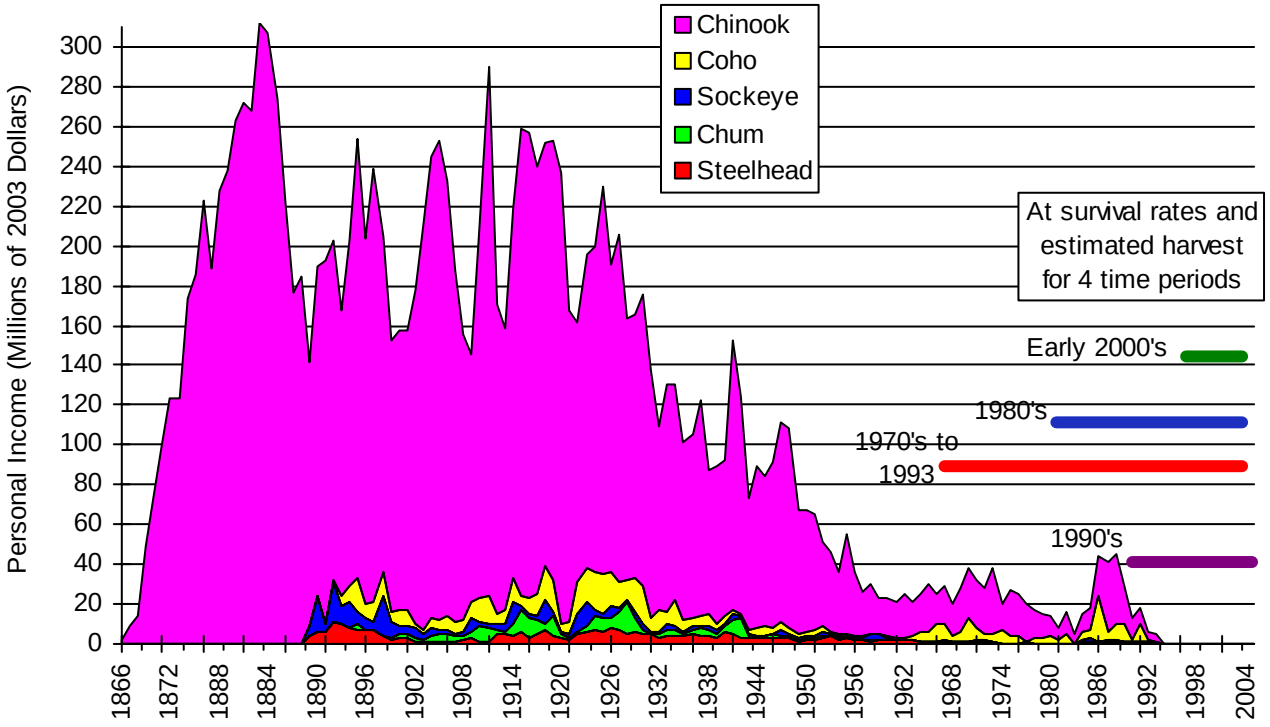
Anadromous Fish Fisheries	Case I NMFS Cap	Case II 1980's Avg.	Case III (High) Early 2000's	Case IV (Low) Early 1990's
A. Inside and Outside the Columbia Basin				
Within Basin	$30.0	$44.0	$81.7	$13.4
Commercial	$16.8	$21.1	$46.2	$7.3
Non-treaty	$10.5	$12.7	$13.7	$4.4
Treaty	$6.3	$8.5	$32.6	$2.9
Recreational	$13.2	$22.9	$35.5	$6.0
Hatchery surplus	$5.5	$7.0	$6.3	$1.4
Hatchery carcass	$1.1	$1.3	$0.9	$0.7
Outside Basin	$51.0	$61.2	$52.8	$24.5
Commercial	$30.9	$37.0	$37.8	$16.9
Recreational	$20.2	$24.2	$14.9	$7.6
Total	$87.7	$113.5	$141.6	$40.0
B. By Geopolitical Regions				
Alaska	$4.0	$4.6	$6.8	$2.0
Canada	$20.5	$24.4	$25.7	$12.1
Washington, ocean and Puget Sound	$16.3	$20.0	$12.5	$6.9
Oregon ocean	$9.7	$11.5	$7.3	$3.3
Columbia River (Oregon, Washington, and hatcheries)	$36.6	$52.3	$88.9	$15.5
California	$0.7	$0.8	$0.5	$0.2
Total	$87.7	$113.5	$141.6	$40.0
C. By Species Groups				
Coho	$25.1	$29.5	$18.2	$7.5
Fall Chinook	$43.4	$54.1	$55.3	$25.6
Spring/summer Chinook	$11.9	$12.6	$49.6	$3.2
Steelhead	$7.2	$17.3	$18.6	$3.7
Total	$87.7	$113.5	$141.6	$40.0

Source: Project.

In more recent times, the Basin produced around 20 million pounds that were harvested in the Basin until the late 1940's. Since then, the total poundage harvested commercially generally declined to the very low level in 1993, when a total of just over one million pounds of salmon were harvested in the Columbia River. As returning fish numbers have declined, so have the revenues received by fishermen and the resulting income generated for inland communities.

Based on the four cases analyzed, the total contribution during the 1980's of Basin produced salmonids was about $113 million. This compares with over $200 million in the best of years in the late 1880's and early 1900's (Figure 12). During the 1990's, the total contribution declined to about $40 million. With Basin smolt production and survival rates experienced in the early 2000's, the total economic contribution from commercial and recreational salmon and steelhead

Figure 12
Historical and Recent Columbia River Basin Estimated Regional
Economic Impacts From Basin Produced Salmonid Harvests



Notes: 1 Economic impacts expressed as total personal income adjusted to Year 2003 dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.
2. Historical available data only represents harvest in the Columbia River from 1866 to 1993. These Project estimates include both ocean and Columbia River harvests.

Sources: Landing data are from NPCC (1986), fish size and ex-vessel price are from ODFW (1995), and regional economic impacts per pound are from Radtke (May 1997) and Project.

harvested throughout the West Coast is estimated to be about $142 million. This approaches the average income contribution of the period from 1890's to 1930's.

Other Fish Resources Not Included in These Estimates

Fish other than anadromous salmonid and resident species support major fisheries of commercial, tribal, and recreational user groups (WDFW and ODFW 2002). These contributions are not included in these estimates. Despite their recognition by many as an important component of the Basin ecosystem, resident fish do not get the level of research and management attention as do anadromous fish. Comprehensive data are often lacking regarding population, life history requirements, and habitat use.[1]

White sturgeon, shad, and smelt are the principal other species contributing to the commercial fisheries. There is also a small Pacific lamprey eel and bait (anchovy and herring) commercial

1. See Appendix C, Table C.1 for a list of resident species known or assumed to occur in the Basin's reservoirs and tributaries.

fishery. Native Americans fished for other species, but little documentation of these fisheries exists.[1] The principal other species contributing to recreational fisheries are white sturgeon, shad, smelt, walleye, northern pikeminnow, and rainbow trout. There is some targeted recreational fishing for smallmouth bass and catfish in the pools behind the upriver dams and in tributaries.

Recreational fisheries for other than salmon and steelhead in the Basin are less well documented than are commercial fisheries. This is, in part, a function of their complexity and the difficulty in monitoring the activity levels. Estimates of recreational angling activity within the Basin are available (Fluharty 2000 and USDI March 2003).[2] The diversity of recreational fishing activities (anadromous, resident, warm water, cold water, ice fishing, and specialized gear fisheries - flies, plugs, etc.) and the vast geographic scale of the Basin make it difficult to provide detailed treatment of each. Also, the lack of comprehensive surveys is limiting. Despite this lack of research, it should not be assumed that the economic values from recreational fishing are insignificant. Based on available data, the estimated number of anglers may be as high as 1,166,000 (Appendix C, Table C.2). These anglers spend about 12,427,000 days fishing within the Basin for a variety of resident and anadromous species. The direct expenditures on gasoline, fishing tackle, etc. from these angler trips are estimated to be about $2 billion. The economic effects in terms of REI of these anglers may be as much as $408 million. A data problem exists in that the Integrated Hatchery Operations Team (IHOT) based estimates of in-river salmonid recreational harvests used to include salmonid recreational harvests in the analysis of the four cases in this paper are part of these total angler trips. A survey is needed to separate the resident fish angling effort from the anadromous salmonid based effort.

1. Hunn (1990) describes some aspects of the usage of nonsalmonid resources by one family.
2. Inland recreational fishing includes angling trips when either anadromous fish or resident fish are the target species. Therefore, the within Basin recreational anadromous fish fisheries are not separated, in this data set, from other fishing trips.

BIBLIOGRAPHY

Cited

Artificial Production Review and Evaluation (APRE). Draft Basin-Level Report. Northwest Power and Conservation Council. Council Document 2003-17. Available online at: http://www.nwcouncil.org/library/2003/2003-17.htm. October 7, 2003.

Ben Johnson Associates. The Economic Impact of a Restored Salmon Fishery in Idaho. July 1999.

Food and Agricultural Organization of the United Nations (FAO). FishStat database. Available online at www.fao.org. July 2003.

Fluharty, David L. Characterization and Assessment of Economic Systems in the Interior Columbia Basin: Fisheries. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-451. April 2000.

Hankin, David G. and Jack Richards. The Northern Pikeminnow Management Program. An Independent Review of Program Justification, Performance, and Cost-Effectiveness. Northwest Power Planning Council. April 4, 2000.

Haynes, Richard W. and Amy L. Horne. Economic Assessment of the Interior Columbia Basin. Draft, April 27, 1996.

Hunn, Eugene S. Nch'i-Wána "The Big River": Mid-Columbia Indians and Their Land. Seattle, University of Washington Press. 378 p. 1990.

Lee, Kai N. Compass and Gyroscope: Integrating Science and Politics for the Environment. Island Press. Washington, D.C. 1993.

Mann, Roger. The Yakima Basin Regional Economy and the Contribution of Fish and Wildlife. Yakima County Public Services. November. 2004.

National Marine Fisheries Service (NOAA Fisheries). Puget Sound Chinook Harvest Resource Management Plan Draft EIS. April 2004.

National Marine Fisheries Service (NMFS), now NOAA Fisheries. Guidelines for Economic Analysis of Fishery Management Actions. Revised August 16, 2000.

National Marine Fisheries Service (NMFS), now NOAA Fisheries. Biological Opinion on Artificial Propagation in the Columbia River Basin. Northwest Region. March 29, 1999.

National Research Council (NRC). Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival. 2004.

Northwest Power Planning Council, now Northwest Power and Conservation Council (NPCC). Appendix D of the 1987 Columbia River Basin Fish and Wildlife Program, Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin. March 1986. Portland, Oregon.

Olson, D., et al. Micro IMPLAN User's Guide: Version 91-F. Minnesota IMPLAN Group Inc., St. Paul, Minnesota. 1993.

Oregon Department of Fish and Wildlife (ODFW). Personal communication with Sue Engwall. 2004.

Oregon Department of Fish and Wildlife (ODFW). Annual Commercial Fishery Statistics. 1995.

Pacific Fishery Management Council (PFMC). Pacific Salmon Management Plan 2003. Appendix A. Portland, Oregon. 2003.

Project. The information developed for this table or figure is part of this project.

Radtke, Hans D., Shannon W. Davis, and Rebecca L. Johnson. Lower Snake River Juvenile Salmon Migration Feasibility Study: Anadromous Fish Economic Analysis. Prepared for Foster Wheeler Environmental Corporation and U.S. Army Corps of Engineers. October 1999.

Radtke, Hans D. II. An Estimate of Personal Income Contribution of Commercial and Recreational Fishing in the Pacific Marine Region of the U.S. and Canada. Interrain Pacific. May 1997.

The Research Group (TRG). Oregon Angler Survey and Economic Study. Oregon Department of Fish and Wildlife. June 1991.

Sando, Rod, Executive Director, Columbia Basin Fish and Wildlife Authority. Letter to Mark Walker, Northwest Power and Conservation Council. December 8, 2003.

Spranger, Michael S. and Randall S. Anderson. Columbia River Salmon. Washington Sea Grant, Marine Advisory Services. WSG-AS-88-3. 1988.

Suzumoto, Bruce. Northwest Power and Conservation Council. Personal communication. November 2003.

U.S. Department of the Interior (USDI), U.S. Fish and Wildlife Service (FWS). 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. May 2002.

U.S. Department of the Interior (USDI), U.S. Fish and Wildlife Service (FWS). 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Idaho, Montana, Oregon, and Washington books. March 2003.

Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). Status Report: Columbia River Fish Runs and Fisheries, 1938-2000. July 2002.

The World Commission on Dams. Online: http://www.dams.org. Accessed 2004.

Not Cited

Adamowicz, W., Louviere, J., and Williams, M. "Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities." *Journal of Environmental Economics and Management.* 26: 271-292. 1994.

Ballard, Arthur. "Mythology of Southern Puget Sound." University of Washington *Publications in Anthropology*, Seattle. 3 (2). Pages 31-150. 1929.

Ballard, Arthur. "Some Tales of the Southern Puget Sound Salish." University of Washington *Publications in Anthropology*, Seattle. 2 (3). Pages 57-81. 1927.

Barclay, J.C. and R.W. Morley. Estimation of Commercial Fishery Benefits and Associated Costs For the National Income Account. Department of Fisheries and Oceans, Vancouver, B.C. 1977.

Bergstrom, J.C. and J.B. Loomis. Economic Dimensions of Ecosystem Management. Paper presented at the Integrating Social Science and Ecosystem Management conference, December 1994, Unicoi Lodge, Helena, MT. 1994.

Brookshire, David S. and Neill, Helen R. "Benefit Transfers: Conceptual and Empirical Issues." *Water Resources Research.* 28(3): 651-655. 1992.

Callaway, John, Shannon Ragland, Salley Keefe, Trudy Cameron, and Douglas Shaw. Columbia River System Operation Review Recreation Impacts: Demand Model and Simulation Results. Appendix J-1, Final Environmental Impact Statement. DOE/EIS-0170, U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon. 1995.

Columbia River Inter-Tribal Fish Commission (CRITFC). Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon. The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes. Portland, Oregon. 131 p. 1995.

ECO Northwest. Salmon and the Economy: A Handbook for Understanding the Issues in Washington and Oregon. The Center for Watershed and Community Health. November 1999.

ECO Northwest. Salmon, Timber, and the Economy in the Pacific Northwest. Prepared for the Pacific Rivers Council. October 1999.

Evergreen Funding Consultants. A Primer on Habitat Project Costs. Prepared for Puget Sound Shared Strategy. Spring 2003.

Friends of the Earth. *Green Scissors '98.* 1998.

Fuss, Howard J., Ross Fuller, Mark A. Kimbel, Andrew E. Appleby, and Stanley A. Hammer. Annual Coded Wire Tag Program (Washington), Missing Production Groups, Annual Report 1993. Washington Department of Fisheries. Prepared for U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Portland. Project no. 89-66. March 1994.

Garrison, Robert L., Christine Mallette, Mark A. Lewis, and William M. Murry. Annual Coded Wire Tag Program, Oregon, Missing Production Groups, 1995 Annual Report. Oregon Department of Fish and Wildlife. Prepared for U.S. Department of Energy, Bonneville Power Administration, Environment, Fish and Wildlife, Portland. Project no. 89-069. December 1995.

Goulder, L.H. and D. Kennedy. "Valuing Ecosystem Services: Philosophical Bases and Empirical Methods." Pages 23-47 *in* G.C. Daily ed. Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, D.C. 1997.

Hanley, N. and C.L. Spash. Cost-Benefit Analysis and the Environment. Edward Elgar, Hants, England, 278 pp. 1993.

Hanna, Susan S. The Economics of Uncertainty: A Survey of the Literature on Uncertainty With Particular Reference to the Fishery. NOAA Tech. Mem. NMFS F/NWC-47. Seattle: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 193 p. 1983.

Hipple, S. "Worker Displacement in the Mid-1990's." *Monthly Labor Review* (July): 15-32. 1999.

Huppert, Daniel D. "Measuring the Value of Fish to Anglers: Application to Central California Anadromous Species." *Marine Resource Economics* 6: 89-107. 1989.

Huppert, Daniel D. and David Fluharty. Economics of Snake River Salmon Recovery: A Report to the National Marine Fisheries Service. School of Marine Affairs, College of Ocean and Fisheries Service, University of Washington. October 1996.

Huppert, Dan, Gareth Green, William Beyers, Andrew Subkoviak, and Andrew Wenzl. Economics of Columbia River Initiative. Draft report for review by the Washington Department of Ecology and the Economics Advisory Committee. November 10, 2003.

Independent Economic Analysis Board (IEAB). Artificial Production Review - Economics Analysis Phase I. Northwest Power Planning Council, Portland, OR. 2002.

Johnson, R.L., H.D. Radtke, S.W. Davis and R.W. Berrens. Economic Values and Impacts of Anadromous Sportfishing in Oregon Coastal Rivers: Assessment of Available Information. Santa Barbara, CA: The Center for the Study of the Environment. 1994.

Karr, James R. "Using Biological Criteria to Ensure a Sustainable Society." In: Watershed Resources: Balancing Environmental, Social, Political and Economic Factors in Large Basins: In: Proceedings of a conference; 1992. October 14-16; Portland, OR. Corvallis, OR: Forest Engineering Department, Oregon State University: 61-70. 1993.

Layton, David F., Gardner M. Brown, Jr., and Mark L. Plummer. Valuing Multiple Programs to improve Fish Populations. Unpublished manuscript, prepared for the Washington Department of Ecology, Olympia, Washington. Available from Cathy Caruthers at WDOE. 1999.

Lewis, B.J. Value and Valuation Methodology in Forestry and Natural Resource Management Contexts. Project report. Minneapolis, MN: University of Minnesota. 1995.

Lippke, B.R., B.B. Bare, R.A. Woods, W. Xu, and M. Mendoza. Economic and Environmental Impact Assessment of Forest Policy Changes in Western Washington. CINTRAFOR, College of Forest Resources, University of Washington. Special Paper 27. January. 1999.

Loomis, John. Recreation and Passive Use Values From Removing the Dams on the Lower Snake River to Increase Salmon. Report from AEI to U.S. Army Corps of Engineers, Walla Walla, Washington. 1999.

Loomis, John B. "The Evolution of a More Rigorous Approach to Benefit Transfer: Benefit Function Transfer." *Water Resources Research.* 28(3): 701-705. 1992.

Loomis, J.B. and D.S. White. "Economic Benefits of Rare and Endangered Species: Summary and Meta-Analysis." *Ecological Economics* 18(3):197-206. 1996.

McConnell, K.E. "Model Building and Judgment: Implications for Benefit Transfers With Travel Cost Models." *Water Resources Research.* 28(3): 695-700. 1994.

Meyer, Philip A. et al. Elwha River Restoration Project: Economic Analysis, Final Technical Report. A report to the U.S. Bureau of Reclamation, the National Park Service, and the Lower Elwha S'Klallam Tribe. April 1995.

Morely, Edward R. "What is Consumer's Surplus Per Day of Use, When is it a Constant Independent of the Number of Days of Use, and What Does it Tell Us About Consumer's Surplus?" *Journal of Environmental Economics and Management.* 26: 257-270. 1994.

National Marine Fisheries Service (NMFS), now NOAA Fisheries. Federal Columbia River Power System (FCRPS) Biological Opinion. 1995.

Netboy, Anthony. The Columbia River Salmon and Steelhead Trout. Seattle: University of Washington Press. 180 p. 1980.

Olsen, Darryll, Jack Richards, and R. Douglas Scott. "Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs." *Rivers* 2(1):44-56. 1991.

Oregon Department of Forestry (ODF). Northwest Oregon State Forests Management Plan. 1996.

Oregon State University (OSU), Department of Agricultural and Resource Economics. Socio-Economics of the Idaho, Washington, Oregon and California Coho and Chinook Salmon Industry. Corvallis, OR; final report to Pacific Fishery Management Council. 380 p. 1978.

Panayotou, T. Green Markets: The Economics of Sustainable Development. ICS Press for the International Center for Economic Growth, San Francisco, CA. 169 pp. 1992.

Power, T.M. and Ruder, P.J. Economic Realities in the Tillamook and Clatsop State Forests: Possibilities for Economic Expansion and Diversification. Portland, OR: The Tillamook Rainforest Coalition. 2003.

Radtke, Hans D. and Shannon W. Davis. Some Estimates of the Asset Value of the Columbia River Gillnet Fishery Based on Present Value Calculations and Gillnetters' Perceptions. Salmon For All, Astoria, Oregon. August 1994.

The Research Group (TRG). Local Economic Impacts From Alternative Hydrosystem Actions Being Considered for the Lower Snake River Dams and the Economic Consequences of Not Increasing Production and Survival Rates of Columbia River Anadromous Fish Runs. Prepared for: National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington. September 2000.

Rettig, Bruce and Bruce McCarl. Potential and Actual Benefits from Commercial Fishing Activities. National Oceanic and Atmospheric Administration Technical Memorandum. National Marine Fisheries Service. F/FWR-8, July 24-26 workshop, Seattle, Washington and also cited in Appendix IV in PFMC 1985 - Review of 1985 Ocean Salmon Fisheries as a guideline for the PFMC measure of economic value of commercial fisheries. 1984.

Ringer, R. Conservation Reserve Enhancement Program. U.S. Department of Agriculture, Farm Service Agency. November. 1998.

Rosenberger, Randall S. What Are the Non-Market Benefits of Salmon Anchor Habitats? OSU Department of Forest Resources. April 2004.

