Economic Evaluation of the Northern Pikeminnow Management Program

prepared by

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prepared for

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PREFACE

This report describes economic analysis results for the Northern Pikeminnow Management Program (NPMP). The northern pikeminnow is an indigenous species to the Columbia and Snake rivers that preys on outmigrating salmon and steelhead. The NPMP goal is to reduce the fish population's larger size class that does the predation. This has been accomplished with a variety of selective fishery methods of which a sport fishing catch's payment component has accounted for the highest proportion of the culling. The study purpose was to respond to the Northwest Power and Conservation Council's (NPCC's) Independent Scientific Review Panel's (ISRP's) comments about the lack of economic considerations in the program's evaluation and monitoring.

The study was sponsored by the Pacific States Marine Fisheries Commission (PSMFC). Russell Porter, Program Director of the Pacific Fishery Management Council (PFMC) provided leadership and oversight for the study. The report's authors were Hans Radtke, Chris Carter, and Shannon Davis. Dr. Radtke is a freelance economist living in Yachats, Oregon. He is a past chairman of the PFMC and currently is a member of the PFMC Scientific and Statistical Committee (SSC). Dr. Carter is a recently retired economist from the Oregon Department of Fish and Wildlife (ODFW). Mr. Davis is a systems research specialist with 25 years of experience. His professional interests are in single/multiuse natural resource planning and management with a specialty in econometric modeling. Mr. Davis served two terms on the SSC. He has completed many projects involving natural resource user surveys.

The following individuals provided valuable insight and perspective about the NPMP. They of course bear no responsibility for any misrepresentations in the authors' interpretations of the communication.

- David G. Hankin, Chair, Department of Fisheries Biology, Humboldt State University
- Susan S. Hanna, Professor, Department of Agricultural and Resource Economics, Oregon State University
- Terry H. Morlan, Manager, Economic Analysis, NPCC
- Jack Richards, Assistant Professor of Economics, Portland State University
- John Skidmore, Pikeminnow Program Manager, Bonneville Power Administration
- Dave Ward, Columbia River Investigations Program Leader, ODFW
- Eric Winther, Biological Project Leader, Washington Department of Fish and Wildlife (WDFW)

PSMFC staff and cooperating agencies' representatives reviewed this report in draft form. The purpose of the review was to provide candid and critical comments that were to assist in making study results as sound as possible and to ensure that the report meets standards for objectivity, evidence, and responsiveness to the study charges. Although the reviewers have provided many useful comments and suggestions, they were not asked to endorse study findings and recommendations. The authors are solely responsible for making certain independent examination of this report was carried out in accordance with accustomed procedures and that review comments were carefully considered.

The authors' interpretations and conclusions should prove valuable for the project's purposes, but no absolute assurances can be given that the described results will be realized. Government legislation and policies, marketing circumstances, and other situations can affect the basis of assumptions in unpredictable ways and lead to unanticipated changes. The methodologies used to determine estimates were adopted with the understanding that technically sound and defensible approaches would be used. Where judgment was necessary, conservative interpretation was employed. Because this philosophy was strictly adhered to in all aspects of the report, the authors represent that the descriptions presented herein are reasonable.

The information should not be used for investment or operational decision making. The authors do not assume any liability for the information and shall not be responsible for any direct, indirect, special, incidental, or consequential damages in connection with the use of the information.

Authorization is granted for the study report's contents to be quoted either orally or in written form without prior consent of the authors. Customary reference to authorship, however, is requested.

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EXECUTIVE SUMMARY

The Northern Pikeminnow Management Program (NPMP) has been underway for the last 13 years. The purpose of the NPMP is to reduce predation by northern pikeminnow of downstream migrating juvenile salmonids. The NPMP is presently centered around a recreational reward fishery where anglers are compensated for catching and removing larger size class pikeminnow that do the predation. The annual budget has varied from $2.0 to $6.4 million, with an average of about $3.0 million. The NPMP has met one of its goals in every year but two in the last 13 years to attain a 10 percent exploitation rate on the larger size class pikeminnow.

Two previous groups reviewed the NPMP for economic considerations. The earlier studies concluded that the sport-reward fishery was the most cost-effective fishery of all northern pikeminnow predation reduction techniques tried. Other techniques have included such methods as purse seining, longlining, site-specific gillnetting, and dam angling. All of these techniques have been discontinued after the 2002 season.

The sport-reward program is popular with its participants, because it provides recreational opportunity, some financial payments, and a positive psychological reward for being involved in a salmon enhancement program. The earlier studies suggested that further investigation of the reward system should be undertaken. More information is needed to define the market and the response of potential anglers to incentives to take part in the NPMP.

The earlier studies and other biological reviews discussed the limits of increasing the predator removal programs. The limit to the larger size class exploitation rate is probably at or close to the current program. (It is estimated that predation on juvenile salmonids was reduced by approximately 25 percent from the NPMP through Year 1996.) Any larger removal program would most likely be more expensive per predator removed and be no more cost effective on a linear scale. There are other factors, like fishing conditions (river flows and weather), that greatly affect harvest rates and confound using previous years' angler response to payment changes to predict the cost-effectiveness for expanding the program by increasing payment amounts.

The earlier economic studies pointed to the difficulties in obtaining data and using relationships to accomplish an economic analysis. While the economic evaluation of the program itself is relatively straightforward, defining the relationship between northern pikeminnow predation, juvenile salmonid downstream survival, and increased harvestable adults is problematic. The present study makes some progress in showing these relationships using existing information and models.

The present study shows the basic economic information that may be used to evaluate the NPMP in terms of net economic value (NEV), regional economic impacts (REI), and cost-effectiveness analysis (CEA) as compared to other external programs having similar objectives. Table ES.1 summarizes the results.

- The program's NEV creates an estimated $1.8 million in wealth to the nation because of the northern pikeminnow fishery and another $1.8 to $6.8 million from anadromous fish

Table ES.1
Northern Pikeminnow Management Program Economic Evaluation in 2002

	Net Economic Value	Regional Economic Impacts	Cost-Effectiveness
NPMP budget			$2.8
Northern pikeminnow fishery	$1.8	$1.4	
NPMP administration		$2.1	
Subtotal NPMP		$3.5	
Anadromous fish fishing	$1.8 to $6.8	$2.7 to $9.9	
NPMP at existing program level	$3.6 to $8.6	$6.2 to $13.4	$2.9 for one percent increase in survival

Notes: 1. Table values are in millions.
Source: Study.

fishing. This does not include any measurement of passive use value for the increased salmonid adult returns or negative passive value associated with the exploitation of the northern pikeminnow.

- A program budget of $2.8 million will generate about $2.1 million in REI's and about $1.4 million in the regional economies where northern pikeminnow fishing takes place. Fishing for salmon and steelhead resulting from increased adults surviving to harvest will generate another from $2.7 million to $9.9 million in economies from Alaska to California on the West Coast and inland in the Columbia River Basin. In total, the act of fishing for northern pikeminnow and anadromous fish may create up to $13.4 million in REI. In terms of full time equivalent jobs at $30,000 each, this is equal to the employment of about 446 people. Since many of these jobs will be seasonal, the actual number of positions may be much higher than the stated full time equivalent job estimates.

- In terms of cost-effectiveness, NPMP budget and accomplishments during the 1991 to 1996 period costs an estimated $2.9 million per year per one percent increase in survival for juvenile salmonids. This compares favorably with other selected passage actions, such as improved screening at specific inriver sites.

This present economic analysis study used an approach to identify the factors that are critical to public investment decision making. Tailored to the NPMP, it was found that two major elements should be considered in investing in the NPMP. These are:

Biological Limits

Research in predation of juvenile salmonids by northern pikeminnow has shown that relative benefits of a given exploitation rate decrease with time as the number of large northern pikeminnow is reduced. This latest research concludes that reduction in predation on juvenile salmon will most likely not be able to be reduced below the present

25 percent level. This research is more conservative than the pre-program estimate of a 50 percent reduction potential. Of greater influence is the decreased water velocity causing the northern pikeminnow to concentrate in near-dam areas. The predators would otherwise tend away from high flow locations, which would reduce salmonid encounter rates.

Three biological issues have been addressed in previous research that appear to have lowered investment risk. They are: (1) whether predation only occurs on the dead, sick, and young that would not contribute to fisheries anyway, (2) whether there is northern pikeminnow or other species compensation, and (3) whether there is bycatch causing increased impacts to ESA-listed stocks. A single study showed that 85 percent of the estimated predation is on live smolts, thereby partly resolving the concern that predation is only on scavenged juveniles. Other studies showed that northern pikeminnow do not have density-dependent growth and other species (like small mouth bass and walleye) do not necessarily replace the predation, but these compensation studies assume that other fish (like Chinook salmon) feeding on smolts in estuaries and bird (like Caspian tern, double-crested cormorants, and western gulls) predation has a constant rate. Fishing techniques for northern pikeminnow are selective, but do generate incidentally caught salmonids and other game fish (white sturgeon, shad, etc.). Management agencies have incorporated these impacts into their harvest models.