Rosenberger, R.S. and J.B. Loomis. "Benefit Transfer." In: P.A. Champ, K.J. Boyle and T.C. Brown (eds.), 2003, A Primer on Nonmarket Valuation. Dordrecht, The Netherlands: Kluwer Academic Publishers. Pp. 445-482. 2003.

Rosenberger, R.S. and J.B. Loomis. Benefit Transfer of Outdoor Recreation Use Values: A Technical Document Supporting the Forest Service Strategic Plan (2000 revision). General Technical Report RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2001.

Save Our Wild Salmon (SOS). Wild Salmon Forever: A Citizen's Strategy to Restore Northwest Salmon and Watersheds. Seattle, WA. 45 p. 1995.

Schalk, Randall F. "Estimating Salmon and Steelhead Usage in the Columbia Basin Before 1850: The Anthropological Perspective." *Northwest Environmental Journal.* 2(2): 1-19. 1986.

Smith, Courtland L. Salmon Fishers of the Columbia. Corvallis, OR: Oregon State University Press. 117 p. 1979.

Tietenberg, T. Environmental and Natural Resource Economics. Harper Collins, New York, 614 pp. 1996.

Tripp, Lisa and Rockland, David B. Fishery Resources of the National Forests: Extent, Uses, and Economic Benefits 1988. Washington, DC: U.S. Department of Agriculture, Forest Service, Wildlife and Fisheries Division. 177 p. 1990.

U.S. Army Corps of Engineers, North Pacific Division (Corps). Columbia River System Operation Review, Final Environmental Impact Statement. Appendix K, Resident Fish. DOE/EIS-0170. November 1995.

U.S. Department of the Interior (USDI), U.S. Fish and Wildlife Service (FWS). 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Idaho, Montana, Oregon, and Washington books. October 1993.

U.S. Department of the Interior (USDI), U.S. Fish and Wildlife Service (FWS). 1985 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Idaho, Montana, Oregon, and Washington books. 1989.

Vatn, Arild and Bromley, Daniel W. "Choices Without Prices Without Apologies." *Journal of Environmental Economics and Management.* 26(2): 129-148. 1994.

Washington Department of Fish and Wildlife (WDFW). Opinion Survey. Washington Department of Fish and Wildlife. 1996.

Water Resources Council. Procedures for Evaluation of National Economic Benefits and Costs in Water Resources Planning. Final Rule Benefits and Costs Published in the FEDERAL REGISTER on December 4, 1979.

APPENDIX A

Modeling For Four Cases of Production and Harvest

SECTION I

Distributional Assumptions

SECTION II

Returning Adults by Geographic Region

SECTION III

Regional Economic Impacts of Columbia River Basin Produced Salmon/Steelhead by Geographic Areas

APPENDIX A

SECTION I

Distributional Assumptions

Distributional Assumptions (Case I)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Coho					
West Coast Ocean					
Alaska					
a) Commercial	NA	--	--	0.001%	--
b) Sport	NA	--	--	--	--
British Columbia					
a) Commercial	NA	2.000%	2.000%	4.500%	2.000%
b) Sport	NA	0.200%	0.200%	0.500%	0.200%
Subtotal Alaska/B.C. harvest	NA	2.200%	2.200%	5.001%	2.200%
Washington ocean					
a) Commercial (0.33% tribal)	NA	0.500%	0.500%	2.005%	1.000%
- Westport (28%)	NA	0.140%	0.140%	0.561%	0.280%
- Other commercial (68%)	NA	0.340%	0.340%	1.363%	0.680%
- Tribal (4%)	NA	0.020%	0.020%	0.080%	0.040%
b) Sport	NA	10.000%	10.000%	15.000%	20.000%
- Westport (41%)	NA	4.100%	4.100%	6.150%	8.200%
- Other sport (59%)	NA	5.900%	5.900%	8.850%	11.800%
Washington Puget Sound					
a) Commercial	NA	--	--	0.050%	--
b) Sport	NA	--	--	0.050%	--
Oregon					
a) Commercial	NA	5.000%	5.000%	12.000%	10.000%
- Astoria (3%)	NA	0.150%	0.150%	0.360%	0.300%
- Other commercial (97%)	NA	4.850%	4.850%	11.640%	9.700%
b) Sport	NA	6.500%	6.500%	12.000%	13.000%
- Astoria & Buoy 10 (16%)	NA	1.040%	1.040%	1.920%	2.080%
- Other sport (84%)	NA	5.460%	5.460%	10.080%	10.920%
California					
a) Commercial	NA	1.500%	1.500%	1.000%	3.000%
b) Sport	NA	1.000%	1.000%	0.500%	2.000%
Available for allocation inriver	NA	87.800%	87.800%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	NA	0.500%	0.500%	5.000%	1.000%
- Astoria (50%)	NA	0.250%	0.250%	2.500%	0.500%
- Other (50%)	NA	0.250%	0.250%	2.500%	0.500%
Tributary	NA	--	--	--	--
b) Gillnet	NA	5.000%	5.000%	27.389%	10.000%
- Astoria (100%)	NA	5.000%	5.000%	27.389%	10.000%
c) Tribal (50% of allocation)	NA	43.900%	43.900%	--	--
Other	NA	0.400%	0.400%	--	0.800%
Total Harvest	NA	76.500%	76.500%	79.995%	63.000%
Hatchery requirement	NA	10.000%	10.000%	4.800%	10.000%
Hatchery surplus market	NA	6.750%	6.750%	7.603%	13.500%
Hatchery surplus carcass	NA	6.750%	6.750%	7.603%	13.500%

Species: Spring/Summer Chinook

West Coast Ocean						
Alaska						
a)	Commercial	2.500%	2.500%	2.500%	9.000%	9.000%
b)	Sport	--	--	--	0.100%	0.100%
British Columbia						
a)	Commercial	5.000%	5.000%	5.000%	11.000%	11.000%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
Subtotal Alaska/B.C. harvest		8.000%	8.000%	8.000%	21.100%	21.100%
Washington ocean						
a)	Commercial	1.000%	1.000%	1.000%	4.000%	4.000%
	- Westport (40%)	0.400%	0.400%	0.400%	1.600%	1.600%
	- Other commercial (59%)	0.590%	0.590%	0.590%	2.360%	2.360%
	- Tribal (1%)	0.010%	0.010%	0.010%	0.040%	0.040%
b)	Sport	1.000%	1.000%	1.000%	1.000%	1.000%
	- Westport (71%)	0.710%	0.710%	0.710%	0.710%	0.710%
	- Other sport (29%)	0.290%	0.290%	0.290%	0.290%	0.290%
Washington Puget Sound						
a)	Commercial	0.500%	0.500%	0.500%	0.010%	0.010%
b)	Sport	--	--	--	0.030%	0.030%
Oregon						
a)	Commercial	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria (2%)	0.010%	0.010%	0.010%	0.020%	0.020%
	- Other commercial (98%)	0.490%	0.490%	0.490%	0.980%	0.980%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	0.010%
	- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	0.990%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		65.334%	65.334%	65.334%	63.023%	63.023%
Columbia Basin inland						
a)	Freshwater sport					
	Mainstem	--	--	--	10.000%	10.000%
	- Astoria (50%)	--	--	--	5.000%	5.000%
	- Other (50%)	--	--	--	5.000%	5.000%
	Tributary	--	--	--	--	--
b)	Gillnet	--	--	--	10.000%	10.000%
	- Astoria (100%)	--	--	--	10.000%	10.000%
c)	Tribal (5% of allocation)	3.267%	3.267%	3.267%	--	--
Other		3.000%	3.000%	3.000%	--	--
Total Harvest		17.767%	17.767%	17.767%	48.140%	48.140%
Hatchery requirement		23.166%	23.166%	23.166%	8.837%	8.837%
Hatchery surplus market		29.534%	29.534%	29.534%	21.512%	21.512%
Hatchery surplus carcass		29.534%	29.534%	29.534%	21.512%	21.512%

Species: Fall Chinook

West Coast Ocean					
Alaska					
a) Commercial	6.000%	6.000%	6.000%	1.500%	NA
b) Sport	0.010%	0.010%	0.010%	--	NA
British Columbia					
a) Commercial	25.000%	25.000%	25.000%	20.000%	NA
b) Sport	2.000%	2.000%	2.000%	3.000%	NA
Subtotal Alaska/B.C. harvest	33.010%	33.010%	33.010%	24.500%	NA
Washington ocean					
a) Commercial (3.00% tribal)	4.500%	4.500%	4.500%	12.000%	NA
- Westport (40%)	1.800%	1.800%	1.800%	4.800%	NA
- Other commercial (59%)	2.655%	2.655%	2.655%	7.080%	NA
- Tribal (1%)	0.045%	0.045%	0.045%	0.120%	NA
b) Sport	2.000%	2.000%	2.000%	10.000%	NA
- Westport (71%)	1.420%	1.420%	1.420%	7.100%	NA
- Other sport (29%)	0.580%	0.580%	0.580%	2.900%	NA
Washington Puget Sound					
a) Commercial	0.001%	0.001%	0.001%	--	NA
b) Sport	0.001%	0.001%	0.001%	--	NA
Oregon					
a) Commercial	1.500%	1.500%	1.500%	3.000%	NA
- Astoria (2%)	0.030%	0.030%	0.030%	0.060%	NA
- Other commercial (98%)	1.470%	1.470%	1.470%	2.940%	NA
b) Sport	0.500%	0.500%	0.500%	1.000%	NA
- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	NA
- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	NA
California					
a) Commercial	0.001%	0.001%	0.001%	0.500%	NA
b) Sport	0.001%	0.001%	0.001%	0.100%	NA
Available for allocation inriver	52.704%	52.704%	52.704%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	1.000%	1.000%	1.000%	5.000%	NA
- Astoria (50%)	0.500%	0.500%	0.500%	2.500%	NA
- Other (50%)	0.500%	0.500%	0.500%	2.500%	NA
Tributary	--	--	--	--	NA
b) Gillnet	12.000%	12.000%	12.000%	11.000%	NA
- Astoria (100%)	12.000%	12.000%	12.000%	11.000%	NA
c) Tribal (50% of allocation)	26.352%	26.352%	26.352%	--	NA
Other	0.145%	0.145%	0.145%	--	NA
Total Harvest	81.009%	81.009%	81.009%	67.100%	NA
Hatchery requirement	14.286%	14.286%	14.286%	26.786%	NA
Hatchery surplus market	2.353%	2.353%	2.353%	3.057%	NA
Hatchery surplus carcass	2.353%	2.353%	2.353%	3.057%	NA

Species: Summer/Winter Steelhead

West Coast Ocean						
Alaska						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
British Columbia						
a)	Commercial	1.000%	1.000%	1.000%	1.000%	1.000%
b)	Sport	--	--	--	--	--
Subtotal Alaska/B.C. harvest		1.030%	1.030%	1.030%	1.030%	1.030%
Washington ocean						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Washington Puget Sound						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Oregon						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		81.797%	81.797%	81.797%	68.940%	68.940%
Columbia Basin inland (60/40)						
a)	Freshwater sport (30% of allocation)					
	Mainstem	6.135%	6.135%	6.135%	45.000%	45.000%
	- Astoria (25%)	1.534%	1.534%	1.534%	11.250%	11.250%
	- Other (75%)	4.601%	4.601%	4.601%	33.750%	33.750%
	Tributary	18.404%	18.404%	18.404%	--	--
b)	Gillnet	--	--	--	--	--
	- Astoria (100%)	--	--	--	--	--
c)	Tribal (20% of allocation)	16.359%	16.359%	16.359%	--	--
Other		--	--	--	--	--
Total Harvest		41.959%	41.959%	41.959%	46.060%	46.060%
Hatchery requirement		17.143%	17.143%	17.143%	30.000%	30.000%
Hatchery surplus market		20.449%	20.449%	20.449%	11.970%	11.970%
Hatchery surplus carcass		20.449%	20.449%	20.449%	11.970%	11.970%

Notes:
1. Expressed as percent of fish surviving-to-fisheries.
2. See text, section on survival rates and contribution to fisheries.
3. For coho:
   a) Assumes treaty allocation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery and tribal obligations, reduce historic lower U.S. allocation to 50%.
4. For spring/summer Chinook:
   a) Assumes treaty allocation of 5%. (Between 25,000 and 50,000 inriver runs - in this scenario about 50,000 adults will be entering the river.
   b) Assumes that lower U.S. ocean catches are incidental and will remain as historic catches.
5. For fall Chinook:
   a) Assumes treaty obligation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery requirements and treaty obligations, reduce lower U.S. allocation to 50%.
6. For steelhead:
   a) Assumed allocation between tribal fishery and inriver recreation fishery for future runs (Mike Matylewich of Columbia River Intertribal Fish Commission) (Inriver catches not to exceed 50%.)
7. Hatchery requirements:
   a) Rates expressed as percent of smolts released.
   b) For hatchery purposes, at least two spawners (one male and one female) are required for future egg and smolt production. Each coho and steelhead female spawner produces about 2,500 eggs, while Chinook produce 3,500 or more eggs. Hatchery egg to smolt survival tends to be about 80 percent. In order to provide some flexibility in hatchery spawner requirements, three future spawners per spawning pair are used in these calculations. Example for coho at 0.01 survival rate equals 25 surviving adults; divide 3 required spawners by 25 equals 12 percent of adults required for hatchery purposes, etc. At 0.012, the requirement is 10 percent ($3 \div [0.012 \times 2{,}500] = 0.10$). At 0.0012, the requirement is 100 percent.

Distributional Assumptions (Case II)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Coho					
West Coast Ocean					
Alaska					
a) Commercial	NA	--	--	0.001%	--
b) Sport	NA	--	--	--	--
British Columbia					
a) Commercial	NA	2.000%	2.000%	4.500%	2.000%
b) Sport	NA	0.200%	0.200%	0.500%	0.200%
Subtotal Alaska/B.C. harvest	NA	2.200%	2.200%	5.001%	2.200%
Washington ocean					
a) Commercial (0.33% tribal)	NA	0.511%	0.511%	2.020%	1.022%
- Westport (28%)	NA	0.143%	0.143%	0.566%	0.286%
- Other commercial (68%)	NA	0.348%	0.348%	1.373%	0.695%
- Tribal (4%)	NA	0.020%	0.020%	0.081%	0.041%
b) Sport	NA	10.223%	10.223%	15.110%	20.446%
- Westport (41%)	NA	4.191%	4.191%	6.195%	8.383%
- Other sport (59%)	NA	6.032%	6.032%	8.915%	12.063%
Washington Puget Sound					
a) Commercial	NA	--	--	0.050%	--
b) Sport	NA	--	--	0.050%	--
Oregon					
a) Commercial	NA	5.112%	5.112%	12.088%	10.223%
- Astoria (3%)	NA	0.153%	0.153%	0.363%	0.307%
- Other commercial (97%)	NA	4.958%	4.958%	11.725%	9.916%
b) Sport	NA	6.645%	6.645%	12.088%	13.290%
- Astoria & Buoy 10 (16%)	NA	1.063%	1.063%	1.934%	2.126%
- Other sport (84%)	NA	5.582%	5.582%	10.154%	11.164%
California					
a) Commercial	NA	1.533%	1.533%	1.007%	3.067%
b) Sport	NA	1.022%	1.022%	0.504%	2.045%
Available for allocation inriver	NA	89.759%	89.759%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	NA	0.511%	0.511%	5.037%	1.022%
- Astoria (50%)	NA	0.256%	0.256%	2.518%	0.511%
- Other (50%)	NA	0.256%	0.256%	2.518%	0.511%
Tributary	NA	--	--	--	--
b) Gillnet	NA	5.112%	5.112%	27.590%	10.223%
- Astoria (100%)	NA	5.112%	5.112%	27.590%	10.223%
c) Tribal (50% of allocation)	NA	44.880%	44.880%	--	--
Other	NA	0.409%	0.409%	--	0.818%
Total Harvest	NA	78.158%	78.158%	80.544%	64.357%
Hatchery requirement	NA	8.041%	8.041%	4.139%	8.041%
Hatchery surplus market	NA	6.901%	6.901%	7.658%	13.801%
Hatchery surplus carcass	NA	6.901%	6.901%	7.658%	13.801%

Species: Spring/Summer Chinook

West Coast Ocean						
Alaska						
a)	Commercial	2.500%	2.500%	2.500%	9.000%	9.000%
b)	Sport	--	--	--	0.100%	0.100%
British Columbia						
a)	Commercial	5.000%	5.000%	5.000%	11.000%	11.000%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
Subtotal Alaska/B.C. harvest		8.000%	8.000%	8.000%	21.100%	21.100%
Washington ocean						
a)	Commercial	1.000%	1.000%	1.000%	4.000%	4.000%
	- Westport (40%)	0.400%	0.400%	0.400%	1.600%	1.600%
	- Other commercial (59%)	0.590%	0.590%	0.590%	2.360%	2.360%
	- Tribal (1%)	0.010%	0.010%	0.010%	0.040%	0.040%
b)	Sport	1.000%	1.000%	1.000%	1.000%	1.000%
	- Westport (71%)	0.710%	0.710%	0.710%	0.710%	0.710%
	- Other sport (29%)	0.290%	0.290%	0.290%	0.290%	0.290%
Washington Puget Sound						
a)	Commercial	0.500%	0.500%	0.500%	0.010%	0.010%
b)	Sport	--	--	--	0.030%	0.030%
Oregon						
a)	Commercial	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria (2%)	0.010%	0.010%	0.010%	0.020%	0.020%
	- Other commercial (98%)	0.490%	0.490%	0.490%	0.980%	0.980%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	0.010%
	- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	0.990%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		66.665%	66.665%	66.665%	63.408%	63.475%
Columbia Basin inland						
a)	Freshwater sport					
	Mainstem	--	--	--	10.000%	10.000%
	- Astoria (50%)	--	--	--	5.000%	5.000%
	- Other (50%)	--	--	--	5.000%	5.000%
	Tributary	--	--	--	--	--
b)	Gillnet	--	--	--	10.000%	10.000%
	- Astoria (100%)	--	--	--	10.000%	10.000%
c)	Tribal (5% of allocation)	3.333%	3.333%	3.333%	--	--
Other		3.000%	3.000%	3.000%	--	--
Total Harvest		17.833%	17.833%	17.833%	48.140%	48.140%
Hatchery requirement		21.835%	21.835%	21.835%	8.452%	8.385%
Hatchery surplus market		30.166%	30.166%	30.166%	21.704%	21.738%
Hatchery surplus carcass		30.166%	30.166%	30.166%	21.704%	21.738%

Species: Fall Chinook

West Coast Ocean					
Alaska					
a) Commercial	6.000%	6.000%	6.000%	1.500%	NA
b) Sport	0.010%	0.010%	0.010%	--	NA
British Columbia					
a) Commercial	25.000%	25.000%	25.000%	20.000%	NA
b) Sport	2.000%	2.000%	2.000%	3.000%	NA
Subtotal Alaska/B.C. harvest	33.010%	33.010%	33.010%	24.500%	NA
Washington ocean					
a) Commercial (3.00% tribal)	4.711%	4.711%	4.711%	13.089%	NA
- Westport (40%)	1.884%	1.884%	1.884%	5.235%	NA
- Other commercial (59%)	2.779%	2.779%	2.779%	7.722%	NA
- Tribal (1%)	0.047%	0.047%	0.047%	0.131%	NA
b) Sport	2.094%	2.094%	2.094%	10.907%	NA
- Westport (71%)	1.487%	1.487%	1.487%	7.744%	NA
- Other sport (29%)	0.607%	0.607%	0.607%	3.163%	NA
Washington Puget Sound					
a) Commercial	0.001%	0.001%	0.001%	--	NA
b) Sport	0.001%	0.001%	0.001%	--	NA
Oregon					
a) Commercial	1.570%	1.570%	1.570%	3.272%	NA
- Astoria (2%)	0.031%	0.031%	0.031%	0.065%	NA
- Other commercial (98%)	1.539%	1.539%	1.539%	3.207%	NA
b) Sport	0.523%	0.523%	0.523%	1.091%	NA
- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.011%	NA
- Other sport (99%)	0.518%	0.518%	0.518%	1.080%	NA
California					
a) Commercial	0.001%	0.001%	0.001%	0.545%	NA
b) Sport	0.001%	0.001%	0.001%	0.109%	NA
Available for allocation inriver	55.173%	55.174%	55.174%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	1.047%	1.047%	1.047%	5.454%	NA
- Astoria (50%)	0.523%	0.523%	0.523%	2.727%	NA
- Other (50%)	0.523%	0.523%	0.523%	2.727%	NA
Tributary	--	--	--	--	NA
b) Gillnet	12.562%	12.562%	12.562%	11.998%	NA
- Astoria (100%)	12.562%	12.562%	12.562%	11.998%	NA
c) Tribal (50% of allocation)	27.587%	27.587%	27.587%	--	NA
Other	0.152%	0.152%	0.152%	--	NA
Total Harvest	83.258%	83.258%	83.258%	70.965%	NA
Hatchery requirement	11.817%	11.816%	11.816%	22.366%	NA
Hatchery surplus market	2.463%	2.463%	2.463%	3.334%	NA
Hatchery surplus carcass	2.463%	2.463%	2.463%	3.334%	NA

Species: Summer/Winter Steelhead

West Coast Ocean						
Alaska						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
British Columbia						
a)	Commercial	1.000%	1.000%	1.000%	1.000%	1.000%
b)	Sport	--	--	--	--	--
Subtotal Alaska/B.C. harvest		1.030%	1.030%	1.030%	1.030%	1.030%
Washington ocean						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Washington Puget Sound						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Oregon						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		91.223%	91.223%	91.223%	85.436%	85.436%
Columbia Basin inland (60/40)						
a)	Freshwater sport (30% of allocation)					
	Mainstem	6.842%	6.842%	6.842%	45.000%	45.000%
	- Astoria (25%)	1.710%	1.710%	1.710%	11.250%	11.250%
	- Other (75%)	5.131%	5.131%	5.131%	33.750%	33.750%
	Tributary	20.525%	20.525%	20.525%	--	--
b)	Gillnet	--	--	--	--	--
	- Astoria (100%)	--	--	--	--	--
c)	Tribal (20% of allocation)	18.245%	18.245%	18.245%	--	--
Other		--	--	--	--	--
Total Harvest		46.672%	46.672%	46.672%	46.060%	46.060%
Hatchery requirement		7.717%	7.717%	7.717%	13.504%	13.504%
Hatchery surplus market		22.806%	22.806%	22.806%	20.218%	20.218%
Hatchery surplus carcass		22.806%	22.806%	22.806%	20.218%	20.218%

Notes:
1. Expressed as percent of fish surviving-to-fisheries.
2. See text, section on survival rates and contribution to fisheries.
3. For coho:
   a) Assumes treaty allocation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery and tribal obligations, reduce historic lower U.S. allocation to 51%.
4. For spring/summer Chinook:
   a) Assumes treaty allocation of 5%. (Between 25,000 and 50,000 inriver runs - in this scenario about 50,000 adults will be entering the river.
   b) Assumes that lower U.S. ocean catches are incidental and will remain as historic catches.
5. For fall Chinook:
   a) Assumes treaty obligation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery requirements and treaty obligations, reduce lower U.S. allocation to 52%.
6. For steelhead:
   a) Assumed allocation between tribal fishery and inriver recreation fishery for future runs (Mike Matylewich of Columbia River Intertribal Fish Commission) (Inriver catches not to exceed 50%.)
7. Hatchery requirements:
   a) Rates expressed as percent of smolts released.
   b) For hatchery purposes, at least two spawners (one male and one female) are required for future egg and smolt production. Each coho and steelhead female spawner produces about 2,500 eggs, while Chinook produce 3,500 or more eggs. Hatchery egg to smolt survival tends to be about 80 percent. In order to provide some flexibility in hatchery spawner requirements, three future spawners per spawning pair are used in these calculations. Example for coho at 0.01 survival rate equals 25 surviving adults; divide 3 required spawners by 25 equals 12 percent of adults required for hatchery purposes, etc. At 0.012, the requirement is 10 percent ($3 \div [0.012 \times 2{,}500] = 0.10$). At 0.0012, the requirement is 100 percent.