Social and Management Limits

It was found that the NPMP has been very well publicly accepted as providing a recreational experience while allowing people to take part in salmon enhancement programs. This generates goodwill and well-being that participation is assisting a good cause. Other social limit concerns are for aggravating conflicts with other sport fisheries and increasing demands on enforcement programs. Exit interviews have not shown these concerns to be of enough significance to require alleviating actions.

While there may be some opportunities to increase angler participation and therefore up the exploitation rate, more market information is needed to identify the factors that will affect angler demand. It could be that only training and promotion is needed. It could also be that the tiered reward system needs changing. However, controlled market response information is lacking at the present. Past information relating effort to changes in the reward amount has also been accompanied by changed fishing conditions. This clouds inferences that can be made about angler participation and program accomplishments.

The conclusion of the present study research is that:

1. An effective northern pikeminnow removal program is needed to mitigate for the increased predation brought about from the dams' generated slack water, i.e. the development of the existing hydrosystem has made this program necessary. The NPMP addresses this need without a parallel concern for eradicating the species by only targeting the larger offending size class.

2. The existing NPMP is as cost-effective as other example physical and operational hydrosystem alteration programs being considered for increasing downstream migration survival. Based on available data, the present NPMP compares favorably with other selected passage actions, such as improved screening at specific inriver sites.

3. Except for the highliner anglers, participants will spend far more money than they realize in rewards. This greatly multiplies the economic impacts per NPMP reward dollar. From a local economic development perspective, it is much better to have participation by low catch anglers than it is to have highliner type anglers. From a program cost-effectiveness perspective, it is better to encourage highliner participation.

4. There are biological and management limits to how much the NPMP can accomplish. This latest research concludes that reduction in predation on juvenile salmon will most likely not be able to be reduced below the present 25 percent level.

5. Due to the uncertainty in predation modeling and lack of information about angler's propensities to participate in the northern pikeminnow fishery, it is not clear that an increased budget for prompting more northern pikeminnow effort will calculate linearly to the CEA measure. Much more information is necessary to accurately model the angler response to payment levels and the relationship between increased effort, higher exploitation rates, and reduced predation levels.

6. To be useful in comparing the economic analysis to other programs with similar goals and for use in ESA-listing program analysis, it is important that smolt origin differential mortality is known. It could be that wild production suffers more or less predation than hatchery origin smolts. It could be that some species released in some hatcheries could have different predation rates. Additional PIT tag system research would be needed for such studies.

7. The following are suggested ways to improve the sport fishing reward program operations that were garnered from an informal survey of 2002 participants.

   a. Increase number of "lottery" type tags and raise the prize amount.
   b. Make the "check in - check out" system easier to use by allowing multi-day validation periods.
   c. Encourage new entrants and improve skills of past participants through training programs. Perhaps a master angler program patterned after the master gardener or master hunter would work. These could also be the voluntary "eyes and ears" of the program. There seems to be a high level of awareness of the NPMP and generic advertising can probably be minimized. While Hankin and Richards (2000) advised against promotion costs, awareness and education should be viewed as necessary to expand the program.
   d. Reduce the emphasis on discovering "cheaters." They are a small in number and, after all, they do reduce the northern pikeminnow population, even if it's from non-targeted stocks. There should be enforcement mechanisms, but if other

fisheries serve as an example, the best information about fraud comes from other anglers.

8. It appears the NPMP suffers from a very large turnover even among the core group of highly successful fishers. Initial angler demand can probably be related to the financial rewards, but there is rapid attrition after discovering the work needed to catch even modest amounts of the larger size class. The trends show the highliner category is catching an increasing share. It is important to keep recruiting new anglers into this role.

9. There is insufficient market information to predict the effort response from changing the tiered reward system and payment levels. Periodic participant economic preference surveys and non-participant market surveys should be reinstituted.

10. It is recommended that decision makers consider more than the short-term financial values captured in the present study analysis. There are stakeholders and non-participants that hold social interests and non-economic values in the program.