Distributional Assumptions (Case III)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Coho					
West Coast Ocean					
Alaska					
a) Commercial	NA	--	--	0.001%	--
b) Sport	NA	--	--	--	--
British Columbia					
a) Commercial	NA	2.000%	2.000%	4.500%	2.000%
b) Sport	NA	0.200%	0.200%	0.500%	0.200%
Subtotal Alaska/B.C. harvest	NA	2.200%	2.200%	5.001%	2.200%
Washington ocean					
a) Commercial (0.33% tribal)	NA	0.534%	0.534%	2.066%	1.068%
- Westport (28%)	NA	0.150%	0.150%	0.578%	0.299%
- Other commercial (68%)	NA	0.363%	0.363%	1.405%	0.726%
- Tribal (4%)	NA	0.021%	0.021%	0.083%	0.043%
b) Sport	NA	10.681%	10.681%	15.454%	21.362%
- Westport (41%)	NA	4.379%	4.379%	6.336%	8.758%
- Other sport (59%)	NA	6.302%	6.302%	9.118%	12.604%
Washington Puget Sound					
a) Commercial	NA	--	--	0.052%	--
b) Sport	NA	--	--	0.052%	--
Oregon					
a) Commercial	NA	5.341%	5.341%	12.363%	10.681%
- Astoria (3%)	NA	0.160%	0.160%	0.371%	0.320%
- Other commercial (97%)	NA	5.180%	5.180%	11.992%	10.361%
b) Sport	NA	6.943%	6.943%	12.363%	13.885%
- Astoria & Buoy 10 (16%)	NA	1.111%	1.111%	1.978%	2.222%
- Other sport (84%)	NA	5.832%	5.832%	10.385%	11.664%
California					
a) Commercial	NA	1.602%	1.602%	1.030%	3.204%
b) Sport	NA	1.068%	1.068%	0.515%	2.136%
Available for allocation inriver	NA	93.780%	93.780%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	NA	0.534%	0.534%	5.151%	1.068%
- Astoria (50%)	NA	0.267%	0.267%	2.576%	0.534%
- Other (50%)	NA	0.267%	0.267%	2.576%	0.534%
Tributary	NA	--	--	--	--
b) Gillnet	NA	5.341%	5.341%	28.218%	10.681%
- Astoria (100%)	NA	5.341%	5.341%	28.218%	10.681%
c) Tribal (50% of allocation)	NA	46.890%	46.890%	--	--
Other	NA	0.427%	0.427%	--	0.854%
Total Harvest	NA	81.560%	81.560%	82.265%	67.141%
Hatchery requirement	NA	4.020%	4.020%	2.070%	4.020%
Hatchery surplus market	NA	7.210%	7.210%	7.833%	14.419%
Hatchery surplus carcass	NA	7.210%	7.210%	7.833%	14.419%

Species: Spring/Summer Chinook

West Coast Ocean						
Alaska						
a)	Commercial	2.500%	2.500%	2.500%	9.000%	9.000%
b)	Sport	--	--	--	0.100%	0.100%
British Columbia						
a)	Commercial	5.000%	5.000%	5.000%	11.000%	11.000%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
Subtotal Alaska/B.C. harvest		8.000%	8.000%	8.000%	21.100%	21.100%
Washington ocean						
a)	Commercial	1.000%	1.000%	1.000%	4.000%	4.000%
	- Westport (40%)	0.400%	0.400%	0.400%	1.600%	1.600%
	- Other commercial (59%)	0.590%	0.590%	0.590%	2.360%	2.360%
	- Tribal (1%)	0.010%	0.010%	0.010%	0.040%	0.040%
b)	Sport	1.000%	1.000%	1.000%	1.000%	1.000%
	- Westport (71%)	0.710%	0.710%	0.710%	0.710%	0.710%
	- Other sport (29%)	0.290%	0.290%	0.290%	0.290%	0.290%
Washington Puget Sound						
a)	Commercial	0.500%	0.500%	0.500%	0.010%	0.010%
b)	Sport	--	--	--	0.030%	0.030%
Oregon						
a)	Commercial	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria (2%)	0.010%	0.010%	0.010%	0.020%	0.020%
	- Other commercial (98%)	0.490%	0.490%	0.490%	0.980%	0.980%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	0.010%
	- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	0.990%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		77.583%	77.583%	77.583%	67.634%	67.668%
Columbia Basin inland						
a)	Freshwater sport					
	Mainstem	23.009%	23.009%	23.009%	10.000%	10.000%
	- Astoria (50%)	11.504%	11.504%	11.504%	5.000%	5.000%
	- Other (50%)	11.504%	11.504%	11.504%	5.000%	5.000%
	Tributary	7.670%	7.670%	7.670%	--	--
b)	Gillnet	5.113%	5.113%	5.113%	10.000%	10.000%
	- Astoria (100%)	5.113%	5.113%	5.113%	10.000%	10.000%
c)	Tribal (50% of allocation)	38.791%	38.791%	38.791%	--	--
Other		3.000%	3.000%	3.000%	--	--
Total Harvest		89.083%	89.083%	89.083%	48.140%	48.140%
Hatchery requirement		10.917%	10.917%	10.917%	4.226%	4.192%
Hatchery surplus market		0.000%	-0.000%	-0.000%	23.817%	23.834%
Hatchery surplus carcass		0.000%	-0.000%	-0.000%	23.817%	23.834%

Species: Fall Chinook

West Coast Ocean					
Alaska					
a) Commercial	6.000%	6.000%	6.000%	1.500%	NA
b) Sport	0.010%	0.010%	0.010%	--	NA
British Columbia					
a) Commercial	25.000%	25.000%	25.000%	20.000%	NA
b) Sport	2.000%	2.000%	2.000%	3.000%	NA
Subtotal Alaska/B.C. harvest	33.010%	33.010%	33.010%	24.500%	NA
Washington ocean					
a) Commercial (3.00% tribal)	5.215%	5.215%	5.215%	15.843%	NA
- Westport (40%)	2.086%	2.086%	2.086%	6.337%	NA
- Other commercial (59%)	3.077%	3.077%	3.077%	9.348%	NA
- Tribal (1%)	0.052%	0.052%	0.052%	0.158%	NA
b) Sport	2.318%	2.318%	2.318%	13.203%	NA
- Westport (71%)	1.646%	1.646%	1.646%	9.374%	NA
- Other sport (29%)	0.672%	0.672%	0.672%	3.829%	NA
Washington Puget Sound					
a) Commercial	0.001%	0.001%	0.001%	--	NA
b) Sport	0.001%	0.001%	0.001%	--	NA
Oregon					
a) Commercial	1.738%	1.738%	1.738%	3.961%	NA
- Astoria (2%)	0.035%	0.035%	0.035%	0.079%	NA
- Other commercial (98%)	1.704%	1.704%	1.704%	3.882%	NA
b) Sport	0.579%	0.579%	0.579%	1.320%	NA
- Astoria & Buoy 10 (1%)	0.006%	0.006%	0.006%	0.013%	NA
- Other sport (99%)	0.574%	0.574%	0.574%	1.307%	NA
California					
a) Commercial	0.001%	0.001%	0.001%	0.660%	NA
b) Sport	0.001%	0.001%	0.001%	0.132%	NA
Available for allocation inriver	61.082%	61.082%	61.082%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	1.159%	1.159%	1.159%	6.601%	NA
- Astoria (50%)	0.579%	0.579%	0.579%	3.301%	NA
- Other (50%)	0.579%	0.579%	0.579%	3.301%	NA
Tributary	--	--	--	--	NA
b) Gillnet	13.907%	13.907%	13.907%	14.523%	NA
- Astoria (100%)	13.907%	13.907%	13.907%	14.523%	NA
c) Tribal (50% of allocation)	30.541%	30.541%	30.541%	--	NA
Other	0.168%	0.168%	0.168%	--	NA
Total Harvest	88.639%	88.639%	88.639%	80.744%	NA
Hatchery requirement	5.908%	5.908%	5.908%	11.183%	NA
Hatchery surplus market	2.727%	2.727%	2.727%	4.036%	NA
Hatchery surplus carcass	2.727%	2.727%	2.727%	4.036%	NA

Species: Summer/Winter Steelhead

West Coast Ocean						
Alaska						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
British Columbia						
a)	Commercial	1.000%	1.000%	1.000%	1.000%	1.000%
b)	Sport	--	--	--	--	--
Subtotal Alaska/B.C. harvest		1.030%	1.030%	1.030%	1.030%	1.030%
Washington ocean						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Washington Puget Sound						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Oregon						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		95.082%	95.082%	95.082%	92.188%	92.188%
Columbia Basin inland (50/50)						
a)	Freshwater sport (25% of allocation)					
	Mainstem	5.943%	5.943%	5.943%	45.000%	45.000%
	- Astoria (25%)	1.486%	1.486%	1.486%	11.250%	11.250%
	- Other (75%)	4.457%	4.457%	4.457%	33.750%	33.750%
	Tributary	17.828%	17.828%	17.828%	--	--
b)	Gillnet	--	--	--	--	--
	- Astoria (100%)	--	--	--	--	--
c)	Tribal (25% of allocation)	23.770%	23.770%	23.770%	--	--
Other		--	--	--	--	--
Total Harvest		48.601%	48.601%	48.601%	46.060%	46.060%
Hatchery requirement		3.858%	3.858%	3.858%	6.752%	6.752%
Hatchery surplus market		23.770%	23.770%	23.770%	23.594%	23.594%
Hatchery surplus carcass		23.770%	23.770%	23.770%	23.594%	23.594%

Notes:
1. Expressed as percent of fish surviving-to-fisheries.
2. See text, section on survival rates and contribution to fisheries.
3. For coho:
   a) Assumes treaty allocation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery and tribal obligations, reduce historic lower U.S. allocation to 53%.
4. For spring/summer Chinook:
   a) Assumes treaty allocation of 50%. (Excess of 112% of 115,000 inriver runs 50% treaty Indian and 50% non-treaty - In this scenario about 130,000 adults will be entering the river.
   b) Assumes that lower U.S. ocean catches are incidental and will remain as historic levels.
5. For fall Chinook:
   a) Assumes treaty obligation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery requirements and treaty obligations, reduce lower U.S. allocation to 58%.
6. For steelhead:
   a) Assumed allocation between tribal fishery and inriver recreation fishery for future runs (Mike Matylewich of Columbia River Intertribal Fish Commission) (Inriver catches not to exceed 50%.)
7. Hatchery requirements:
   a) Rates expressed as percent of smolts released.
   b) For hatchery purposes, at least two spawners (one male and one female) are required for future egg and smolt production. Each coho and steelhead female spawner produces about 2,500 eggs, while Chinook produce 3,500 or more eggs. Hatchery egg to smolt survival tends to be about 80 percent. In order to provide some flexibility in hatchery spawner requirements, three future spawners per spawning pair are used in these calculations. Example for coho at 0.01 survival rate equals 25 surviving adults; divide 3 required spawners by 25 equals 12 percent of adults required for hatchery purposes, etc. At 0.012, the requirement is 10 percent ($3 \div [0.012 \times 2{,}500] = 0.10$). At 0.0012, the requirement is 100 percent.

Distributional Assumptions (Case IV)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Species: Coho					
West Coast Ocean					
Alaska					
a) Commercial	NA	--	--	0.001%	--
b) Sport	NA	--	--	--	--
British Columbia					
a) Commercial	NA	2.000%	2.000%	4.500%	2.000%
b) Sport	NA	0.200%	0.200%	0.500%	0.200%
Subtotal Alaska/B.C. harvest	NA	2.200%	2.200%	5.001%	2.200%
Washington ocean					
a) Commercial (0.33% tribal)	NA	0.101%	0.101%	1.845%	0.772%
- Westport (28%)	NA	0.028%	0.028%	0.517%	0.216%
- Other commercial (68%)	NA	0.069%	0.069%	1.255%	0.525%
- Tribal (4%)	NA	0.004%	0.004%	0.074%	0.031%
b) Sport	NA	2.027%	2.027%	13.803%	15.444%
- Westport (41%)	NA	0.831%	0.831%	5.659%	6.332%
- Other sport (59%)	NA	1.196%	1.196%	8.144%	9.112%
Washington Puget Sound					
a) Commercial	NA	--	--	0.046%	--
b) Sport	NA	--	--	0.046%	--
Oregon					
a) Commercial	NA	1.014%	1.014%	11.042%	7.722%
- Astoria (3%)	NA	0.030%	0.030%	0.331%	0.232%
- Other commercial (97%)	NA	0.983%	0.983%	10.711%	7.490%
b) Sport	NA	1.318%	1.318%	11.042%	10.039%
- Astoria & Buoy 10 (16%)	NA	0.211%	0.211%	1.767%	1.606%
- Other sport (84%)	NA	1.107%	1.107%	9.275%	8.433%
California					
a) Commercial	NA	0.304%	0.304%	0.920%	2.317%
b) Sport	NA	0.203%	0.203%	0.460%	1.544%
Available for allocation inriver	NA	17.800%	17.800%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	NA	0.101%	0.101%	4.601%	0.772%
- Astoria (50%)	NA	0.051%	0.051%	2.300%	0.386%
- Other (50%)	NA	0.051%	0.051%	2.300%	0.386%
Tributary	NA	--	--	--	--
b) Gillnet	NA	1.014%	1.014%	25.203%	7.722%
- Astoria (100%)	NA	1.014%	1.014%	25.203%	7.722%
c) Tribal (50% of allocation)	NA	8.900%	8.900%	--	--
Other	NA	0.081%	0.081%	--	0.618%
Total Harvest	NA	17.263%	17.263%	74.009%	49.150%
Hatchery requirement	NA	80.000%	80.000%	12.000%	30.000%
Hatchery surplus market	NA	1.368%	1.368%	6.996%	10.425%
Hatchery surplus carcass	NA	1.368%	1.368%	6.996%	10.425%

Species: Spring/Summer Chinook

West Coast Ocean						
Alaska						
a)	Commercial	2.500%	2.500%	2.500%	9.000%	9.000%
b)	Sport	--	--	--	0.100%	0.100%
British Columbia						
a)	Commercial	5.000%	5.000%	5.000%	11.000%	11.000%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
Subtotal Alaska/B.C. harvest		8.000%	8.000%	8.000%	21.100%	21.100%
Washington ocean						
a)	Commercial	1.000%	1.000%	1.000%	4.000%	4.000%
	- Westport (40%)	0.400%	0.400%	0.400%	1.600%	1.600%
	- Other commercial (59%)	0.590%	0.590%	0.590%	2.360%	2.360%
	- Tribal (1%)	0.010%	0.010%	0.010%	0.040%	0.040%
b)	Sport	1.000%	1.000%	1.000%	1.000%	1.000%
	- Westport (71%)	0.710%	0.710%	0.710%	0.710%	0.710%
	- Other sport (29%)	0.290%	0.290%	0.290%	0.290%	0.290%
Washington Puget Sound						
a)	Commercial	0.500%	0.500%	0.500%	0.010%	0.010%
b)	Sport	--	--	--	0.030%	0.030%
Oregon						
a)	Commercial	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria (2%)	0.010%	0.010%	0.010%	0.020%	0.020%
	- Other commercial (98%)	0.490%	0.490%	0.490%	0.980%	0.980%
b)	Sport	0.500%	0.500%	0.500%	1.000%	1.000%
	- Astoria & Buoy 10 (1%)	0.005%	0.005%	0.005%	0.010%	0.010%
	- Other sport (99%)	0.495%	0.495%	0.495%	0.990%	0.990%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		2.786%	2.786%	2.786%	47.370%	47.370%
Columbia Basin inland						
a)	Freshwater sport					
	Mainstem	--	--	--	10.000%	10.000%
	- Astoria (50%)	--	--	--	5.000%	5.000%
	- Other (50%)	--	--	--	5.000%	5.000%
	Tributary	--	--	--	--	--
b)	Gillnet	--	--	--	10.000%	10.000%
	- Astoria (100%)	--	--	--	10.000%	10.000%
c)	Tribal (1% of allocation)	0.028%	0.028%	0.028%	--	--
Other		2.758%	2.758%	2.758%	--	--
Total Harvest		14.286%	14.286%	14.286%	48.140%	48.140%
Hatchery requirement		85.714%	85.714%	85.714%	24.490%	24.490%
Hatchery surplus market		--	--	--	13.685%	13.685%
Hatchery surplus carcass		--	--	--	13.685%	13.685%

Species: Fall Chinook

West Coast Ocean					
Alaska					
a) Commercial	6.000%	6.000%	6.000%	1.500%	NA
b) Sport	0.010%	0.010%	0.010%	--	NA
British Columbia					
a) Commercial	25.000%	25.000%	25.000%	20.000%	NA
b) Sport	2.000%	2.000%	2.000%	3.000%	NA
Subtotal Alaska/B.C. harvest	33.010%	33.010%	33.010%	24.500%	NA
Washington ocean					
a) Commercial (3.00% tribal)	3.890%	3.890%	3.890%	10.152%	NA
- Westport (40%)	1.556%	1.556%	1.556%	4.061%	NA
- Other commercial (59%)	2.295%	2.295%	2.295%	5.990%	NA
- Tribal (1%)	0.039%	0.039%	0.039%	0.102%	NA
b) Sport	1.729%	1.729%	1.729%	8.460%	NA
- Westport (71%)	1.228%	1.228%	1.228%	6.007%	NA
- Other sport (29%)	0.501%	0.501%	0.501%	2.454%	NA
Washington Puget Sound					
a) Commercial	0.000%	0.000%	0.000%	--	NA
b) Sport	0.000%	0.000%	0.000%	--	NA
Oregon					
a) Commercial	1.297%	1.297%	1.297%	2.538%	NA
- Astoria (2%)	0.026%	0.026%	0.026%	0.051%	NA
- Other commercial (98%)	1.271%	1.271%	1.271%	2.487%	NA
b) Sport	0.432%	0.432%	0.432%	0.846%	NA
- Astoria & Buoy 10 (1%)	0.004%	0.004%	0.004%	0.008%	NA
- Other sport (99%)	0.428%	0.428%	0.428%	0.838%	NA
California					
a) Commercial	0.000%	0.000%	0.000%	0.423%	NA
b) Sport	0.000%	0.000%	0.000%	0.085%	NA
Available for allocation inriver	45.561%	45.561%	45.561%	NA	NA
Columbia Basin inland					
a) Freshwater sport					
Mainstem	0.864%	0.864%	0.864%	4.230%	NA
- Astoria (50%)	0.432%	0.432%	0.432%	2.115%	NA
- Other (50%)	0.432%	0.432%	0.432%	2.115%	NA
Tributary	--	--	--	--	NA
b) Gillnet	10.374%	10.374%	10.374%	9.306%	NA
- Astoria (100%)	10.374%	10.374%	10.374%	9.306%	NA
c) Tribal (50% of allocation)	22.781%	22.781%	22.781%	--	NA
Other	0.125%	0.125%	0.125%	--	NA
Total Harvest	74.504%	74.504%	74.504%	60.541%	NA
Hatchery requirement	21.429%	21.429%	21.429%	34.286%	NA
Hatchery surplus market	2.034%	2.034%	2.034%	2.586%	NA
Hatchery surplus carcass	2.034%	2.034%	2.034%	2.586%	NA