I. INTRODUCTION

A. Program Definition

The Northern Pikeminnow Management Program (NPMP) has been underway for the last 13 years. The goal of the NPMP is to reduce predation on juvenile salmonids through sustained harvest of northern pikeminnow. The reduction of these predators increases the survival of juvenile salmonid while migrating downstream through the Columbia River system. This in turn increases adult salmonid abundances available for harvest and spawning. The NPMP harvest methods have evolved over the years; earlier programs involved commercial gear such as gillnets.[1] The present program is now centered around a recreational reward fishery. Participating anglers are compensated for their catches by offering a payment for larger fish.

The NPMP operates in the central Columbia River Basin (Map I.1). The anglers use single pole, hook and line techniques. Current angler regulations are as follows:

> The angler must posses a valid fishing license from Washington or Oregon. The fishing areas are the "mainstem" Columbia River from the mouth up to the restricted zone below Priest Rapids Dam, and in the Snake River from the mouth up to the restricted zone below Hell's Canyon Dam. The mainstem includes backwaters, sloughs, and up tributaries 400 feet from the "tributary mouths." Tributary mouth is as defined by state fishing regulations. The season for the fishery starts from about the first of May and runs through September. For every northern pikeminnow nine inches or longer returned to a registration station, anglers receive $4 to $6. The more fish an angler catches, the more they're worth. There are three reward tiers: the first 100 in one season are worth $4 each; after 100, they're worth $5 each; and after 400 they're worth $6 each. Special tagged northern pikeminnow are worth $100. Fish less than nine inches total length are not eligible for reward payment. Anglers check into certain stations and fish must be returned to the same registration station where the angler registered. It must be on the same calendar day stamped on the registration form before that station closes for that day and the fish must have been caught subsequent to that day's registration.

The total annual budget for administration and funding of the NPMP and for evaluation of NPMP impacts has been approximately $3.0 million over the past five years of its operation. In 2002, the total reward dollars paid was $1,053,831. About one half of this money was paid to 125 (out of 2,465) top anglers. The balance of the budget is used for administration, operation, research, and monitoring.

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1. Other technologies for removal of northern pikeminnow were tested from 1990 to 1993, including lure trolling, purse seining, electrofishing, trap-netting, and commercial longlining; however, none proved effective. In 1994, a site-specific gillnet fishery to remove northern pikeminnow near hatchery release points and tributary mouths was implemented. Implementation of the test fisheries was discontinued after 1994, leaving sport-reward, dam-angling, and site-specific gillnet fisheries as the removal methods. The dam-angling and site-specific gillnet fisheries were discontinued after 2002.

Map I.1
Angler Registration Station Locations in 2004

1a.	Cathlamet Marina	6a.	Bonneville Trail Head
1b.	Willow Grove Park	8.	The Dalles Boat Basin
2a.	Rainier Marina	9.	Giles French
2c.	Kalama Marina	10.	Columbia Point Park
3.	M. James Gleason Boat Ramp	11.	Vernita Bridge Rest Area
3a.	Chinook Landing	12.	Greenbelt
4.	Washougal Boat Ramp / Port of Camas	12a.	Lyon's Ferry
5.	The Fishery (at Covert's Landing)	12b.	Boyer Park

Source: NPMP (2004).

The Bonneville Power Administration (BPA) pays the Pacific States Marine Fisheries Commission (PSMFC) to administer the program in association with the Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). The WDFW provides on-ground management and record-keeping. The ODFW has responsibility for evaluation of program accomplishments.[1] The Columbia River Inter-Tribal Fish Commission (CRITFC) and four Indian tribes had responsibility for administering the dam-angling and site-specific fisheries. Since these fisheries were discontinued after 2002, CRITFC and the tribes are not now associated with the program.