Species: Summer/Winter Steelhead

West Coast Ocean						
Alaska						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
British Columbia						
a)	Commercial	1.000%	1.000%	1.000%	1.000%	1.000%
b)	Sport	--	--	--	--	--
Subtotal Alaska/B.C. harvest		1.030%	1.030%	1.030%	1.030%	1.030%
Washington ocean						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Washington Puget Sound						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Oregon						
a)	Commercial	--	--	--	--	--
b)	Sport	0.030%	0.030%	0.030%	0.030%	0.030%
California						
a)	Commercial	--	--	--	--	--
b)	Sport	--	--	--	--	--
Available for allocation inriver		74.940%	74.940%	74.940%	38.940%	38.940%
Columbia Basin inland (60/40)						
a)	Freshwater sport (30% of allocation)					
	Mainstem	5.621%	5.621%	5.621%	35.000%	35.000%
	- Astoria (25%)	1.405%	1.405%	1.405%	8.750%	8.750%
	- Other (75%)	4.215%	4.215%	4.215%	26.250%	26.250%
	Tributary	16.862%	16.862%	16.862%	--	--
b)	Gillnet	--	--	--	--	--
	- Astoria (100%)	--	--	--	--	--
c)	Tribal (20% of allocation)	14.988%	14.988%	14.988%	--	--
Other		--	--	--	--	--
Total Harvest		38.530%	38.530%	38.530%	36.060%	36.060%
Hatchery requirement		24.000%	24.000%	24.000%	60.000%	60.000%
Hatchery surplus market		18.735%	18.735%	18.735%	1.970%	1.970%
Hatchery surplus carcass		18.735%	18.735%	18.735%	1.970%	1.970%

Notes:
1. Expressed as percent of fish surviving-to-fisheries.
2. See text, section on survival rates and contribution to fisheries.
3. For coho:
   a) Assumes treaty and spawner allocation of 50% of available harvest after hatchery requirements are met.
   b) In order to meet hatchery and tribal obligations, reduce historic lower U.S. allocation to 10%.
4. For spring/summer Chinook:
   a) In this scenario, the inriver runs may be about 25,000 or less. Assumes a minimum of 1% for treaty harvest.
   b) Assumes that lower U.S. ocean catches are incidental and will remain as historic levels.
5. For fall Chinook:
   a) Assumes treaty obligation of 50% of available harvest after hatchery and spawner requirements are met.
   b) In order to meet hatchery requirements and treaty obligations, reduce lower U.S. harvest to 43%.
6. For steelhead:
   a) Assumed allocation between tribal fishery and inriver recreation fishery for future runs (Mike Matylewich of Columbia River Intertribal Fish Commission) (Inriver catches not to exceed 50%.)
7. Hatchery requirements:
   a) Rates expressed as percent of smolts released.
   b) For hatchery purposes, at least two spawners (one male and one female) are required for future egg and smolt production. Each coho and steelhead female spawner produces about 2,500 eggs, while Chinook produce 3,500 or more eggs. Hatchery egg to smolt survival tends to be about 80 percent. In order to provide some flexibility in hatchery spawner requirements, three future spawners per spawning pair are used in these calculations. Example for coho at 0.01 survival rate equals 25 surviving adults; divide 3 required spawners by 25 equals 12 percent of adults required for hatchery purposes, etc. At 0.012, the requirement is 10 percent ($3 \div [0.012 \times 2{,}500] = 0.10$). At 0.0012, the requirement is 100 percent.

APPENDIX A

SECTION II

Returning Adults by Geographic Region

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Coho
Case I: NMFS Cap (1970's-1990's Actual)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	0	843,373	2,462,651	30,742,613	1,277,108	35,325,745
Wild fish contribution - % Assumption	5%	5%	5%	5%	5%	5%
- No. of releases	0	44,388	129,613	1,618,032	67,216	1,859,250
Total smolt production	0	887,761	2,592,264	32,360,645	1,344,324	37,184,995
Representative survival rate in % - Hatchery	NA	1.20%	1.20%	2.50%	1.20%	2.33%
- Wild	NA	1.20%	1.20%	2.50%	1.20%	2.33%
Number survived to adults	NA	10,653	31,107	809,016	16,132	866,908
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	8	--	8
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	213	622	36,406	323	37,564
b) Sport	NA	21	62	4,045	32	4,161
Washington ocean						
a) Commercial	NA	53	156	16,221	161	16,591
- Westport (28%)	NA	15	44	4,542	45	4,645
- Other commercial (68%)	NA	36	106	11,030	110	11,282
- Tribal (4%)	NA	2	6	649	6	664
b) Sport	NA	1,065	3,111	121,352	3,226	128,755
- Westport (41%)	NA	437	1,275	49,754	1,323	52,789
- Other sport (59%)	NA	629	1,835	71,598	1,904	75,965
Washington Puget Sound						
a) Commercial	NA	--	--	405	--	405
b) Sport	NA	--	--	405	--	405
Oregon						
a) Commercial	NA	533	1,555	97,082	1,613	100,783

- Astoria (3%)	NA	16	47	2,912	48	3,023
- Other commercial (97%)	NA	517	1,509	94,169	1,565	97,760
b) Sport	NA	692	2,022	97,082	2,097	101,894
- Astoria & Buoy 10 (16%)	NA	111	324	15,533	336	16,303
- Other sport (84%)	NA	582	1,698	81,549	1,762	85,591
California						
a) Commercial	NA	160	467	8,090	484	9,201
b) Sport	NA	107	311	4,045	323	4,785
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	53	156	40,451	161	40,821
- Astoria (50%)	NA	27	78	20,225	81	20,410
- Other (50%)	NA	27	78	20,225	81	20,410
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	533	1,555	221,581	1,613	225,283
c) Tribal C & S	NA	4,677	13,656	--	--	18,333
Other	NA	43	124	--	129	296
Hatchery						
Hatchery requirement	NA	1,065	3,111	38,833	1,613	44,622
Hatchery surplus market	NA	719	2,100	61,505	2,178	66,502
Hatchery surplus carcass	NA	719	2,100	61,505	2,178	66,502

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Coho
Case II: 80's Actual

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	0	843,373	2,462,651	30,742,613	1,277,108	35,325,745
Wild fish contribution - % Assumption	5%	5%	5%	5%	5%	5%
- No. of releases	0	44,388	129,613	1,618,032	67,216	1,859,250
Total smolt production	0	887,761	2,592,264	32,360,645	1,344,324	37,184,995
Representative survival rate in % - Hatchery	NA	1.49%	1.49%	2.90%	1.49%	2.72%
- Wild	NA	1.49%	1.49%	2.90%	1.49%	2.72%
Number survived to adults	NA	13,249	38,687	938,163	20,062	1,010,161
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	9	--	9
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	265	774	42,217	401	43,657
b) Sport	NA	26	77	4,691	40	4,835
Washington ocean						
a) Commercial	NA	68	198	18,948	205	19,419
- Westport (28%)	NA	19	55	5,305	57	5,437
- Other commercial (68%)	NA	46	134	12,885	139	13,205
- Tribal (4%)	NA	3	8	758	8	777
b) Sport	NA	1,354	3,955	141,755	4,102	151,167
- Westport (41%)	NA	555	1,622	58,120	1,682	61,978
- Other sport (59%)	NA	799	2,333	83,636	2,420	89,188
Washington Puget Sound						
a) Commercial	NA	--	--	473	--	473
b) Sport	NA	--	--	473	--	473
Oregon						

a) Commercial	NA	677	1,977	113,404	2,051	118,110
- Astoria (3%)	NA	20	59	3,402	62	3,543
- Other commercial (97%)	NA	657	1,918	110,002	1,989	114,567
b) Sport	NA	880	2,571	113,404	2,666	119,522
- Astoria & Buoy 10 (16%)	NA	141	411	18,145	427	19,123
- Other sport (84%)	NA	740	2,159	95,260	2,240	100,398
California						
a) Commercial	NA	203	593	9,450	615	10,862
b) Sport	NA	135	395	4,725	410	5,666
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	68	198	47,252	205	47,722
- Astoria (50%)	NA	34	99	23,626	103	23,861
- Other (50%)	NA	34	99	23,626	103	23,861
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	677	1,977	258,836	2,051	263,542
c) Tribal C & S	NA	5,946	17,362	--	--	23,309
Other	NA	54	158	--	164	376
Hatchery						
Hatchery requirement	NA	1,065	3,111	38,833	1,613	44,622
Hatchery surplus market	NA	914	2,670	71,846	2,769	78,199
Hatchery surplus carcass	NA	914	2,670	71,846	2,769	78,199

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Coho
Case III: Representative Early 2000's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	1,244,676	2,058,340	5,938,039	13,615,637	337,907	23,194,600
Wild fish contribution - % Assumption	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
- No. of releases	100,920	166,892	481,463	1,103,971	27,398	1,880,643
Total smolt production	1,345,596	2,225,232	6,419,502	14,719,608	365,305	25,075,243
Representative survival rate in % - Hatchery	0.50%	1.50%	2.50%	3.00%	3.00%	2.60%
- Wild	0.50%	1.50%	2.50%	3.00%	3.00%	2.60%
Number survived to adults	6,728	33,378	160,488	441,588	10,959	653,141
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	4	--	4
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	668	3,210	19,871	219	23,968
b) Sport	NA	67	321	2,208	22	2,618
Washington ocean						
a) Commercial	NA	178	857	9,122	117	10,274
- Westport (28%)	NA	50	240	2,554	33	2,877
- Other commercial (68%)	NA	121	583	6,203	80	6,986
- Tribal (4%)	NA	7	34	365	5	411
b) Sport	NA	3,565	17,142	68,243	2,341	91,291
- Westport (41%)	NA	1,462	7,028	27,980	960	37,429
- Other sport (59%)	NA	2,103	10,114	40,264	1,381	53,862
Washington Puget Sound						
a) Commercial	NA	--	--	227	--	227
b) Sport	NA	--	--	227	--	227
Oregon						

a) Commercial	NA	1,783	8,571	54,595	1,171	66,119
- Astoria (3%)	NA	53	257	1,638	35	1,984
- Other commercial (97%)	NA	1,729	8,314	52,957	1,135	64,135
b) Sport	NA	2,317	11,142	54,595	1,522	69,576
- Astoria & Buoy 10 (16%)	NA	371	1,783	8,735	243	11,132
- Other sport (84%)	NA	1,947	9,359	45,860	1,278	58,444
California						
a) Commercial	NA	535	2,571	4,550	351	8,007
b) Sport	NA	357	1,714	2,275	234	4,580
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	178	857	22,748	117	23,900
- Astoria (50%)	NA	89	429	11,374	59	11,950
- Other (50%)	NA	89	429	11,374	59	11,950
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	1,783	8,571	124,608	1,171	136,132
c) Tribal C & S	NA	15,651	75,252	--	--	90,903
Other	NA	143	686	--	94	922
Hatchery						
Hatchery requirement	NA	1,342	6,452	9,139	441	17,374
Hatchery surplus market	NA	2,406	11,571	34,588	1,580	50,145
Hatchery surplus carcass	NA	2,406	11,571	34,588	1,580	50,145

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Coho
Case IV: Early 90's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	0	700,000	2,044,000	25,561,369	1,060,000	29,365,369
Wild fish contribution - % Assumption	5%	5%	5%	5%	5%	5%
- No. of releases	0	36,842	107,579	1,345,335	55,789	1,545,546
Total smolt production	0	736,842	2,151,579	26,906,704	1,115,789	30,910,915
Representative survival rate in % - Hatchery	NA	0.15%	0.15%	1.00%	0.40%	0.90%
- Wild	NA	0.15%	0.15%	1.00%	0.40%	0.90%
Number survived to adults	NA	1,105	3,227	269,067	4,463	277,863
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	3	--	3
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	22	65	12,108	89	12,284
b) Sport	NA	2	6	1,345	9	1,363
Washington ocean						
a) Commercial	NA	1	3	4,964	34	5,003
- Westport (28%)	NA	0	1	1,390	10	1,401
- Other commercial (68%)	NA	1	2	3,376	23	3,402
- Tribal (4%)	NA	0	0	199	1	200
b) Sport	NA	22	65	37,138	689	37,916
- Westport (41%)	NA	9	27	15,227	283	15,545
- Other sport (59%)	NA	13	39	21,912	407	22,370
Washington Puget Sound						
a) Commercial	NA	--	--	124	--	124
b) Sport	NA	--	--	124	--	124
Oregon						

a) Commercial	NA	11	33	29,711	345	30,099
- Astoria (3%)	NA	0	1	891	10	903
- Other commercial (97%)	NA	11	32	28,819	334	29,196
b) Sport	NA	15	43	29,711	448	30,216
- Astoria & Buoy 10 (16%)	NA	2	7	4,754	72	4,835
- Other sport (84%)	NA	12	36	24,957	376	25,381
California						
a) Commercial	NA	3	10	2,476	103	2,592
b) Sport	NA	2	7	1,238	69	1,316
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	1	3	12,379	34	12,418
- Astoria (50%)	NA	1	2	6,190	17	6,209
- Other (50%)	NA	1	2	6,190	17	6,209
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	11	33	67,812	345	68,201
c) Tribal C & S	NA	98	287	--	--	386
Other	NA	1	3	--	28	31
Hatchery						
Hatchery requirement	NA	884	2,582	32,288	1,339	37,093
Hatchery surplus market	NA	15	44	18,823	465	19,348
Hatchery surplus carcass	NA	15	44	18,823	465	19,348

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Spring/Summer Chinook
Case I: NMFS Cap (1970's-1990's Actual)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	2,342,791	5,990,957	6,264,260	5,253,481	7,541,137	27,392,626
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	1,004,053	2,567,553	2,684,683	2,251,492	3,231,916	11,739,697
Total smolt production	3,346,844	8,558,510	8,948,943	7,504,973	10,773,053	39,132,323
Representative survival rate in % - Hatchery	0.37%	0.37%	0.37%	0.97%	0.97%	0.65%
- Wild	0.37%	0.37%	0.37%	0.97%	0.97%	0.65%
Number survived to adults	12,383	31,666	33,111	72,798	104,499	254,458
West Coast Harvest						
Alaska						
a) Commercial	310	792	828	6,552	9,405	17,886
b) Sport	--	--	--	73	104	177
British Columbia						
a) Commercial	619	1,583	1,656	8,008	11,495	23,361
b) Sport	62	158	166	728	1,045	2,159
Washington ocean						
a) Commercial	124	317	331	2,912	4,180	7,863
- Westport (28%)	50	127	132	1,165	1,672	3,145
- Other commercial (68%)	73	187	195	1,718	2,466	4,639
- Tribal (4%)	1	3	3	29	42	79
b) Sport	124	317	331	728	1,045	2,545
- Westport (41%)	88	225	235	517	742	1,807
- Other sport (59%)	36	92	96	211	303	738
Washington Puget Sound						
a) Commercial	62	158	166	7	10	404
b) Sport	--	--	--	22	31	53
Oregon						

a) Commercial	62	158	166	728	1,045	2,159
- Astoria (3%)	1	3	3	15	21	43
- Other commercial (97%)	61	155	162	713	1,024	2,116
b) Sport	62	158	166	728	1,045	2,159
- Astoria & Buoy 10 (16%)	1	2	2	7	10	22
- Other sport (84%)	61	157	164	721	1,035	2,137
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	7,280	10,450	17,730
- Astoria (50%)	--	--	--	3,640	5,225	8,865
- Other (50%)	--	--	--	3,640	5,225	8,865
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	7,280	10,450	17,730
c) Tribal C & S	405	1,034	1,082	--	--	2,521
Other	371	950	993	--	--	2,315
Hatchery						
Hatchery requirement	2,869	7,336	7,671	6,433	9,234	33,542
Hatchery surplus market	3,657	9,352	9,779	15,660	22,479	60,928
Hatchery surplus carcass	3,657	9,352	9,779	15,660	22,479	60,928

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Spring/Summer Chinook
Case II: 80's Actual

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	2,342,791	5,990,957	6,264,260	5,253,481	7,541,137	27,392,626
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	1,004,053	2,567,553	2,684,683	2,251,492	3,231,916	11,739,697
Total smolt production	3,346,844	8,558,510	8,948,943	7,504,973	10,773,053	39,132,323
Representative survival rate in % - Hatchery	0.39%	0.39%	0.39%	1.01%	1.02%	0.69%
- Wild	0.39%	0.39%	0.39%	1.01%	1.02%	0.69%
Number survived to adults	13,138	33,597	35,130	76,109	110,131	268,106
West Coast Harvest						
Alaska						
a) Commercial	328	840	878	6,850	9,912	18,808
b) Sport	--	--	--	76	110	186
British Columbia						
a) Commercial	657	1,680	1,756	8,372	12,114	24,580
b) Sport	66	168	176	761	1,101	2,272
Washington ocean						
a) Commercial	131	336	351	3,044	4,405	8,268
- Westport (28%)	53	134	141	1,218	1,762	3,307
- Other commercial (68%)	78	198	207	1,796	2,599	4,878
- Tribal (4%)	1	3	4	30	44	83
b) Sport	131	336	351	761	1,101	2,681
- Westport (41%)	93	239	249	540	782	1,904
- Other sport (59%)	38	97	102	221	319	778
Washington Puget Sound						
a) Commercial	66	168	176	8	11	428
b) Sport	--	--	--	23	33	56
Oregon						

a) Commercial	66	168	176	761	1,101	2,272
- Astoria (3%)	1	3	4	15	22	45
- Other commercial (97%)	64	165	172	746	1,079	2,226
b) Sport	66	168	176	761	1,101	2,272
- Astoria & Buoy 10 (16%)	1	2	2	8	11	23
- Other sport (84%)	65	166	174	753	1,090	2,249
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	7,611	11,013	18,624
- Astoria (50%)	--	--	--	3,805	5,507	9,312
- Other (50%)	--	--	--	3,805	5,507	9,312
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	7,611	11,013	18,624
c) Tribal C & S	438	1,120	1,171	--	--	2,729
Other	394	1,008	1,054	--	--	2,456
Hatchery						
Hatchery requirement	2,869	7,336	7,671	6,433	9,234	33,542
Hatchery surplus market	3,963	10,135	10,597	16,519	23,940	65,154
Hatchery surplus carcass	3,963	10,135	10,597	16,519	23,940	65,154

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Spring/Summer Chinook
Case III: Representative Early 2000's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	12,517,116	6,992,970	5,477,483	4,189,200	5,235,613	34,412,382
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	5,364,478	2,996,987	2,347,493	1,795,371	2,243,834	14,748,164
Total smolt production	17,881,595	9,989,958	7,824,975	5,984,571	7,479,447	49,160,546
Representative survival rate in % - Hatchery	1.00%	1.20%	1.20%	1.20%	2.20%	1.28%
- Wild	1.00%	1.20%	1.20%	1.20%	2.20%	1.28%
Number survived to adults	178,816	119,879	93,900	71,815	164,548	628,958
West Coast Harvest						
Alaska						
a) Commercial	4,470	2,997	2,347	6,463	14,809	31,088
b) Sport	--	--	--	72	165	236
British Columbia						
a) Commercial	8,941	5,994	4,695	7,900	18,100	45,630
b) Sport	894	599	469	718	1,645	4,327
Washington ocean						
a) Commercial	1,788	1,199	939	2,873	6,582	13,380
- Westport (28%)	715	480	376	1,149	2,633	5,352
- Other commercial (68%)	1,055	707	554	1,695	3,883	7,894
- Tribal (4%)	18	12	9	29	66	134
b) Sport	1,788	1,199	939	718	1,645	6,290
- Westport (41%)	1,270	851	667	510	1,168	4,466
- Other sport (59%)	519	348	272	208	477	1,824
Washington Puget Sound						
a) Commercial	894	599	469	7	16	1,987
b) Sport	--	--	--	22	49	71
Oregon						

a) Commercial	894	599	469	718	1,645	4,327
- Astoria (3%)	18	12	9	14	33	87
- Other commercial (97%)	876	587	460	704	1,613	4,240
b) Sport	894	599	469	718	1,645	4,327
- Astoria & Buoy 10 (16%)	9	6	5	7	16	43
- Other sport (84%)	885	593	465	711	1,629	4,283
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	41,143	27,583	21,605	7,181	16,455	113,967
- Astoria (50%)	20,572	13,791	10,803	3,591	8,227	56,984
- Other (50%)	20,572	13,791	10,803	3,591	8,227	56,984
Tributary	13,714	9,194	7,202	--	--	30,110
b) Gillnet	9,143	6,129	4,801	7,181	16,455	43,710
c) Tribal C & S	69,365	46,503	36,425	--	--	152,293
Other	5,364	3,596	2,817	--	--	11,778
Hatchery						
Hatchery requirement	19,522	13,088	10,251	3,035	6,898	52,794
Hatchery surplus market	0	-0	-0	17,104	39,218	56,322
Hatchery surplus carcass	0	-0	-0	17,104	39,218	56,322

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Spring/Summer Chinook
Case IV: Early 90's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	2,202,224	5,631,500	5,888,404	4,938,272	7,088,669	25,749,069
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	943,810	2,413,500	2,523,602	2,116,402	3,038,001	11,035,315
Total smolt production	3,146,034	8,045,000	8,412,006	7,054,674	10,126,670	36,784,384
Representative survival rate in % - Hatchery	0.10%	0.10%	0.10%	0.35%	0.35%	0.22%
- Wild	0.10%	0.10%	0.10%	0.35%	0.35%	0.22%
Number survived to adults	3,146	8,045	8,412	24,691	35,443	79,738
West Coast Harvest						
Alaska						
a) Commercial	79	201	210	2,222	3,190	5,902
b) Sport	--	--	--	25	35	60
British Columbia						
a) Commercial	157	402	421	2,716	3,899	7,595
b) Sport	16	40	42	247	354	699
Washington ocean						
a) Commercial	31	80	84	988	1,418	2,601
- Westport (28%)	13	32	34	395	567	1,041
- Other commercial (68%)	19	47	50	583	836	1,535
- Tribal (4%)	0	1	1	10	14	26
b) Sport	31	80	84	247	354	797
- Westport (41%)	22	57	60	175	252	566
- Other sport (59%)	9	23	24	72	103	231
Washington Puget Sound						
a) Commercial	16	40	42	2	4	104
b) Sport	--	--	--	7	11	18
Oregon						

a) Commercial	16	40	42	247	354	699
- Astoria (3%)	0	1	1	5	7	14
- Other commercial (97%)	15	39	41	242	347	685
b) Sport	16	40	42	247	354	699
- Astoria & Buoy 10 (16%)	0	0	0	2	4	7
- Other sport (84%)	16	40	42	244	351	692
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	2,469	3,544	6,013
- Astoria (50%)	--	--	--	1,235	1,772	3,007
- Other (50%)	--	--	--	1,235	1,772	3,007
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	2,469	3,544	6,013
c) Tribal C & S	1	2	2	--	--	5
Other	87	222	232	--	--	541
Hatchery						
Hatchery requirement	2,697	6,896	7,210	6,047	8,680	31,529
Hatchery surplus market	--	--	--	3,379	4,850	8,229
Hatchery surplus carcass	--	--	--	3,379	4,850	8,229

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Fall Chinook
Case I: NMFS Cap (1970's-1990's Actual)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	612,797	12,329,885	24,002,299	76,857,203	0	113,802,184
Wild fish contribution - % Assumption	50%	50%	50%	50%	50%	50%
- No. of releases	612,797	12,329,885	24,002,299	76,857,203	0	113,802,184
Total smolt production	1,225,594	24,659,770	48,004,598	153,714,406	0	227,604,368
Representative survival rate in % - Hatchery	0.60%	0.60%	0.60%	0.32%	NA	0.41%
- Wild	0.60%	0.60%	0.60%	0.32%	NA	0.41%
Number survived to adults	7,354	147,959	288,028	491,886	NA	935,226
West Coast Harvest						
Alaska						
a) Commercial	441	8,878	17,282	7,378	NA	33,979
b) Sport	1	15	29	--	NA	44
British Columbia						
a) Commercial	1,838	36,990	72,007	98,377	NA	209,212
b) Sport	147	2,959	5,761	14,757	NA	23,623
Washington ocean						
a) Commercial	331	6,658	12,961	59,026	NA	78,977
- Westport (28%)	132	2,663	5,184	23,611	NA	31,591
- Other commercial (68%)	195	3,928	7,647	34,826	NA	46,596
- Tribal (4%)	3	67	130	590	NA	790
b) Sport	147	2,959	5,761	49,189	NA	58,055
- Westport (41%)	104	2,101	4,090	34,924	NA	41,219
- Other sport (59%)	43	858	1,671	14,265	NA	16,836
Washington Puget Sound						
a) Commercial	0	1	1	--	NA	2
b) Sport	0	1	1	--	NA	2
Oregon						

a) Commercial	110	2,219	4,320	14,757	NA	21,407
- Astoria (3%)	2	44	86	295	NA	428
- Other commercial (97%)	108	2,175	4,234	14,461	NA	20,979
b) Sport	37	740	1,440	4,919	NA	7,136
- Astoria & Buoy 10 (16%)	0	7	14	49	NA	71
- Other sport (84%)	36	732	1,426	4,870	NA	7,064
California						
a) Commercial	0	1	1	2,459	NA	2,462
b) Sport	0	1	1	492	NA	494
Columbia Basin inland						
a) Freshwater sport						
Mainstem	74	1,480	2,880	24,594	NA	29,028
- Astoria (50%)	37	740	1,440	12,297	NA	14,514
- Other (50%)	37	740	1,440	12,297	NA	14,514
Tributary	--	--	--	--	NA	--
b) Gillnet	882	17,755	34,563	54,107	NA	107,308
c) Tribal C & S	1,938	38,990	75,901	--	NA	116,830
Other	11	215	418	--	NA	643
Hatchery						
Hatchery requirement	1,051	21,137	41,147	131,755	NA	195,089
Hatchery surplus market	173	3,481	6,776	15,038	NA	25,468
Hatchery surplus carcass	173	3,481	6,776	15,038	NA	25,468

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Fall Chinook
Case II: 80's Actual

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	612,797	12,329,885	24,002,299	76,857,203	0	113,802,184
Wild fish contribution - % Assumption	50%	50%	50%	50%	50%	50%
- No. of releases	612,797	12,329,885	24,002,299	76,857,203	0	113,802,184
Total smolt production	1,225,594	24,659,770	48,004,598	153,714,406	0	227,604,368
Representative survival rate in % - Hatchery	0.73%	0.73%	0.73%	0.38%	NA	0.49%
- Wild	0.73%	0.73%	0.73%	0.38%	NA	0.49%
Number survived to adults	8,890	178,882	348,224	589,080	NA	1,125,076
West Coast Harvest						
Alaska						
a) Commercial	533	10,733	20,893	8,836	NA	40,996
b) Sport	1	18	35	--	NA	54
British Columbia						
a) Commercial	2,222	44,721	87,056	117,816	NA	251,815
b) Sport	178	3,578	6,964	17,672	NA	28,392
Washington ocean						
a) Commercial	419	8,427	16,404	77,103	NA	102,353
- Westport (28%)	168	3,371	6,562	30,841	NA	40,941
- Other commercial (68%)	247	4,972	9,679	45,491	NA	60,388
- Tribal (4%)	4	84	164	771	NA	1,024
b) Sport	186	3,745	7,291	64,252	NA	75,474
- Westport (41%)	132	2,659	5,176	45,619	NA	53,587
- Other sport (59%)	54	1,086	2,114	18,633	NA	21,888
Washington Puget Sound						
a) Commercial	0	1	2	--	NA	3
b) Sport	0	1	2	--	NA	3
Oregon						

a) Commercial	140	2,809	5,468	19,276	NA	27,692
- Astoria (3%)	3	56	109	386	NA	554
- Other commercial (97%)	137	2,753	5,359	18,890	NA	27,138
b) Sport	47	936	1,823	6,425	NA	9,231
- Astoria & Buoy 10 (16%)	0	9	18	64	NA	92
- Other sport (84%)	46	927	1,804	6,361	NA	9,138
California						
a) Commercial	0	1	2	3,213	NA	3,215
b) Sport	0	1	2	643	NA	645
Columbia Basin inland						
a) Freshwater sport						
Mainstem	93	1,873	3,645	32,126	NA	37,737
- Astoria (50%)	47	936	1,823	16,063	NA	18,869
- Other (50%)	47	936	1,823	16,063	NA	18,869
Tributary	--	--	--	--	NA	--
b) Gillnet	1,117	22,472	43,745	70,677	NA	138,011
c) Tribal C & S	2,452	49,348	96,064	--	NA	147,865
Other	13	272	529	--	NA	814
Hatchery						
Hatchery requirement	1,051	21,137	41,147	131,755	NA	195,089
Hatchery surplus market	219	4,406	8,576	19,643	NA	32,843
Hatchery surplus carcass	219	4,406	8,576	19,643	NA	32,843

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Fall Chinook
Case III: Representative Early 2000's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	3,445,924	11,784,085	24,623,481	26,468,496	0	66,321,986
Wild fish contribution - % Assumption	30%	90%	30%	20%	NA	65%
- No. of releases	1,476,825	106,056,765	10,552,920	6,617,124	0	124,703,634
Total smolt production	4,922,749	117,840,850	35,176,401	33,085,620	0	191,025,620
Representative survival rate in % - Hatchery	0.60%	0.60%	0.60%	0.32%	NA	0.55%
- Wild	0.60%	0.60%	0.60%	0.32%	NA	0.55%
Number survived to adults	29,536	707,045	211,058	105,874	NA	1,053,514
West Coast Harvest						
Alaska						
a) Commercial	1,772	42,423	12,664	1,588	NA	58,447
b) Sport	3	71	21	--	NA	95
British Columbia						
a) Commercial	7,384	176,761	52,765	21,175	NA	258,085
b) Sport	591	14,141	4,221	3,176	NA	22,129
Washington ocean						
a) Commercial	1,540	36,875	11,007	16,774	NA	66,196
- Westport (28%)	616	14,750	4,403	6,710	NA	26,479
- Other commercial (68%)	909	21,756	6,494	9,897	NA	39,056
- Tribal (4%)	15	369	110	168	NA	662
b) Sport	685	16,389	4,892	13,978	NA	35,944
- Westport (41%)	486	11,636	3,473	9,925	NA	25,520
- Other sport (59%)	199	4,753	1,419	4,054	NA	10,424
Washington Puget Sound						
a) Commercial	0	4	1	--	NA	5
b) Sport	0	4	1	--	NA	5
Oregon						

a) Commercial	513	12,292	3,669	4,194	NA	20,668
- Astoria (3%)	10	246	73	84	NA	413
- Other commercial (97%)	503	12,046	3,596	4,110	NA	20,254
b) Sport	171	4,097	1,223	1,398	NA	6,889
- Astoria & Buoy 10 (16%)	2	41	12	14	NA	69
- Other sport (84%)	169	4,056	1,211	1,384	NA	6,820
California						
a) Commercial	0	4	1	699	NA	704
b) Sport	0	4	1	140	NA	145
Columbia Basin inland						
a) Freshwater sport						
Mainstem	342	8,194	2,446	6,989	NA	17,972
- Astoria (50%)	171	4,097	1,223	3,495	NA	8,986
- Other (50%)	171	4,097	1,223	3,495	NA	8,986
Tributary	--	--	--	--	NA	--
b) Gillnet	4,108	98,332	29,353	15,376	NA	147,169
c) Tribal C & S	9,021	215,938	64,459	--	NA	289,418
Other	50	1,188	355	--	NA	1,592
Hatchery						
Hatchery requirement	1,745	41,773	12,470	11,840	NA	67,827
Hatchery surplus market	805	19,278	5,755	4,273	NA	30,111
Hatchery surplus carcass	805	19,278	5,755	4,273	NA	30,111

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Fall Chinook
Case IV: Early 90's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	533,134	10,727,000	20,882,000	67,966,887	0	100,109,021
Wild fish contribution - % Assumption	50%	50%	50%	50%	50%	50%
- No. of releases	533,134	10,727,000	20,882,000	67,966,887	0	100,109,021
Total smolt production	1,066,268	21,454,000	41,764,000	135,933,774	0	200,218,042
Representative survival rate in % - Hatchery	0.40%	0.40%	0.40%	0.25%	NA	0.30%
- Wild	0.40%	0.40%	0.40%	0.25%	NA	0.30%
Number survived to adults	4,265	85,816	167,056	339,834	NA	596,972
West Coast Harvest						
Alaska						
a) Commercial	256	5,149	10,023	5,098	NA	20,526
b) Sport	0	9	17	--	NA	26
British Columbia						
a) Commercial	1,066	21,454	41,764	67,967	NA	132,251
b) Sport	85	1,716	3,341	10,195	NA	15,338
Washington ocean						
a) Commercial	166	3,338	6,499	34,502	NA	44,505
- Westport (28%)	66	1,335	2,599	13,801	NA	17,802
- Other commercial (68%)	98	1,970	3,834	20,356	NA	26,258
- Tribal (4%)	2	33	65	345	NA	445
b) Sport	74	1,484	2,888	28,751	NA	33,197
- Westport (41%)	52	1,053	2,051	20,413	NA	23,570
- Other sport (59%)	21	430	838	8,338	NA	9,627
Washington Puget Sound						
a) Commercial	0	0	1	--	NA	1
b) Sport	0	0	1	--	NA	1
Oregon						

a)	Commercial	55	1,113	2,166	8,625	NA	11,960
	- Astoria (3%)	1	22	43	173	NA	239
	- Other commercial (97%)	54	1,091	2,123	8,453	NA	11,721
b)	Sport	18	371	722	2,875	NA	3,987
	- Astoria & Buoy 10 (16%)	0	4	7	29	NA	40
	- Other sport (84%)	18	367	715	2,846	NA	3,947
California							
a)	Commercial	0	0	1	1,438	NA	1,439
b)	Sport	0	0	1	288	NA	289
Columbia Basin inland							
a)	Freshwater sport						
	Mainstem	37	742	1,444	14,376	NA	16,599
	- Astoria (50%)	18	371	722	7,188	NA	8,299
	- Other (50%)	18	371	722	7,188	NA	8,299
	Tributary	--	--	--	--	NA	--
b)	Gillnet	442	8,902	17,330	31,627	NA	58,301
c)	Tribal C & S	972	19,549	38,057	--	NA	58,578
Other		5	108	209	--	NA	322
Hatchery							
Hatchery requirement		914	18,389	35,798	116,515	NA	171,615
Hatchery surplus market		87	1,745	3,397	8,790	NA	14,019
Hatchery surplus carcass		87	1,745	3,397	8,790	NA	14,019

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Summer/Winter Steelhead
Case I: NMFS Cap (1970's-1990's Actual)

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	12,900,795	1,363,636	536,886	3,775,119	1,465,625	20,042,061
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	5,528,912	584,415	230,094	1,617,908	628,125	8,589,455
Total smolt production	18,429,707	1,948,051	766,980	5,393,027	2,093,750	28,631,516
Representative survival rate in % - Hatchery	0.70%	0.70%	0.70%	0.40%	0.40%	0.62%
- Wild	0.70%	0.70%	0.70%	0.40%	0.40%	0.62%
Number survived to adults	129,008	13,636	5,369	21,572	8,375	177,960
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	39	4	2	6	3	53
British Columbia						
a) Commercial	1,290	136	54	216	84	1,780
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
- Westport (28%)						
- Other commercial (68%)						
- Tribal (4%)						
b) Sport	--	--	--	--	--	--
- Westport (41%)						
- Other sport (59%)						
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						

a) Commercial	--	--	--	--	--	--
- Astoria (3%)						
- Other commercial (97%)						
b) Sport	39	4	2	6	3	53
- Astoria & Buoy 10 (16%)						
- Other sport (84%)						
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	7,914	837	329	9,707	3,769	22,556
- Astoria (25%)	1,979	209	82	2,427	942	5,639
- Other (75%)	5,936	627	247	7,281	2,827	16,917
Tributary	23,743	2,510	988	--	--	27,241
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	21,105	2,231	878	--	--	24,214
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	22,116	2,338	920	6,472	2,513	34,358
Hatchery surplus market	26,381	2,789	1,098	2,582	1,002	33,852
Hatchery surplus carcass	26,381	2,789	1,098	2,582	1,002	33,852

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Summer/Winter Steelhead
Case II: 80's Actual

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	12,900,795	1,363,636	536,886	3,775,119	1,465,625	20,042,061
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	5,528,912	584,415	230,094	1,617,908	628,125	8,589,455
Total smolt production	18,429,707	1,948,051	766,980	5,393,027	2,093,750	28,631,516
Representative survival rate in % - Hatchery	1.56%	1.56%	1.56%	0.89%	0.89%	1.38%
- Wild	1.56%	1.56%	1.56%	0.89%	0.89%	1.38%
Number survived to adults	286,599	30,294	11,927	47,924	18,606	395,349
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	86	9	4	14	6	119
British Columbia						
a) Commercial	2,866	303	119	479	186	3,953
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
- Westport (28%)						
- Other commercial (68%)						
- Tribal (4%)						
b) Sport	--	--	--	--	--	--
- Westport (41%)						
- Other sport (59%)						
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						

a) Commercial	--	--	--	--	--	--
- Astoria (3%)						
- Other commercial (97%)						
b) Sport	86	9	4	14	6	119
- Astoria & Buoy 10 (16%)						
- Other sport (84%)						
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	19,608	2,073	816	21,566	8,373	52,435
- Astoria (25%)	4,902	518	204	5,391	2,093	13,109
- Other (75%)	14,706	1,554	612	16,174	6,279	39,327
Tributary	58,825	6,218	2,448	--	--	67,491
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	52,289	5,527	2,176	--	--	59,992
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	22,116	2,338	920	6,472	2,513	34,358
Hatchery surplus market	65,361	6,909	2,720	9,689	3,762	88,441
Hatchery surplus carcass	65,361	6,909	2,720	9,689	3,762	88,441

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Summer/Winter Steelhead
Case III: Representative Early 2000's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	9,469,817	1,262,177	589,679	2,341,892	925,147	14,588,711
Wild fish contribution - % Assumption	25%	25%	25%	10%	10%	22%
- No. of releases	3,156,606	420,726	196,560	260,210	102,794	4,136,895
Total smolt production	12,626,422	1,682,903	786,238	2,602,102	1,027,941	18,725,606
Representative survival rate in % - Hatchery	2.00%	2.00%	5.00%	1.00%	8.00%	2.32%
- Wild	2.00%	2.00%	5.00%	1.00%	8.00%	2.32%
Number survived to adults	252,528	33,658	39,312	26,021	82,235	433,755
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	76	10	12	8	25	130
British Columbia						
a) Commercial	2,525	337	393	260	822	4,338
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
- Westport (28%)						
- Other commercial (68%)						
- Tribal (4%)						
b) Sport	--	--	--	--	--	--
- Westport (41%)						
- Other sport (59%)						
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						

a) Commercial	--	--	--	--	--	--
- Astoria (3%)						
- Other commercial (97%)						
b) Sport	76	10	12	8	25	130
- Astoria & Buoy 10 (16%)						
- Other sport (84%)						
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	15,007	2,000	2,336	11,709	37,006	68,058
- Astoria (25%)	3,752	500	584	2,927	9,251	17,015
- Other (75%)	11,255	1,500	1,752	8,782	27,754	51,044
Tributary	45,020	6,000	7,008	--	--	58,029
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	60,027	8,001	9,345	--	--	77,372
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	9,743	1,299	1,517	1,757	5,553	19,868
Hatchery surplus market	60,027	8,001	9,345	6,139	19,403	102,914
Hatchery surplus carcass	60,027	8,001	9,345	6,139	19,403	102,914

Estimated Columbia River Basin Salmon/Steelhead Production (Hatchery and Wild) of Smolt Releases, Smolt Production, Survival Rates, and Returning Adults by Geographic Region

Species: Summer/Winter Steelhead
Case IV: Early 90's

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Number of annual hatchery smolt releases	11,352,700	1,200,000	472,460	3,322,105	1,259,750	17,607,015
Wild fish contribution - % Assumption	30%	30%	30%	30%	30%	30%
- No. of releases	4,865,443	514,286	202,483	1,423,759	539,893	7,545,864
Total smolt production	16,218,143	1,714,286	674,943	4,745,864	1,799,643	25,152,879
Representative survival rate in % - Hatchery	0.50%	0.50%	0.50%	0.20%	0.20%	0.42%
- Wild	0.50%	0.50%	0.50%	0.20%	0.20%	0.42%
Number survived to adults	81,091	8,571	3,375	9,492	3,599	106,128
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	24	3	1	3	1	32
British Columbia						
a) Commercial	811	86	34	95	36	1,061
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
- Westport (28%)						
- Other commercial (68%)						
- Tribal (4%)						
b) Sport	--	--	--	--	--	--
- Westport (41%)						
- Other sport (59%)						
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						

a) Commercial	--	--	--	--	--	--
- Astoria (3%)						
- Other commercial (97%)						
b) Sport	24	3	1	3	1	32
- Astoria & Buoy 10 (16%)						
- Other sport (84%)						
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	4,558	482	190	3,322	1,260	9,811
- Astoria (25%)	1,139	120	47	831	315	2,453
- Other (75%)	3,418	361	142	2,492	945	7,358
Tributary	13,673	1,445	569	--	--	15,687
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	12,154	1,285	506	--	--	13,944
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	19,462	2,057	810	5,695	2,160	30,183
Hatchery surplus market	15,192	1,606	632	187	71	17,688
Hatchery surplus carcass	15,192	1,606	632	187	71	17,688

APPENDIX A

SECTION III

Regional Economic Impacts of Columbia River Basin Produced Salmon/Steelhead by Geographic Areas

Regional Economic Impacts by Geographic Areas

Species: Coho
Case I: NMFS Cap (1970's-1990's Actual)

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon				
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	189	0	189	0%
British Columbia	726,003	242,705	968,707	4%
Washington ocean	222,600	7,281,145	7,503,746	32%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	7,511	24,270	31,782	0%
Oregon	1,859,207	5,824,916	7,684,123	32%
- Astoria				
- Other				
California	183,556	242,705	426,261	2%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,427,048	2,427,048	10%
Tributary	0	0	0	0%
Gillnet	3,688,399	0	3,688,399	16%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	806,882	0	806,882	3%
Hatchery carcass	220,490	0	220,490	1%
Total with hatchery surplus utilization			23,757,626	100%
Total without hatchery surplus utilization			22,730,255	