The NPMP funding levels and methods were questioned by the Northwest Power and Conservation Council (NPCC) Independent Scientific Review Panel (ISRP) in a review dated August 2, 2002. The ISRP comments were from a rolling review schedule for the Columbia River Basin Fish and Wildlife Program (CRBFWP) Mainstem and Systemwide projects. The

1. ODFW evaluation of the program consists of (1) monitoring the exploitation rate and size of northern pikeminnow harvested annually for each harvest method, and (2) monitoring the effects of observed exploitation rates on reductions in juvenile salmonid predation. Monitoring the effects of exploitation includes (1) comparing predation indices before and after sustained implementation of the program, (2) describing the response of northern pikeminnow to sustained removals, and (3) describing the response of other predators (walleye and smallmouth bass) to sustained removals of northern pikeminnow.

comments were considered by the NPCC for recommendations to the BPA for funding decisions on a three year package of improvement projects in the CRBFWP. The BPA in October 2, 2003 considered the NPCC June 11, 2003 recommendations for 50 percent reduced funding levels, but decided to go with a higher level of $2.2 million in Fiscal Year (FY) 2004 and $2.1 million in FY 2005 and FY 2006. This compares to the project sponsor request for $3.3 million in FY 2004 and about $3.5 million in following years. The BPA commented in its decision that it expected that the funding was adequate to achieve 90 percent of past years' predation reduction benefits or mid-term funding reallocations should be considered.[1]

The PSMFC wishes to respond to the ISRP comments about lack of monitoring the program for economic considerations by undertaking an economic analysis study. The study would address recommendations by the ISRP and those of a study completed by Hankin and Richards (2000). (The Hankin and Richards study was done on recommendation of the ISRP in a previous review of the NPMP project proposal.) The ISRP commented that there is no analysis of the cost-effectiveness of the pikeminnow removal on salmon or any discussion of economic tradeoffs for conducting this program. The ISRP points out that the Hankin and Richards (2000) study had two recommendations for improving the efficiency of the program that have not been carried out. These were to conduct further study of the tiered reward system and to explore possibilities to increase rewards by substituting funds spent for promotion.

The PSMFC contracted with The Research Group, Corvallis Oregon for a workscope to undertake the economic analysis. The workscope was limited to using available data and information. This means any evaluation methods requiring new data collection, such as surveys of program participants, can only be recommended for implementation.

The study used the following sequence of activities.

1. Describe the program's economic considerations.
2. Assess the program's economic contribution and compare the program to other approaches for accomplishing program objectives.
3. Explain study findings and recommend future research.

The documentation of these activities' results is contained in three successive chapters of this report.

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1. The BPA is considering reducing summertime water spills over dams in order to realize more revenues from power generation and to compensate for expected low water flow levels. Mitigation actions to offset impacts from higher mortality to salmonid outmigration include increasing funds to the NPMP. The funds would be to increase the recreational fishing reward structure, thereby increasing angling activity, resulting in increased catches of the northern pikeminnow offending size class. The rewards would be increased: Tier 1 would increase to $5, Tier 2 would increase to $6 per fish, and Tier 3 would increase to $8 per fish. The tagged fish would increase from $100 to $500. Additional areas may be opened, such as for the lower reaches of the Yakima River. The estimated cost for the proposed action is $1.5 million.

B. Background

Hankin and Richards (2000) discuss the biology as well as the economic justification for the NPMP. The following summary is selectively paraphrased from their report; other reports are referenced to substantiate the program description.[1]

The northern pikeminnow are a native species and have always preyed upon juvenile salmonids. The development of the Columbia River hydropower system has likely increased the level of predation. Dams have slowed water velocity and decreased turbidity, effects which have increased exposure time of juvenile salmonids to predators and probably also increased predation success. Development of the hydropower system has also resulted in increased water temperatures, and therefore increased predator activity and consumption. Dams concentrate prey in forebay and tailrace areas, further increasing the likelihood of predation. Juvenile salmonids in dam tailraces are likely disoriented from passage through or around turbines, spillways, or bypass systems, increasing their vulnerability to predation.

In "natural-river" systems where northern pikeminnow or related pikeminnow species coexist with anadromous salmonids, Brown and Moyle (1981) found that predation by pikeminnow in streams was minimal. Buchanan et al. (1981) found that predation on salmonids by northern pikeminnow was minimal in free-flowing reaches of the Willamette River. Beamesderfer and Rieman (1991) and Ward et al. (1995) confirmed that northern pikeminnow densities were highest near dams, and Vigg et al. (1991) and Ward et al. (1995) confirmed that consumption rates are also highest near dams. Together, these studies suggest that the predation impact of northern pikeminnow in the Columbia and Snake rivers today is likely much greater than what it may have been prior to construction of dams.

The concept of the NPMP can be directly traced to Rieman and Beamesderfer (1990) whose research suggested that relatively low annual exploitation rates (10 to 20 percent) applied to northern pikeminnow populations could, in principle, result in a reduction of approximately 50 percent in the total consumption of juvenile salmonids by northern pikeminnow. Northern pikeminnow apparently become a serious predator of juvenile salmonids only after they reach a size of approximately 250 mm or 9.8 inches fork length (approximately 279 mm or 11.0 inches total length); thereafter their importance (measured by daily consumption of juvenile salmonids) as a predator increases with their increasing size. Because northern pikeminnow are relatively long-lived (specimens have been aged up to 16 years in the Columbia River) and their annual natural mortality rates are believed to be relatively low (Rieman and Beamesderfer 1990, Parker et al. 1995), a relatively small increase in annual mortality rate can produce a substantial reduction in the number of larger, older northern pikeminnow. As these larger and older fish have greatest predation impact (i.e., consume the greatest numbers of juvenile salmonids), a substantial reduction in their numbers could have an important impact on total population predatory impact even though the overall population size is not dramatically reduced.

Beamesderfer et al. (1996) have estimated that approximately 16.4 million outmigrating juvenile salmonids were consumed by northern pikeminnow annually in the Columbia and Snake rivers

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1. Care has been taken to make sure the author's context has been preserved, however the reader is encouraged to review the original sources to make sure meaning and intent are unchanged.

prior to the NPMP. Total systemwide impacts are not evenly distributed throughout the Columbia and Snake rivers, but are concentrated in the lower Columbia River below the Dalles Dam where approximately 13.0 million of the 16.4 million total salmonids are believed to have been consumed by northern pikeminnow (Beamesderfer et al. 1996). When compared to the estimated 200 million juvenile salmonids produced in these combined river systems, the northern pikeminnow are thus believed to have consumed approximately eight percent of all downstream migrants. At this level of outmigration, about 6.5 percent of these downstream migrants are consumed below The Dalles Dam.

Ward, et. al. (October 24, 2002) addresses previous estimates of predation losses biases for consumption of juvenile salmonids killed by dam passage. Most salmonids consumed by northern pikeminnow were eaten alive, despite observed preferences for dead salmonids in laboratory and field tests (Gadomski and Hall-Griswold 1992; Petersen et al. 1994). Petersen et al. (1994) marked and released dead and live salmonids into a dam tailrace in a 10 percent dead proportion that simulated turbine mortality rate and observed that 22 percent of marked salmonids subsequently recovered from northern pikeminnow were dead before release. If dead fish constitute 22 percent of northern pikeminnow prey near a dam, dam effects extend 10 km upstream and downstream, and 69 percent of predation occurs in that zone (Petersen 1994), then 85 percent of the estimated predation would be on live fish (1 minus (0.69 times 0.22)).

Rieman and Beamesderfer (1990) concluded that compensation by surviving northern pikeminnow was unlikely because (1) fecundity is much lower than fecundity of species considered resilient, (2) growth is slow and mortality low compared with other species, and (3) density-dependent growth was not obvious. Knutsen and Ward (1999) found no evidence to date of compensation by surviving northern pikeminnow, although there are still some outstanding questions about compensatory feeding by northern pikeminnow (Petersen 2001). Friesen and Ward (2000) and Ward and Zimmerman (1999) found no evidence to date of compensation by walleye or smallmouth bass for decreased populations of northern pikeminnow.

The NPMP has resulted in a steady exploitation of the northern pikeminnow population over recent years at about 12 percent after an initial absolute catch was ramping up (Table I.1).[1] Since implementation of the NPMP, annual harvest rates of fish larger than 250 mm fork length have averaged within the 10 to 20 percent stated target range, with the sport-reward fishery contributing over 90 percent of the total catch. In recent years, the dam-angling and gillnet fisheries combined have contributed less than one percent of the total catch. The dam-angling and gillnet fisheries were discontinued after 2002.

Friesen and Ward (1999) estimate that as a result of northern pikeminnow harvest since 1990, predation on juvenile salmonids by northern pikeminnow has been reduced by as much as 25 percent annually. The relative benefits of a given exploitation rate decrease with time as the number of large northern pikeminnow is reduced; however, additional reductions in potential predation are possible if exploitation is maintained at mean levels (Figure I.1). Friesen and Ward

1. Any future decrease in the absolute numbers of fish caught would be due to the effectiveness of the ongoing NPMP. In a setting like this, where a fishery is first imposed on a previously unexploited population of fish, catches would be expected to be greatest in the first few years of program operation and to thereafter decline to lower levels without a change in effort or catch per unit effort.