Upper Columbia					Willamette				
Alaska	0	0	0	0%	Alaska	0	0	0	0%
British Columbia	4,249	1,278	5,527	5%	British Columbia	6,434	1,936	8,370	2%
Washington ocean					Washington ocean	2,214	193,583	195,796	42%
- Westport					- Westport				
- Other					- Other				
- Tribal					- Tribal				
Washington Puget Sound	0	0	0	0%	Washington Puget Sound	0	0	0	0%
Oregon					Oregon	30,894	125,829	156,723	34%
- Astoria					- Astoria				
- Other					- Other				
California	3,626	6,392	10,017	8%	California	10,980	19,358	30,339	7%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	3,196	3,196	3%	Mainstem	0	9,679	9,679	2%
Tributary	0	0	0	0%	Tributary	0	0	0	0%
Gillnet	8,866	0	8,866	7%	Gillnet	26,853	0	26,853	6%
Tribal	77,848	0	77,848	66%	Tribal	0	0	0	0%
Other	0	0	0	0%	Other	0	0	0	0%
Hatchery					Hatchery				
Hatchery surplus market	9,434	0	9,434	8%	Hatchery surplus market	28,570	0	28,570	6%
Hatchery carcass	3,921	0	3,921	3%	Hatchery carcass	8,331	0	8,331	2%
Total with hatchery surplus utilization			118,810	100%	Total with hatchery surplus utilization			464,661	100%
Total without hatchery surplus utilization			105,455		Total without hatchery surplus utilization			427,760	

Middle Columbia				
Alaska	0	0	0	0%
British Columbia	12,407	3,733	16,140	2%
Washington ocean	2,134	186,643	188,777	27%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	29,787	121,318	151,104	22%
- Astoria				
- Other				
California	10,587	18,664	29,251	4%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	9,332	9,332	1%
Tributary	0	0	0	0%
Gillnet	25,890	0	25,890	4%
Tribal	227,316	0	227,316	33%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	27,546	0	27,546	4%
Hatchery carcass	11,450	0	11,450	2%
Total with hatchery surplus utilization			686,807	100%
Total without hatchery surplus utilization			647,811	

Total				
Alaska	189	0	189	0%
British Columbia	749,092	249,652	998,744	4%
Washington ocean				
- Westport	63,750	3,167,369	3,231,119	13%
- Other	154,822	4,557,921	4,712,743	19%
- Tribal	9,107	0	9,107	0%
Washington Puget Sound	7,511	24,270	31,782	0%
Oregon				
- Astoria	57,903	978,178	1,036,080	4%
- Other	1,872,185	5,135,432	7,007,618	28%
California	208,749	287,119	495,868	2%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,224,628	1,224,628	5%
- Other	0	1,224,628	1,224,628	5%
Tributary	0	0	0	0%
Gillnet	3,750,008	0	3,750,008	15%
Tribal	305,164	0	305,164	1%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	872,432	0	872,432	3%
Hatchery carcass	244,191	0	244,191	1%
Total with hatchery surplus utilization			25,144,301	100%
Total without hatchery surplus utilization			24,027,678	

Regional Economic Impacts by Geographic Areas

Species: Coho
Case II: 80's Actual

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon				
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA		
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	219	0	219	0%
British Columbia	841,898	281,449	1,123,346	4%
Washington ocean	260,026	8,505,319	8,765,345	32%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	8,774	28,351	37,125	0%
Oregon	2,171,794	6,804,255	8,976,049	32%
- Astoria				
- Other				
California	214,417	283,511	497,928	2%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,835,106	2,835,106	10%
Tributary	0	0	0	0%
Gillnet	4,308,527	0	4,308,527	16%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	942,542	0	942,542	3%
Hatchery carcass	243,213	0	243,213	1%
Total with hatchery surplus utilization			27,729,401	100%
Total without hatchery surplus utilization			26,543,646	

Upper Columbia				
Alaska	0	0	0	0%
British Columbia	5,284	1,590	6,874	5%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon				
- Astoria				
- Other				
California	4,610	8,127	12,737	8%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	4,063	4,063	3%
Tributary	0	0	0	0%
Gillnet	11,273	0	11,273	8%
Tribal	98,978	0	98,978	66%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	11,994	0	11,994	8%
Hatchery carcass	4,350	0	4,350	3%
Total with hatchery surplus utilization			150,269	100%
Total without hatchery surplus utilization			133,925	

Willamette				
Alaska	0	0	0	0%
British Columbia	8,002	2,407	10,409	2%
Washington ocean	2,815	246,122	248,936	42%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	39,279	159,979	199,258	34%
- Astoria				
- Other				
California	13,961	24,612	38,573	7%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	12,306	12,306	2%
Tributary	0	0	0	0%
Gillnet	34,141	0	34,141	6%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	36,324	0	36,324	6%
Hatchery carcass	9,629	0	9,629	2%
Total with hatchery surplus utilization			589,577	100%
Total without hatchery surplus utilization			543,623	

Middle Columbia				
Alaska	0	0	0	0%
British Columbia	15,430	4,642	20,072	2%
Washington ocean	2,714	237,300	240,013	28%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	37,871	154,245	192,116	22%
- Astoria				
- Other				
California	13,460	23,730	37,190	4%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	11,865	11,865	1%
Tributary	0	0	0	0%
Gillnet	32,917	0	32,917	4%
Tribal	289,011	0	289,011	33%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	35,022	0	35,022	4%
Hatchery carcass	12,702	0	12,702	1%
Total with hatchery surplus utilization			870,909	100%
Total without hatchery surplus utilization			823,185	

Total				
Alaska	219	0	219	0%
British Columbia	870,613	290,089	1,160,702	4%
Washington ocean				
- Westport	74,615	3,718,704	3,793,319	13%
- Other	181,209	5,351,305	5,532,514	19%
- Tribal	10,659	0	10,659	0%
Washington Puget Sound	8,774	28,351	37,125	0%
Oregon				
- Astoria	67,857	1,147,409	1,215,266	4%
- Other	2,194,056	6,023,895	8,217,951	28%
California	246,448	339,980	586,427	2%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,431,670	1,431,670	5%
- Other	0	1,431,670	1,431,670	5%
Tributary	0	0	0	0%
Gillnet	4,386,857	0	4,386,857	15%
Tribal	387,989	0	387,989	1%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,025,883	0	1,025,883	3%
Hatchery carcass	269,895	0	269,895	1%
Total with hatchery surplus utilization			29,488,148	100%
Total without hatchery surplus utilization			28,192,370	

Regional Economic Impacts by Geographic Areas

Species: Coho
Case III: Representative Early 2000's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon				
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA		
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	103	0	103	0%
British Columbia	396,277	132,476	528,753	4%
Washington ocean	125,181	4,094,598	4,219,779	32%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	4,224	13,649	17,873	0%
Oregon	1,045,537	3,275,679	4,321,216	32%
- Astoria				
- Other				
California	103,224	136,487	239,711	2%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,364,866	1,364,866	10%
Tributary	0	0	0	0%
Gillnet	2,074,195	0	2,074,195	16%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	453,755	0	453,755	3%
Hatchery carcass	96,089	0	96,089	1%
Total with hatchery surplus utilization			13,316,339	100%
Total without hatchery surplus utilization			12,766,495	

Upper Columbia				
Alaska	0	0	0	0%
British Columbia	13,313	4,005	17,318	4%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon				
- Astoria				
- Other				
California	12,133	21,391	33,524	9%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	10,696	10,696	3%
Tributary	0	0	0	0%
Gillnet	29,673	0	29,673	8%
Tribal	260,525	0	260,525	67%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	31,570	0	31,570	8%
Hatchery carcass	8,237	0	8,237	2%
Total with hatchery surplus utilization			391,543	100%
Total without hatchery surplus utilization			351,736	

Willamette				
Alaska	0	0	0	0%
British Columbia	4,371	1,315	5,686	2%
Washington ocean	1,606	140,466	142,073	42%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	22,417	91,303	113,720	34%
- Astoria				
- Other				
California	7,968	14,047	22,014	7%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	7,023	7,023	2%
Tributary	0	0	0	0%
Gillnet	19,485	0	19,485	6%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	20,731	0	20,731	6%
Hatchery carcass	4,441	0	4,441	1%
Total with hatchery surplus utilization			335,173	100%
Total without hatchery surplus utilization			310,001	

Middle Columbia					Total				
Alaska	0	0	0	0%	Alaska	103	0	103	0%
British Columbia	64,009	19,259	83,267	2%	British Columbia	477,969	157,055	635,025	3%
Washington ocean	11,762	1,028,505	1,040,267	28%	Washington ocean				
- Westport					- Westport	39,479	2,245,767	2,285,246	13%
- Other					- Other	95,877	3,231,713	3,327,590	18%
- Tribal					- Tribal	5,640	0	5,640	0%
Washington Puget Sound	0	0	0	0%	Washington Puget Sound	4,224	13,649	17,873	0%
Oregon	164,140	668,528	832,668	22%	Oregon				
- Astoria					- Astoria	37,987	667,928	705,915	4%
- Other					- Other	1,228,245	3,506,624	4,734,869	26%
California	58,339	102,851	161,189	4%	California	181,664	274,775	456,439	3%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	51,425	51,425	1%	Mainstem				
Tributary	0	0	0	0%	- Astoria	0	717,005	717,005	4%
Gillnet	142,669	0	142,669	4%	- Other	0	717,005	717,005	4%
Tribal	1,252,634	0	1,252,634	33%	Tributary	0	0	0	0%
Other	0	0	0	0%	Gillnet	2,266,021	0	2,266,021	12%
Hatchery					Tribal	1,513,159	0	1,513,159	8%
Hatchery surplus market	151,794	0	151,794	4%	Other	0	0	0	0%
Hatchery carcass	39,605	0	39,605	1%	Hatchery				
Total with hatchery surplus utilization			3,755,520	100%	Hatchery surplus market	657,851	0	657,851	4%
Total without hatchery surplus utilization			3,564,121		Hatchery carcass	148,371	0	148,371	1%
					Total with hatchery surplus utilization			18,188,111	100%
					Total without hatchery surplus utilization			17,381,889	

Regional Economic Impacts by Geographic Areas

Species: Coho
Case IV: Early 90's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon				
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA		
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	63	0	63	0%
British Columbia	241,458	80,720	322,178	4%
Washington ocean	68,124	2,228,303	2,296,427	31%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	2,299	7,428	9,726	0%
Oregon	568,987	1,782,642	2,351,629	32%
- Astoria				
- Other				
California	56,175	74,277	130,452	2%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	742,768	742,768	10%
Tributary	0	0	0	0%
Gillnet	1,128,788	0	1,128,788	15%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	246,936	0	246,936	3%
Hatchery carcass	112,315	0	112,315	2%
Total with hatchery surplus utilization			7,341,280	100%
Total without hatchery surplus utilization			6,982,030	

Upper Columbia				
Alaska	0	0	0	0%
British Columbia	441	133	573	12%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon				
- Astoria				
- Other				
California	76	134	211	4%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	67	67	1%
Tributary	0	0	0	0%
Gillnet	186	0	186	4%
Tribal	1,637	0	1,637	34%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	198	0	198	4%
Hatchery carcass	1,976	0	1,976	41%
Total with hatchery surplus utilization			4,850	100%
Total without hatchery surplus utilization			2,675	

Willamette				
Alaska	0	0	0	0%
British Columbia	1,780	536	2,316	2%
Washington ocean	473	41,358	41,831	41%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	6,600	26,883	33,483	33%
- Astoria				
- Other				
California	2,346	4,136	6,482	6%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,068	2,068	2%
Tributary	0	0	0	0%
Gillnet	5,737	0	5,737	6%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	6,104	0	6,104	6%
Hatchery carcass	3,965	0	3,965	4%
Total with hatchery surplus utilization			101,985	100%
Total without hatchery surplus utilization			91,916	

Middle Columbia				
Alaska	0	0	0	0%
British Columbia	1,287	387	1,674	8%
Washington ocean	45	3,926	3,971	19%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	627	2,552	3,178	15%
- Astoria				
- Other				
California	223	393	615	3%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	196	196	1%
Tributary	0	0	0	0%
Gillnet	545	0	545	3%
Tribal	4,781	0	4,781	22%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	579	0	579	3%
Hatchery carcass	5,771	0	5,771	27%
Total with hatchery surplus utilization			21,311	100%
Total without hatchery surplus utilization			14,961	

Total				
Alaska	63	0	63	0%
British Columbia	244,966	81,776	326,742	4%
Washington ocean				
- Westport	19,224	932,722	951,946	13%
- Other	46,687	1,342,209	1,388,896	19%
- Tribal	2,746	0	2,746	0%
Washington Puget Sound	2,299	7,428	9,726	0%
Oregon				
- Astoria	17,293	290,072	307,365	4%
- Other	559,135	1,522,878	2,082,014	28%
California	58,820	78,940	137,759	2%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	372,549	372,549	5%
- Other	0	372,549	372,549	5%
Tributary	0	0	0	0%
Gillnet	1,135,256	0	1,135,256	15%
Tribal	6,419	0	6,419	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	253,818	0	253,818	3%
Hatchery carcass	124,026	0	124,026	2%
Total with hatchery surplus utilization			7,471,874	100%
Total without hatchery surplus utilization			7,094,030	

Regional Economic Impacts by Geographic Areas

Species: Spring/Summer Chinook
Case I: NMFS Cap (1970's-1990's Actual)

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	23,521	0	23,521	7%
British Columbia	47,614	3,715	51,329	15%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	2,804	0	2,804	1%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	43,820	0	43,820	13%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	197,381	0	197,381	59%
Hatchery carcass	14,341	0	14,341	4%
Total with hatchery surplus utilization			333,196	100%
Total without hatchery surplus utilization			121,474	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	497,791	4,368	502,159	13%
British Columbia	615,802	43,679	659,481	17%
Washington ocean	154,564	43,679	198,243	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	330	1,310	1,640	0%
Oregon	33,634	43,679	77,313	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	873,579	873,579	22%
Tributary	0	0	0	0%
Gillnet	788,580	0	788,580	20%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	845,175	0	845,175	21%
Hatchery carcass	48,549	0	48,549	1%
Total with hatchery surplus utilization			3,994,719	100%
Total without hatchery surplus utilization			3,100,996	

Upper Columbia				
Alaska	60,148	0	60,148	7%
British Columbia	121,758	9,500	131,258	15%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	7,171	0	7,171	1%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	112,056	0	112,056	13%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	504,739	0	504,739	59%
Hatchery carcass	36,672	0	36,672	4%
Total with hatchery surplus utilization			852,044	100%
Total without hatchery surplus utilization			310,633	

Willamette				
Alaska	714,557	6,270	720,827	13%
British Columbia	883,957	62,699	946,656	17%
Washington ocean	221,870	62,699	284,570	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	473	1,881	2,354	0%
Oregon	48,280	62,699	110,979	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,253,983	1,253,983	22%
Tributary	0	0	0	0%
Gillnet	1,131,971	0	1,131,971	20%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,213,211	0	1,213,211	21%
Hatchery carcass	69,689	0	69,689	1%
Total with hatchery surplus utilization			5,734,241	100%
Total without hatchery surplus utilization			4,451,341	

Middle Columbia				
Alaska	62,892	0	62,892	7%
British Columbia	127,313	9,933	137,246	15%
Washington ocean	17,575	19,867	37,442	4%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	7,498	0	7,498	1%
Oregon	7,649	9,933	17,582	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	117,168	0	117,168	12%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	527,765	0	527,765	56%
Hatchery carcass	38,345	0	38,345	4%
Total with hatchery surplus utilization			945,937	100%
Total without hatchery surplus utilization			379,828	

Total				
Alaska	1,358,911	10,638	1,369,549	11%
British Columbia	1,796,444	129,526	1,925,970	16%
Washington ocean				
- Westport	166,957	108,399	275,356	2%
- Other	246,261	44,276	290,537	2%
- Tribal	4,174	0	4,174	0%
Washington Puget Sound	18,276	3,191	21,467	0%
Oregon				
- Astoria	1,995	1,295	3,290	0%
- Other	97,744	128,231	225,975	2%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,063,781	1,063,781	9%
- Other	0	1,063,781	1,063,781	9%
Tributary	0	0	0	0%
Gillnet	1,920,551	0	1,920,551	16%
Tribal	273,043	0	273,043	2%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	3,288,270	0	3,288,270	28%
Hatchery carcass	207,595	0	207,595	2%
Total with hatchery surplus utilization			11,933,339	100%
Total without hatchery surplus utilization			8,437,474	

Regional Economic Impacts by Geographic Areas

Species: Spring/Summer Chinook
Case II: 80's Actual

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	24,956	0	24,956	7%
British Columbia	50,517	3,942	54,459	15%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	2,975	0	2,975	1%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	47,439	0	47,439	13%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	213,901	0	213,901	60%
Hatchery carcass	15,013	0	15,013	4%
Total with hatchery surplus utilization			358,743	100%
Total without hatchery surplus utilization			129,829	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	520,430	4,567	524,996	13%
British Columbia	643,808	45,665	689,473	16%
Washington ocean	161,594	45,665	207,259	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	345	1,370	1,715	0%
Oregon	35,164	45,665	80,829	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	913,307	913,307	22%
Tributary	0	0	0	0%
Gillnet	824,442	0	824,442	20%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	891,506	0	891,506	21%
Hatchery carcass	50,435	0	50,435	1%
Total with hatchery surplus utilization			4,183,962	100%
Total without hatchery surplus utilization			3,242,021	

Upper Columbia				
Alaska	63,816	0	63,816	7%
British Columbia	129,182	10,079	139,261	15%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	7,608	0	7,608	1%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	121,311	0	121,311	13%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	546,981	0	546,981	60%
Hatchery carcass	38,392	0	38,392	4%
Total with hatchery surplus utilization			917,368	100%
Total without hatchery surplus utilization			331,996	

Willamette				
Alaska	753,075	6,608	759,682	13%
British Columbia	931,605	66,079	997,684	16%
Washington ocean	233,830	66,079	299,909	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	499	1,982	2,481	0%
Oregon	50,883	66,079	116,961	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,321,578	1,321,578	22%
Tributary	0	0	0	0%
Gillnet	1,192,988	0	1,192,988	20%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,292,039	0	1,292,039	21%
Hatchery carcass	72,899	0	72,899	1%
Total with hatchery surplus utilization			6,056,222	100%
Total without hatchery surplus utilization			4,691,284	

Middle Columbia				
Alaska	66,727	0	66,727	7%
British Columbia	135,075	10,539	145,614	14%
Washington ocean	18,647	21,078	39,725	4%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	7,955	0	7,955	1%
Oregon	8,115	10,539	18,654	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	126,844	0	126,844	12%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	571,932	0	571,932	56%
Hatchery carcass	40,143	0	40,143	4%
Total with hatchery surplus utilization			1,017,595	100%
Total without hatchery surplus utilization			405,519	

Total				
Alaska	1,429,003	11,174	1,440,177	11%
British Columbia	1,890,187	136,304	2,026,491	16%
Washington ocean				
- Westport	175,551	114,213	289,764	2%
- Other	258,938	46,650	305,588	2%
- Tribal	4,389	0	4,389	0%
Washington Puget Sound	19,382	3,352	22,734	0%
Oregon				
- Astoria	2,099	1,363	3,462	0%
- Other	102,859	134,941	237,800	2%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,117,442	1,117,442	9%
- Other	0	1,117,442	1,117,442	9%
Tributary	0	0	0	0%
Gillnet	2,017,430	0	2,017,430	16%
Tribal	295,594	0	295,594	2%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	3,516,359	0	3,516,359	28%
Hatchery carcass	216,882	0	216,882	2%
Total with hatchery surplus utilization			12,611,556	100%
Total without hatchery surplus utilization			8,878,315	

Regional Economic Impacts by Geographic Areas

Species: Spring/Summer Chinook
Case III: Representative Early 2000's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	339,649	0	339,649	2%
British Columbia	687,550	53,645	741,195	5%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	40,493	0	40,493	0%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	4,937,193	4,937,193	30%
Tributary	0	1,645,731	1,645,731	10%
Gillnet	990,401	0	990,401	6%
Tribal	7,513,909	0	7,513,909	46%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	42,899	0	42,899	0%
Total with hatchery surplus utilization			16,251,469	100%
Total without hatchery surplus utilization			16,208,570	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	491,067	4,309	495,376	12%
British Columbia	607,484	43,089	650,573	16%
Washington ocean	152,477	43,089	195,566	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	325	1,293	1,618	0%
Oregon	33,180	43,089	76,269	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	861,778	861,778	21%
Tributary	0	0	0	0%
Gillnet	777,927	0	777,927	19%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	923,105	0	923,105	23%
Hatchery carcass	44,255	0	44,255	1%
Total with hatchery surplus utilization			4,026,466	100%
Total without hatchery surplus utilization			3,059,107	

Upper Columbia				
Alaska	227,703	0	227,703	2%
British Columbia	460,938	35,964	496,902	5%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	27,147	0	27,147	0%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	3,309,927	3,309,927	30%
Tributary	0	1,103,309	1,103,309	10%
Gillnet	663,971	0	663,971	6%
Tribal	5,037,374	0	5,037,374	46%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	28,760	0	28,760	0%
Total with hatchery surplus utilization			10,895,093	100%
Total without hatchery surplus utilization			10,866,333	

Willamette				
Alaska	1,125,172	9,873	1,135,044	12%
British Columbia	1,391,915	98,729	1,490,644	16%
Washington ocean	349,366	98,729	448,095	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	745	2,962	3,707	0%
Oregon	76,024	98,729	174,753	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,974,574	1,974,574	21%
Tributary	0	0	0	0%
Gillnet	1,782,448	0	1,782,448	19%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	2,116,590	0	2,116,590	23%
Hatchery carcass	101,339	0	101,339	1%
Total with hatchery surplus utilization			9,227,194	100%
Total without hatchery surplus utilization			7,009,265	