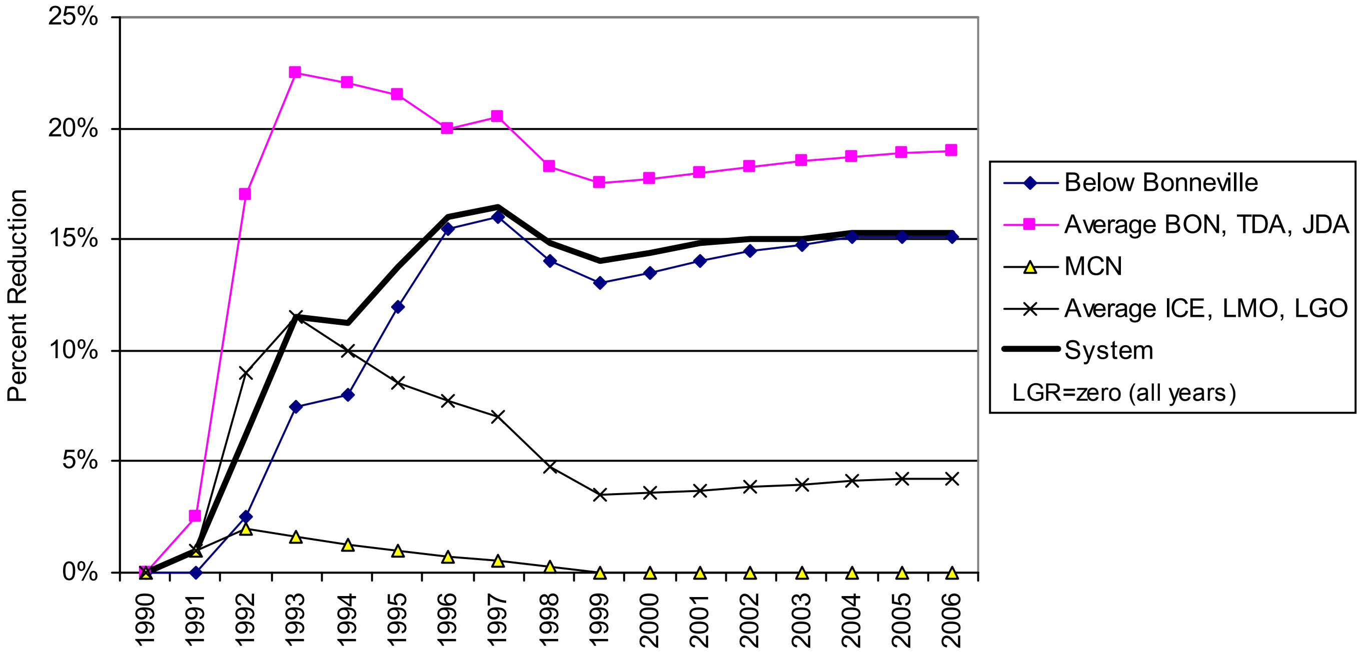
Table I.1
Annual Catch, Effort, and Exploitation Rate

Year	Sport Reward Catch	Sport Reward Tier 1	Sport Reward Tier 2	Sport Reward Tier 3	Sport Reward Effort	CPUE	Dam Angling	Gillnet	Other	Total	Sport Reward Exploitation Rate	All Fisheries Exploitation Rate
1990	4,681	100.0%	--	--	--	--	11,001	--	1,648	17,330	--	--
1991	159,542	100.0%	--	--	67,317	2.37	39,196	--	7,366	206,104	8.5%	10.7%
1992	185,468	100.0%	--	--	87,900	2.11	27,868	--	8,766	222,102	9.3%	12.0%
1993	104,616	100.0%	--	--	50,055	2.09	17,210	1,772	1,688	125,286	6.8%	8.1%
1994	128,851	100.0%	--	--	40,647	3.17	16,097	9,024	--	153,972	10.9%	13.2%
1995	199,788	36.0%	30.7%	33.3%	62,725	3.19	5,299	9,484	--	214,571	13.4%	15.5%
1996	157,230	34.4%	30.7%	34.9%	35,485	4.43	5,455	6,165	--	168,850	12.1%	12.9%
1997	119,488	34.6%	31.9%	33.5%	27,338	4.37	3,517	2,806	--	125,811	8.9%	9.6%
1998	108,903	33.4%	31.3%	35.4%	21,959	4.96	3,480	3,035	--	115,418	11.1%	11.5%
1999	114,687	34.3%	32.3%	33.5%	25,906	4.43	3,559	1,604	--	119,850	12.5%	12.7%
2000	189,710	30.1%	27.6%	42.4%	30,337	6.25	423	557	--	190,690	11.9%	11.9%
2001	244,032	30.2%	27.6%	42.1%	39,091	6.24	2,751	523	--	247,306	16.2%	16.2%
2002	202,068	27.6%	28.0%	44.5%	30,521	6.62	7	712	--	202,787	12.3%	12.3%
2003	196,977	28.5%	29.6%	41.9%	28,691	6.87	--	--	--	196,977	13.0%	13.0%