Middle Columbia				
Alaska	178,356	0	178,356	2%
British Columbia	361,046	28,170	389,216	4%
Washington ocean	49,842	56,340	106,182	1%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	21,263	0	21,263	0%
Oregon	21,692	28,170	49,862	1%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,592,612	2,592,612	30%
Tributary	0	864,204	864,204	10%
Gillnet	520,078	0	520,078	6%
Tribal	3,945,694	0	3,945,694	45%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	22,527	0	22,527	0%
Total with hatchery surplus utilization			8,689,994	100%
Total without hatchery surplus utilization			8,667,467	

Total				
Alaska	2,361,947	14,182	2,376,129	5%
British Columbia	3,508,933	259,596	3,768,529	8%
Washington ocean				
- Westport	284,093	267,936	552,029	1%
- Other	419,037	109,439	528,475	1%
- Tribal	7,102	0	7,102	0%
Washington Puget Sound	89,973	4,255	94,228	0%
Oregon				
- Astoria	3,998	2,596	6,594	0%
- Other	195,898	257,000	452,899	1%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	6,838,042	6,838,042	14%
- Other	0	6,838,042	6,838,042	14%
Tributary	0	3,613,244	3,613,244	7%
Gillnet	4,734,826	0	4,734,826	10%
Tribal	16,496,978	0	16,496,978	33%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	3,039,695	0	3,039,695	6%
Hatchery carcass	239,779	0	239,779	0%
Total with hatchery surplus utilization			49,586,590	100%
Total without hatchery surplus utilization			46,307,116	

Regional Economic Impacts by Geographic Areas

Species: Spring/Summer Chinook
Case IV: Early 90's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	5,976	0	5,976	23%
British Columbia	12,097	944	13,040	51%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	712	0	712	3%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	95	0	95	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	5,926	0	5,926	23%
Total with hatchery surplus utilization			25,749	100%
Total without hatchery surplus utilization			19,823	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	168,839	1,481	170,320	14%
British Columbia	208,865	14,815	223,680	18%
Washington ocean	52,424	14,815	67,239	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	112	444	556	0%
Oregon	11,408	14,815	26,223	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	296,296	296,296	24%
Tributary	0	0	0	0%
Gillnet	267,467	0	267,467	21%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	182,366	0	182,366	15%
Hatchery carcass	20,713	0	20,713	2%
Total with hatchery surplus utilization			1,254,860	100%
Total without hatchery surplus utilization			1,051,781	

Upper Columbia				
Alaska	15,281	0	15,281	23%
British Columbia	30,933	2,414	33,347	51%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	1,822	0	1,822	3%
Oregon				
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	243	0	243	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	15,153	0	15,153	23%
Total with hatchery surplus utilization			65,845	100%
Total without hatchery surplus utilization			50,692	

Willamette				
Alaska	242,360	2,127	244,487	14%
British Columbia	299,816	21,266	321,082	18%
Washington ocean	75,253	21,266	96,519	5%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	161	638	799	0%
Oregon	16,375	21,266	37,641	2%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	425,320	425,320	24%
Tributary	0	0	0	0%
Gillnet	383,937	0	383,937	21%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	261,778	0	261,778	15%
Hatchery carcass	29,733	0	29,733	2%
Total with hatchery surplus utilization			1,801,295	100%
Total without hatchery surplus utilization			1,509,785	

Middle Columbia				
Alaska	15,978	0	15,978	19%
British Columbia	32,344	2,524	34,868	42%
Washington ocean	4,465	5,047	9,512	11%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	1,905	0	1,905	2%
Oregon	1,943	2,524	4,467	5%
- Astoria				
- Other				
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	0	0	0%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	254	0	254	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	0	0	0	0%
Hatchery carcass	15,844	0	15,844	19%
Total with hatchery surplus utilization			82,828	100%
Total without hatchery surplus utilization			66,984	

Total				
Alaska	448,433	3,608	452,041	14%
British Columbia	584,055	41,962	626,017	19%
Washington ocean				
- Westport	55,233	33,968	89,201	3%
- Other	81,469	13,874	95,343	3%
- Tribal	1,381	0	1,381	0%
Washington Puget Sound	4,711	1,082	5,794	0%
Oregon				
- Astoria	646	420	1,066	0%
- Other	31,665	41,542	73,208	2%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	360,808	360,808	11%
- Other	0	360,808	360,808	11%
Tributary	0	0	0	0%
Gillnet	651,403	0	651,403	20%
Tribal	592	0	592	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	444,144	0	444,144	14%
Hatchery carcass	87,369	0	87,369	3%
Total with hatchery surplus utilization			3,249,175	100%
Total without hatchery surplus utilization			2,717,662	

Regional Economic Impacts by Geographic Areas

Species: Fall Chinook
Case I: NMFS Cap (1970's-1990's Actual)

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	33,522	44	33,566	10%
British Columbia	141,373	8,824	150,197	46%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	2	2	4	0%
Oregon				
- Astoria				
- Other				
California	2	2	4	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	6,618	6,618	2%
Tributary	0	0	0	0%
Gillnet	39,965	0	39,965	12%
Tribal	87,763	0	87,763	27%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	5,655	0	5,655	2%
Hatchery carcass	2,689	0	2,689	1%
Total with hatchery surplus utilization			326,462	100%
Total without hatchery surplus utilization			318,118	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	560,583	0	560,583	3%
British Columbia	7,565,235	885,395	8,450,630	39%
Washington ocean	3,133,103	2,951,317	6,084,420	28%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	681,779	295,132	976,911	4%
- Astoria				
- Other				
California	145,381	29,513	174,895	1%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,213,487	2,213,487	10%
Tributary	0	0	0	0%
Gillnet	2,450,513	0	2,450,513	11%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	491,540	0	491,540	2%
Hatchery carcass	322,572	0	322,572	1%
Total with hatchery surplus utilization			21,725,551	100%
Total without hatchery surplus utilization			20,911,438	

Upper Columbia				
Alaska	674,490	888	675,378	10%
British Columbia	2,844,514	177,550	3,022,065	46%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	34	44	78	0%
Oregon				
- Astoria				
- Other				
California	44	44	88	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	133,163	133,163	2%
Tributary	0	0	0	0%
Gillnet	804,121	0	804,121	12%
Tribal	1,765,859	0	1,765,859	27%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	113,779	0	113,779	2%
Hatchery carcass	54,097	0	54,097	1%
Total with hatchery surplus utilization			6,568,627	100%
Total without hatchery surplus utilization			6,400,751	

Willamette				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon	NA	NA	NA	NA
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

Middle Columbia				
Alaska	1,313,014	1,728	1,314,742	9%
British Columbia	5,537,350	345,633	5,882,983	42%
Washington ocean	687,980	345,633	1,033,613	7%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	65	86	152	0%
Oregon	199,610	86,408	286,019	2%
- Astoria				
- Other				
California	85	86	172	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	259,225	259,225	2%
Tributary	0	0	0	0%
Gillnet	1,565,363	0	1,565,363	11%
Tribal	3,437,557	0	3,437,557	24%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	221,491	0	221,491	2%
Hatchery carcass	105,309	0	105,309	1%
Total with hatchery surplus utilization			14,106,624	100%
Total without hatchery surplus utilization			13,779,824	

Total				
Alaska	2,581,609	2,660	2,584,269	6%
British Columbia	16,088,471	1,417,403	17,505,874	40%
Washington ocean				
- Westport	1,676,824	2,473,160	4,149,984	10%
- Other	2,473,315	1,010,164	3,483,479	8%
- Tribal	41,921	0	41,921	0%
Washington Puget Sound	100	133	233	0%
Oregon				
- Astoria	19,780	4,281	24,062	0%
- Other	969,244	423,852	1,393,097	3%
California	145,512	29,646	175,159	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,306,247	1,306,247	3%
- Other	0	1,306,247	1,306,247	3%
Tributary	0	0	0	0%
Gillnet	4,859,963	0	4,859,963	11%
Tribal	5,291,179	0	5,291,179	12%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	832,465	0	832,465	2%
Hatchery carcass	484,666	0	484,666	1%
Total with hatchery surplus utilization			43,438,844	100%
Total without hatchery surplus utilization			42,121,713	

Regional Economic Impacts by Geographic Areas

Species: Fall Chinook
Case II: 80's Actual

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	40,526	53	40,580	10%
British Columbia	170,910	10,668	181,578	45%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	2	3	5	0%
Oregon				
- Astoria				
- Other				
California	3	3	6	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	8,376	8,376	2%
Tributary	0	0	0	0%
Gillnet	50,578	0	50,578	13%
Tribal	111,070	0	111,070	28%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	7,157	0	7,157	2%
Hatchery carcass	2,790	0	2,790	1%
Total with hatchery surplus utilization			402,139	100%
Total without hatchery surplus utilization			392,193	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	671,350	0	671,350	2%
British Columbia	9,060,075	1,060,343	10,120,418	37%
Washington ocean	4,092,587	3,855,130	7,947,717	29%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	890,568	385,513	1,276,081	5%
- Astoria				
- Other				
California	189,903	38,551	228,454	1%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,891,347	2,891,347	11%
Tributary	0	0	0	0%
Gillnet	3,200,960	0	3,200,960	12%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	642,070	0	642,070	2%
Hatchery carcass	332,692	0	332,692	1%
Total with hatchery surplus utilization			27,311,090	100%
Total without hatchery surplus utilization			26,336,328	

Upper Columbia				
Alaska	815,459	1,073	816,532	10%
British Columbia	3,439,019	214,658	3,653,677	45%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	42	56	99	0%
Oregon				
- Astoria				
- Other				
California	55	56	112	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	168,538	168,538	2%
Tributary	0	0	0	0%
Gillnet	1,017,736	0	1,017,736	13%
Tribal	2,234,961	0	2,234,961	28%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	144,004	0	144,004	2%
Hatchery carcass	56,129	0	56,129	1%
Total with hatchery surplus utilization			8,091,787	100%
Total without hatchery surplus utilization			7,891,654	

Willamette				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon	NA	NA	NA	NA
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

Middle Columbia					Total				
Alaska	1,587,430	2,089	1,589,519	9%	Alaska	3,114,765	3,216	3,117,981	6%
British Columbia	6,694,639	417,869	7,112,509	41%	British Columbia	19,364,643	1,703,539	21,068,182	39%
Washington ocean	870,739	437,449	1,308,188	8%	Washington ocean				
- Westport					- Westport	2,173,141	3,215,209	5,388,350	10%
- Other					- Other	3,205,382	1,313,254	4,518,637	8%
- Tribal					- Tribal	54,329	0	54,329	0%
Washington Puget Sound	83	109	192	0%	Washington Puget Sound	127	168	295	0%
Oregon	252,636	109,362	361,999	2%	Oregon				
- Astoria					- Astoria	25,589	5,538	31,127	0%
- Other					- Other	1,253,843	548,308	1,802,151	3%
California	108	109	217	0%	California	190,069	38,720	228,789	0%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	328,087	328,087	2%	Mainstem				
Tributary	0	0	0	0%	- Astoria	0	1,698,174	1,698,174	3%
Gillnet	1,981,197	0	1,981,197	11%	- Other	0	1,698,174	1,698,174	3%
Tribal	4,350,732	0	4,350,732	25%	Tributary	0	0	0	0%
Other	0	0	0	0%	Gillnet	6,250,472	0	6,250,472	12%
Hatchery					Tribal	6,696,763	0	6,696,763	12%
Hatchery surplus market	280,329	0	280,329	2%	Other	0	0	0	0%
Hatchery carcass	109,264	0	109,264	1%	Hatchery				
Total with hatchery surplus utilization			17,422,232	100%	Hatchery surplus market	1,073,560	0	1,073,560	2%
Total without hatchery surplus utilization			17,032,639		Hatchery carcass	500,874	0	500,874	1%
					Total with hatchery surplus utilization			54,127,857	100%
					Total without hatchery surplus utilization			52,553,423	

Regional Economic Impacts by Geographic Areas

Species: Fall Chinook
Case III: Representative Early 2000's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	134,646	177	134,823	10%
British Columbia	567,841	35,444	603,285	43%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	8	10	18	0%
Oregon				
- Astoria				
- Other				
California	10	10	20	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	30,808	30,808	2%
Tributary	0	0	0	0%
Gillnet	186,039	0	186,039	13%
Tribal	408,544	0	408,544	29%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	26,324	0	26,324	2%
Hatchery carcass	5,605	0	5,605	0%
Total with hatchery surplus utilization			1,395,467	100%
Total without hatchery surplus utilization			1,363,539	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	120,660	0	120,660	2%
British Columbia	1,628,348	190,573	1,818,921	33%
Washington ocean	890,365	838,705	1,729,069	31%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	193,748	83,870	277,618	5%
- Astoria				
- Other				
California	41,314	8,387	49,701	1%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	629,028	629,028	11%
Tributary	0	0	0	0%
Gillnet	696,386	0	696,386	13%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	139,686	0	139,686	3%
Hatchery carcass	35,409	0	35,409	1%
Total with hatchery surplus utilization			5,496,479	100%
Total without hatchery surplus utilization			5,321,385	

Regional Economic Impacts by Geographic Areas

Species: Fall Chinook
Case III: Representative Early 2000's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	134,646	177	134,823	10%
British Columbia	567,841	35,444	603,285	43%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	8	10	18	0%
Oregon				
- Astoria				
- Other				
California	10	10	20	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	30,808	30,808	2%
Tributary	0	0	0	0%
Gillnet	186,039	0	186,039	13%
Tribal	408,544	0	408,544	29%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	26,324	0	26,324	2%
Hatchery carcass	5,605	0	5,605	0%
Total with hatchery surplus utilization			1,395,467	100%
Total without hatchery surplus utilization			1,363,539	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	120,660	0	120,660	2%
British Columbia	1,628,348	190,573	1,818,921	33%
Washington ocean	890,365	838,705	1,729,069	31%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	193,748	83,870	277,618	5%
- Astoria				
- Other				
California	41,314	8,387	49,701	1%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	629,028	629,028	11%
Tributary	0	0	0	0%
Gillnet	696,386	0	696,386	13%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	139,686	0	139,686	3%
Hatchery carcass	35,409	0	35,409	1%
Total with hatchery surplus utilization			5,496,479	100%
Total without hatchery surplus utilization			5,321,385	

Middle Columbia				
Alaska	962,139	1,266	963,406	9%
British Columbia	4,057,612	253,270	4,310,882	39%
Washington ocean	584,266	293,529	877,795	8%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	55	73	129	0%
Oregon	169,519	73,382	242,901	2%
- Astoria				
- Other				
California	72	73	146	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	220,147	220,147	2%
Tributary	0	0	0	0%
Gillnet	1,329,384	0	1,329,384	12%
Tribal	2,919,343	0	2,919,343	26%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	188,101	0	188,101	2%
Hatchery carcass	40,047	0	40,047	0%
Total with hatchery surplus utilization			11,092,280	100%
Total without hatchery surplus utilization			10,864,132	

Total				
Alaska	4,440,610	5,686	4,446,296	8%
British Columbia	19,846,790	1,327,741	21,174,531	38%
Washington ocean				
- Westport	1,405,474	1,531,208	2,936,683	5%
- Other	2,073,075	625,423	2,698,498	5%
- Tribal	35,137	0	35,137	0%
Washington Puget Sound	249	329	578	0%
Oregon				
- Astoria	19,098	4,134	23,231	0%
- Other	935,781	409,219	1,345,000	2%
California	41,639	8,717	50,356	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	808,737	808,737	1%
- Other	0	808,737	808,737	1%
Tributary	0	0	0	0%
Gillnet	6,665,244	0	6,665,244	12%
Tribal	13,107,682	0	13,107,682	24%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	984,248	0	984,248	2%
Hatchery carcass	215,216	0	215,216	0%
Total with hatchery surplus utilization			55,300,173	100%
Total without hatchery surplus utilization			54,100,709	

Regional Economic Impacts by Geographic Areas

Species: Fall Chinook
Case IV: Early 90's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	19,443	26	19,469	11%
British Columbia	81,996	5,118	87,114	49%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	1	1	2	0%
Oregon				
- Astoria				
- Other				
California	1	1	2	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	3,318	3,318	2%
Tributary	0	0	0	0%
Gillnet	20,038	0	20,038	11%
Tribal	44,004	0	44,004	25%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	2,835	0	2,835	2%
Hatchery carcass	2,199	0	2,199	1%
Total with hatchery surplus utilization			178,982	100%
Total without hatchery surplus utilization			173,948	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	387,296	0	387,296	3%
British Columbia	5,226,672	611,702	5,838,374	42%
Washington ocean	1,831,340	1,725,083	3,556,423	26%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	0	0	0	0%
Oregon	398,509	172,508	571,017	4%
- Astoria				
- Other				
California	84,977	17,251	102,228	1%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,293,812	1,293,812	9%
Tributary	0	0	0	0%
Gillnet	1,432,357	0	1,432,357	10%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	287,312	0	287,312	2%
Hatchery carcass	275,352	0	275,352	2%
Total with hatchery surplus utilization			13,744,171	100%
Total without hatchery surplus utilization			13,181,508	

Upper Columbia				
Alaska	391,204	515	391,719	11%
British Columbia	1,649,818	102,979	1,752,798	49%
Washington ocean				
- Westport				
- Other				
- Tribal				
Washington Puget Sound	17	22	39	0%
Oregon				
- Astoria				
- Other				
California	22	22	44	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	66,767	66,767	2%
Tributary	0	0	0	0%
Gillnet	403,182	0	403,182	11%
Tribal	885,392	0	885,392	25%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	57,048	0	57,048	2%
Hatchery carcass	44,245	0	44,245	1%
Total with hatchery surplus utilization			3,601,233	100%
Total without hatchery surplus utilization			3,499,940	

Willamette				
Alaska	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA
- Westport				
- Other				
- Tribal				
Washington Puget Sound	NA	NA	NA	NA
Oregon	NA	NA	NA	NA
- Astoria				
- Other				
California	NA	NA	NA	NA
Columbia Basin inland				
Freshwater sport				
Mainstem	NA	NA	NA	NA
Tributary	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA
Tribal	NA	NA	NA	NA
Other	NA	NA	NA	NA
Hatchery				
Hatchery surplus market	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA
Total with hatchery surplus utilization			NA	NA
Total without hatchery surplus utilization			NA	

Middle Columbia				
Alaska	761,548	1,002	762,550	10%
British Columbia	3,211,663	200,467	3,412,130	44%
Washington ocean	344,949	173,298	518,247	7%
- Westport				
- Other				
- Tribal				
Washington Puget Sound	33	43	76	0%
Oregon	100,084	43,325	143,408	2%
- Astoria				
- Other				
California	43	43	86	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	129,974	129,974	2%
Tributary	0	0	0	0%
Gillnet	784,864	0	784,864	10%
Tribal	1,723,571	0	1,723,571	22%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	111,054	0	111,054	1%
Hatchery carcass	86,130	0	86,130	1%
Total with hatchery surplus utilization			7,672,092	100%
Total without hatchery surplus utilization			7,474,908	

Total				
Alaska	1,559,491	1,543	1,561,034	6%
British Columbia	10,170,149	920,266	11,090,416	43%
Washington ocean				
- Westport	944,918	1,414,199	2,359,116	9%
- Other	1,393,754	577,630	1,971,384	8%
- Tribal	23,623	0	23,623	0%
Washington Puget Sound	50	67	117	0%
Oregon				
- Astoria	11,051	2,392	13,443	0%
- Other	541,509	236,803	778,312	3%
California	85,043	17,318	102,361	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	746,936	746,936	3%
- Other	0	746,936	746,936	3%
Tributary	0	0	0	0%
Gillnet	2,640,441	0	2,640,441	10%
Tribal	2,652,967	0	2,652,967	10%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	458,249	0	458,249	2%
Hatchery carcass	407,926	0	407,926	2%
Total with hatchery surplus utilization			25,553,261	100%
Total without hatchery surplus utilization			24,687,086	

Regional Economic Impacts by Geographic Areas

Species: Summer/Winter Steelhead
Case I: NMFS Cap (1970's-1990's Actual)

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	0	2,322	2,322	0%
British Columbia	31,581	0	31,581	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	2,322	2,322	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	949,723	949,723	20%
Tributary	0	2,849,170	2,849,170	60%
Gillnet	0	0	0	0%
Tribal	391,657	0	391,657	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	411,889	0	411,889	9%
Hatchery carcass	106,570	0	106,570	2%
Total with hatchery surplus utilization			4,745,235	100%
Total without hatchery surplus utilization			4,226,776	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	0	388	388	0%
British Columbia	5,281	0	5,281	0%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	388	388	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,164,894	1,164,894	95%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	40,316	0	40,316	3%
Hatchery carcass	19,895	0	19,895	2%
Total with hatchery surplus utilization			1,231,162	100%
Total without hatchery surplus utilization			1,170,951	

Upper Columbia					Willamette				
Alaska	0	245	245	0%	Alaska	0	151	151	0%
British Columbia	3,338	0	3,338	1%	British Columbia	2,050	0	2,050	0%
Washington ocean	0	0	0	0%	Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%	Washington Puget Sound	0	0	0	0%
Oregon	0	245	245	0%	Oregon	0	151	151	0%
California	0	0	0	0%	California	0	0	0	0%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	100,387	100,387	20%	Mainstem	0	452,250	452,250	95%
Tributary	0	301,162	301,162	60%	Tributary	0	0	0	0%
Gillnet	0	0	0	0%	Gillnet	0	0	0	0%
Tribal	41,399	0	41,399	8%	Tribal	0	0	0	0%
Other	0	0	0	0%	Other	0	0	0	0%
Hatchery					Hatchery				
Hatchery surplus market	43,537	0	43,537	9%	Hatchery surplus market	15,652	0	15,652	3%
Hatchery carcass	11,265	0	11,265	2%	Hatchery carcass	7,724	0	7,724	2%
Total with hatchery surplus utilization			501,579	100%	Total with hatchery surplus utilization			477,978	100%
Total without hatchery surplus utilization			446,777		Total without hatchery surplus utilization			454,602	

Middle Columbia				
Alaska	0	97	97	0%
British Columbia	1,314	0	1,314	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	97	97	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	39,524	39,524	20%
Tributary	0	118,573	118,573	60%
Gillnet	0	0	0	0%
Tribal	16,299	0	16,299	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	17,141	0	17,141	9%
Hatchery carcass	4,435	0	4,435	2%
Total with hatchery surplus utilization			197,480	100%
Total without hatchery surplus utilization			175,904	

Total				
Alaska	0	3,203	3,203	0%
British Columbia	43,564	0	43,564	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	3,203	3,203	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	676,695	676,695	9%
- Other	0	2,030,084	2,030,084	28%
Tributary	0	3,268,905	3,268,905	46%
Gillnet	0	0	0	0%
Tribal	449,355	0	449,355	6%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	528,536	0	528,536	7%
Hatchery carcass	149,889	0	149,889	2%
Total with hatchery surplus utilization			7,153,435	100%
Total without hatchery surplus utilization			6,475,010	

Regional Economic Impacts by Geographic Areas

Species: Summer/Winter Steelhead
Case II: 80's Actual

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	0	5,159	5,159	0%
British Columbia	70,159	0	70,159	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	5,159	5,159	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,353,005	2,353,005	20%
Tributary	0	7,059,014	7,059,014	60%
Gillnet	0	0	0	0%
Tribal	970,357	0	970,357	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,020,484	0	1,020,484	9%
Hatchery carcass	192,227	0	192,227	2%
Total with hatchery surplus utilization			11,675,563	100%
Total without hatchery surplus utilization			10,462,852	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	0	863	863	0%
British Columbia	11,732	0	11,732	0%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	863	863	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	2,587,902	2,587,902	93%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	151,279	0	151,279	5%
Hatchery carcass	35,513	0	35,513	1%
Total with hatchery surplus utilization			2,788,152	100%
Total without hatchery surplus utilization			2,601,359	

Upper Columbia				
Alaska	0	545	545	0%
British Columbia	7,416	0	7,416	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	545	545	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	248,717	248,717	20%
Tributary	0	746,151	746,151	60%
Gillnet	0	0	0	0%
Tribal	102,569	0	102,569	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	107,867	0	107,867	9%
Hatchery carcass	20,319	0	20,319	2%
Total with hatchery surplus utilization			1,234,130	100%
Total without hatchery surplus utilization			1,105,944	

Willamette				
Alaska	0	335	335	0%
British Columbia	4,555	0	4,555	0%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	335	335	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,004,701	1,004,701	93%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	58,731	0	58,731	5%
Hatchery carcass	13,787	0	13,787	1%
Total with hatchery surplus utilization			1,082,444	100%
Total without hatchery surplus utilization			1,009,925	

Middle Columbia				
Alaska	0	215	215	0%
British Columbia	2,920	0	2,920	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	215	215	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	97,920	97,920	20%
Tributary	0	293,759	293,759	60%
Gillnet	0	0	0	0%
Tribal	40,381	0	40,381	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	42,467	0	42,467	9%
Hatchery carcass	8,000	0	8,000	2%
Total with hatchery surplus utilization			485,875	100%
Total without hatchery surplus utilization			435,408	

Total				
Alaska	0	7,116	7,116	0%
British Columbia	96,780	0	96,780	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	7,116	7,116	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	1,573,061	1,573,061	9%
- Other	0	4,719,184	4,719,184	27%
Tributary	0	8,098,924	8,098,924	47%
Gillnet	0	0	0	0%
Tribal	1,113,307	0	1,113,307	6%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,380,828	0	1,380,828	8%
Hatchery carcass	269,846	0	269,846	2%
Total with hatchery surplus utilization			17,266,163	100%
Total without hatchery surplus utilization			15,615,489	

Regional Economic Impacts by Geographic Areas

Species: Summer/Winter Steelhead
Case III: Representative Early 2000's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	0	4,546	4,546	0%
British Columbia	61,818	0	61,818	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	4,546	4,546	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,800,813	1,800,813	19%
Tributary	0	5,402,438	5,402,438	57%
Gillnet	0	0	0	0%
Tribal	1,113,958	0	1,113,958	12%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	937,202	0	937,202	10%
Hatchery carcass	153,318	0	153,318	2%
Total with hatchery surplus utilization			9,478,638	100%
Total without hatchery surplus utilization			8,388,118	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	0	468	468	0%
British Columbia	6,370	0	6,370	0%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	468	468	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	1,405,135	1,405,135	92%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	95,854	0	95,854	6%
Hatchery carcass	17,352	0	17,352	1%
Total with hatchery surplus utilization			1,525,648	100%
Total without hatchery surplus utilization			1,412,442	

Upper Columbia					Willamette				
Alaska	0	606	606	0%	Alaska	0	1,480	1,480	0%
British Columbia	8,239	0	8,239	1%	British Columbia	20,131	0	20,131	0%
Washington ocean	0	0	0	0%	Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%	Washington Puget Sound	0	0	0	0%
Oregon	0	606	606	0%	Oregon	0	1,480	1,480	0%
California	0	0	0	0%	California	0	0	0	0%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	240,020	240,020	19%	Mainstem	0	4,440,706	4,440,706	92%
Tributary	0	720,060	720,060	57%	Tributary	0	0	0	0%
Gillnet	0	0	0	0%	Gillnet	0	0	0	0%
Tribal	148,473	0	148,473	12%	Tribal	0	0	0	0%
Other	0	0	0	0%	Other	0	0	0	0%
Hatchery					Hatchery				
Hatchery surplus market	124,914	0	124,914	10%	Hatchery surplus market	302,932	0	302,932	6%
Hatchery carcass	20,435	0	20,435	2%	Hatchery carcass	54,838	0	54,838	1%
Total with hatchery surplus utilization			1,263,353	100%	Total with hatchery surplus utilization			4,821,567	100%
Total without hatchery surplus utilization			1,118,004		Total without hatchery surplus utilization			4,463,797	

Middle Columbia				
Alaska	0	708	708	0%
British Columbia	9,623	0	9,623	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	708	708	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	280,338	280,338	19%
Tributary	0	841,013	841,013	57%
Gillnet	0	0	0	0%
Tribal	173,413	0	173,413	12%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	145,897	0	145,897	10%
Hatchery carcass	23,868	0	23,868	2%
Total with hatchery surplus utilization			1,475,568	100%
Total without hatchery surplus utilization			1,305,803	

Total				
Alaska	0	7,808	7,808	0%
British Columbia	106,182	0	106,182	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	7,808	7,808	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	2,041,753	2,041,753	11%
- Other	0	6,125,258	6,125,258	33%
Tributary	0	6,963,511	6,963,511	38%
Gillnet	0	0	0	0%
Tribal	1,435,844	0	1,435,844	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	1,606,800	0	1,606,800	9%
Hatchery carcass	269,810	0	269,810	1%
Total with hatchery surplus utilization			18,564,773	100%
Total without hatchery surplus utilization			16,688,163	

Regional Economic Impacts by Geographic Areas

Species: Summer/Winter Steelhead
Case IV: Early 90's

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Snake River				
Alaska	0	1,460	1,460	0%
British Columbia	19,851	0	19,851	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	1,460	1,460	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	546,924	546,924	20%
Tributary	0	1,640,773	1,640,773	60%
Gillnet	0	0	0	0%
Tribal	225,547	0	225,547	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	237,198	0	237,198	9%
Hatchery carcass	76,151	0	76,151	3%
Total with hatchery surplus utilization			2,749,363	100%
Total without hatchery surplus utilization			2,436,014	

	Total state level avg. economic impact	Total recreational economic impact	Total economic impact	%
Lower Columbia				
Alaska	0	171	171	0%
British Columbia	2,324	0	2,324	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	171	171	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	398,653	398,653	96%
Tributary	0	0	0	0%
Gillnet	0	0	0	0%
Tribal	0	0	0	0%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	2,919	0	2,919	1%
Hatchery carcass	12,926	0	12,926	3%
Total with hatchery surplus utilization			417,163	100%
Total without hatchery surplus utilization			401,318	

Upper Columbia					Willamette				
Alaska	0	154	154	0%	Alaska	0	65	65	0%
British Columbia	2,098	0	2,098	1%	British Columbia	881	0	881	1%
Washington ocean	0	0	0	0%	Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%	Washington Puget Sound	0	0	0	0%
Oregon	0	154	154	0%	Oregon	0	65	65	0%
California	0	0	0	0%	California	0	0	0	0%
Columbia Basin inland					Columbia Basin inland				
Freshwater sport					Freshwater sport				
Mainstem	0	57,811	57,811	20%	Mainstem	0	151,170	151,170	96%
Tributary	0	173,433	173,433	60%	Tributary	0	0	0	0%
Gillnet	0	0	0	0%	Gillnet	0	0	0	0%
Tribal	23,841	0	23,841	8%	Tribal	0	0	0	0%
Other	0	0	0	0%	Other	0	0	0	0%
Hatchery					Hatchery				
Hatchery surplus market	25,072	0	25,072	9%	Hatchery surplus market	1,107	0	1,107	1%
Hatchery carcass	8,049	0	8,049	3%	Hatchery carcass	4,901	0	4,901	3%
Total with hatchery surplus utilization			290,612	100%	Total with hatchery surplus utilization			158,189	100%
Total without hatchery surplus utilization			257,491		Total without hatchery surplus utilization			152,181	

Middle Columbia				
Alaska	0	61	61	0%
British Columbia	826	0	826	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	61	61	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem	0	22,761	22,761	20%
Tributary	0	68,283	68,283	60%
Gillnet	0	0	0	0%
Tribal	9,386	0	9,386	8%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	9,871	0	9,871	9%
Hatchery carcass	3,169	0	3,169	3%
Total with hatchery surplus utilization			114,419	100%
Total without hatchery surplus utilization			101,378	

Total				
Alaska	0	1,910	1,910	0%
British Columbia	25,980	0	25,980	1%
Washington ocean	0	0	0	0%
Washington Puget Sound	0	0	0	0%
Oregon	0	1,910	1,910	0%
California	0	0	0	0%
Columbia Basin inland				
Freshwater sport				
Mainstem				
- Astoria	0	294,330	294,330	8%
- Other	0	882,989	882,989	24%
Tributary	0	1,882,489	1,882,489	50%
Gillnet	0	0	0	0%
Tribal	258,774	0	258,774	7%
Other	0	0	0	0%
Hatchery				
Hatchery surplus market	276,168	0	276,168	7%
Hatchery carcass	105,197	0	105,197	3%
Total with hatchery surplus utilization			3,729,747	100%
Total without hatchery surplus utilization			3,348,382	

APPENDIX B

List of Sources Used to Provide Estimates of Representative Survival Rates for Columbia River Basin Salmonids

APPENDIX B
List of Sources Used to Provide Estimates of Representative
Survival Rates for Columbia River Basin Salmonids[1]

A. Documents

0. Mahnken, C., G. Ruggerone, W. Waknitz, and T. Flagg. "A Historical Perspective on Salmonid Production From Pacific Rim Hatcheries. N. Pac. Anadr. Fish Comm. Bull. No. 1:38-53. 1998.

Outdated, but very good historical overview of survival rates.

1. Radtke, Hans D., Shannon W. Davis, and Rebecca L. Johnson. Lower Snake River Juvenile Salmon Migration Feasibility Study: Anadromous Fish Economic Analysis. Prepared for Foster Wheeler Environmental Corporation and U.S. Army Corps of Engineers. October 1999.

This document includes a historical representation up to 1994 of survival rates of Basin salmonid releases. These are generally known as the IHOT reports.

2. Artificial Production Review and Evaluation (APRE). Northwest Power and Conservation Council. Portland, Oregon. 2004.

Information of survival rates is available for some hatchery programs within the Basin. Some of the information is dated.

3. Fish Passage Center and Comparative Survival Study Oversight Committee. Comparative Survival Study (CSS) of PIT Tagged Spring/Summer Chinook. 2002 Annual Report, Migration Years 1997-2000, Mark/Recapture Activities and Bootstrap Analysis. Columbia Basin Fish and Wildlife Agencies and Columbia Basin Tribes. Final. November 26, 2003.

Provides up to date information on SAR's on Snake River Chinook stocks.

4. Williams, J.G., S.G. Smith, W.D. Muir, B.P. Sandford, S. Achord, R. McNatt, D.M. Marsh, R.W. Zabel, M.D. Scheuerell. Effects of the Federal Columbia River Power System on Salmon Populations. Fish Ecology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, NOAA. Final draft for Collaboration Group. May 6, 2004.

Provides some information on current estimates of Snake River stocks.

5. Pastor, Stephen M. Annual Report 2002. Project No. 1989-06500, Annual Stock Assessment - CWT (USFWS). U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Provides information on some USFWS hatchery programs.

1. Survival rates represent smolt to adult (SAR's), including harvest throughout their range.

6. North, J., C. Rodriguez, M. Miller, J. Sewall, P. Frazier, S. Gray, T. Jones, A. Dietrichs, T. Miethe. Select Area Fishery Evaluation Project. Final Project Completion Report. October 1993-July 2004. U.S. Department of Energy, Bonneville Power Administration. October 2004.

   Provides some up to date survival estimates of lower Columbia hatchery releases.

7. Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife. Status Report. Columbia River Fish Runs and Fisheries, 1938-2000. July 2002.

   Provides run estimates but not much information on survival rates.

B. People Contacted

1. Michele DeHart, Fish Passage Center, Portland, Oregon
2. Larry Basham, Fish Passage Center, Portland, Oregon
3. Henry Franzoni, Fish Passage Center, Portland, Oregon
4. Curt Melcher, Oregon Department of Fish and Wildlife
5. Cindy LeFleur, Washington Department of Fish and Wildlife
6. Larry LaVoy, Washington Department of Fish and Wildlife
7. Howard Schaller, U.S. Fish and Wildlife Service
8. Henry Yuen, U.S. Fish and Wildlife Service
9. Charlie Petrosky, Idaho Department of Fish and Game
10. Tod Jones, Clatsop Economic Development Council Fisheries Project
11. Bruce Suzumoto, Northwest Power and Conservation Council.
12. Mike Matelywich, Columbia River Inter-Tribal Fish Commission

C. Discussion of Salmonid Survival Rates, Smolt-to-Adult Survival Rates

Any modeling of fish produced in the Basin and harvested throughout their range relies on estimates of smolt-to-adult survival rates (SAR's). Past experience has shown that statistical averaging or regression analysis is not very useful for predicting SAR's. This is why a broad range of historical periods are used to describe what may be a representative range of SAR's.

A good historical background on survival rates in the Pacific Rim is provided by Mahnken et al. (1998). For the Basin, a review of survival rates and alternative representative rates was developed in Radtke et al. (October 1999). Most recent information on survival rates (some up to date, others outdated) are presented in several papers. (See Section A.) This information was then presented to agency scientists and managers. (See Section B.) The resulting survival rates by major species/geographic areas represent the best estimates of survival rates that can be expected over the next several years. These do not represent the estimates of any one of the agency personnel mentioned, but rather a consensus that these estimates are a best estimate of the characterization of salmonid runs of the Columbia River for the most recent years, and what could reasonably be expected for the next two to five years.

APPENDIX C

Other Fish Resources Not Included in the Analysis

Table C.1
Matrix of Resident Fish Species Known or Assumed to Occur in the Reservoirs and Rivers

	Mica/Revelstoke/Arrow	Lake Koocanusa	Kootenai River	Kootenay Lake	Hungry Horse Res.	Upper Flathead River	Flathead Lake	Lower Flathead River	Clark Fork River	Lake Pend Oreille	Pend Oreille River	Lake Roosevelt	Lake Rufus Woods	Mid-Columbia R-O-R	Hanford Reach	Hells Canyon Complex	Hells Canyon Reach	Dworshak Reservoir	Lower Clearwater R	Lower Snake R-O-R	Lower Columbia R-O-R	Below Bonneville
Brown bullhead			X							X	X	X		X				X	X	X	X	
Channel catfish															X	X	X		X	X	X	
Tadpole madtom																X	X			X	X	
Flathead catfish																X				X		
Mosquitofish																				X	X	
Burbot	X	X	X	X					X			X	X		X							
3-spine stickleback														X	X						X	X
Sandroller			X											X	X				X	X	X	X
Pumpkinseed			X						X	X	X	X		X	X	X	X	X	X	X	X	
Warmouth																X				X		
Bluegill														X	X	X			X	X	X	
Smallmouth bass									X			X		X	X	X	X	X	X	X	X	
Largemouth bass								X	X	X	X	X			X	X		X	X	X	X	
White crappie												X			X	X				X	X	
Black crappie										X	X	X	X	X	X	X	X	X	X	X	X	
Yellow perch		X	X				X		X	X	X	X	X		X	X				X	X	
Walleye	X										X	X	X	X	X					X	X	
Sculpin spp.											X	X		X		X		X				
Coastrange sculpin																						X
Prickly sculpin	X												X		X					X	X	
Mottled sculpin															X					X		
Paiute sculpin												X			X				X	X		
Slimy sculpin	X		X				X		X	X												
Shorthead sculpin						X	X	X														X
Reticulate sculpin															X							
Torrent sculpin	X		X							X	X		X		X			X	X			
W. brook lamprey																		X			X	
White sturgeon	X	X	X	X							X	X	X	X	X	X	X		X	X	X	X
Lake whitefish	X						X		X	X	X	X	X		X							
Cutthroat trout	X	X	X		X	X	X	X	X	X	X	X	X		X			X	X			X
Rainbow trout	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Kokanee	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Pygmy whitefish	X				X		X			X		X										
Mountain whitefish	X	X		X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Brown trout								X	X		X	X	X							X		
Bull trout	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Brook trout	X						X	X		X	X	X	X					X				
Lake trout							X			X												
Northern pike								X	X									X				
Chiselmouth												X	X	X	X	X	X	X	X	X	X	
Goldfish											X										X	
Lake chub	X		X								X											
Common carp	X										X	X	X	X	X	X	X		X	X	X	X
Tui chub																						X
Peamouth	X	X	X				X	X	X	X	X	X	X	X	X	X				X	X	
Northern squawfish	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Longnose dace	X		X						X	X					X	X	X	X	X	X		
Leopard dace	X														X	X						
Speckled dace													X		X			X	X	X	X	
Redside shiner	X	X	X				X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Tench										X	X	X			X							
Longnose sucker	X	X	X		X		X		X	X	X	X	X			X						
Bridgelip sucker	X											X	X	X	X	X	X	X	X	X	X	
Largescale sucker	X	X	X		X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Mountain sucker															X							
Black bullhead									X		X			X	X	X						
Yellow bullhead															X					X		

Source: Corps (1995).

Table C.2
Columbia River Basin Recreational Fisheries in 2001
(Thousands)

Parameter	Idaho		Montana		Oregon		Washington		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Total freshwater anglers	416	100%	349	100%	611	100%	659	100%	2,035	100%
Resident	251	60%	212	61%	461	75%	611	93%	1,535	75%
Nonresident	165	40%	138	39%	150	25%	48	7%	501	25%
Basin freshwater anglers	416	100%	139	100%	227	100%	384	100%	1,166	100%
Resident	266	64%	70	51%	180	79%	319	83%	836	72%
Nonresident	150	36%	69	50%	45	20%	65	17%	330	28%
Total freshwater days fishing	4,070	100%	4,068	100%	7,895	100%	9,800	100%	25,833	100%
Resident	2,942	72%	3,515	86%	7,346	93%	9,465	97%	23,268	90%
Nonresident	1,128	28%	554	14%	549	7%	335	3%	2,566	10%
Basin freshwater days fishing	4,070	100%	1,237	100%	1,847	100%	5,272	100%	12,427	100%
Resident	3,217	79%	989	80%	1,376	74%	4,714	89%	10,296	83%
Nonresident	855	21%	247	20%	462	25%	580	11%	2,144	17%
Total fishing expenditures										
by state residents	$230,006		$202,751		$590,738		$966,874		$1,990,369	
Basin share of expenditures	100%		40%		31%		40%		46%	
Basin fishing expenditures										
in 2001 dollars	$230,006		$80,491		$185,491		$387,698		$883,687	
Basin fishing economic contributions										
in 2003 dollars	$133,708	100%	$40,627	100%	$60,692	100%	$173,209	100%	$408,236	100%
Resident	$105,670	79%	$32,502	80%	$45,215	74%	$154,849	89%	$338,236	83%
Nonresident	$28,079	21%	$8,125	20%	$15,173	25%	$19,053	11%	$70,430	17%

Notes:
1. The 1985 USDI FWS five-year survey for states had breakdowns of fishing activity by wildlife management regions. The table assumes the same pattern and distribution of angler activities as to what was in the 1985 survey (USDI FWS 1989) as found in Fluharty (2000).
2. Economic contribution from 2001 angler participation is calculated using regional economic impact per recreational angler day from TRG (1991). The economic contribution is adjusted to 2003 dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.
3. Recreational fisheries include angler trips when the target species are either anadromous fish or resident fish.

Source: Fluharty (2000), USDI (March 2003), and Study.