Notes:
1. Minimum reward size decreased from 11 to 9 inches in 2000, but exploitation rates are only shown for ≥ 250 mm (or 9.8 inches) fork length for comparison across years.
2. The program began in 1990 without a tired reward system at $1 per fish. This was increased to $3 per fish in July 1990 which lasted through 1994. In 1995, the tiered reward system began with $3, $4, and $5 for total seasonal harvests of 1-100 fish, 101-400 fish and 400+ fish caught. In 1999, the tiered reward system increased to $4, $5, and $6. In July 2001 additional economic incentives were offered during drought/power emergencies. The catch and tag rewards by tier increased to $5, $6, and $8 and tag reward to $1,000. In 2002, the catch and tag rewards returned to $4, $5, and $6 by tier and the tag reward returned to $100.
3. Dam-angling and gillnet were discontinued after 2002.
4. Effort is measured by angler days.

Source: Ward et. al. (October 24, 2002), NPMP personal communication March 2004, and Study.

Figure I.1
Mid-Range Model Estimate for Percent Northern Pikeminnow Predation Reduction

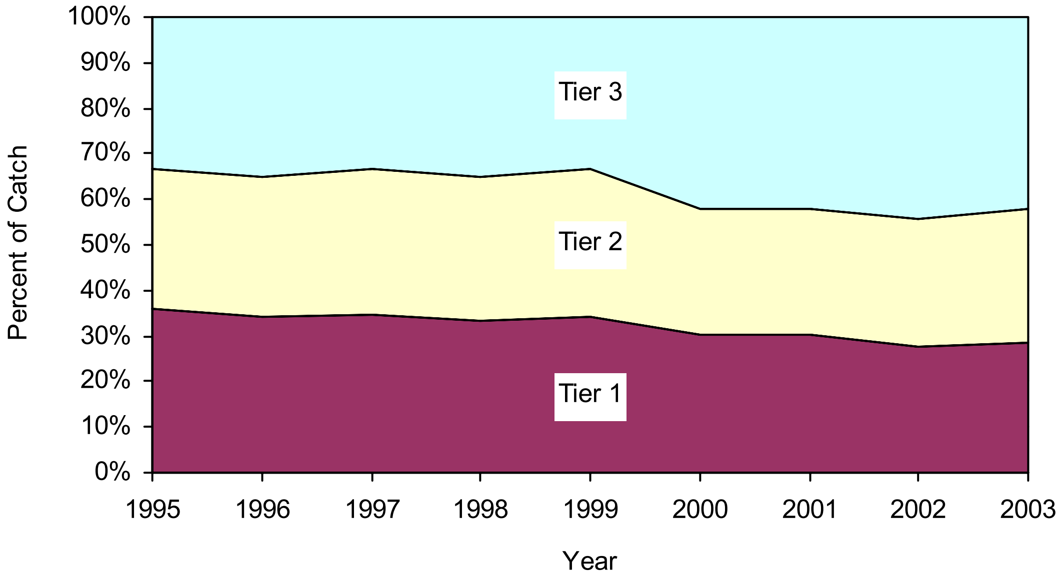


Notes: Estimated reduction in system-wide juvenile salmonid mortality due to northern pikeminnow predation – compared to reach subareas: below Bonneville, lower Columbia reservoirs (BON, TDA, JDA mean), McNary (MCN), lower Snake reservoirs (ICE, LGO, LMO mean), and Lower Granite (LGR), 1990 to 2006.
Source: Northwest Fisheries Science Center (2000).

(1999) estimated a long-term reduction in potential predation of 3.8 million juvenile salmonids per year (representing 1.9 percent of the total population) if northern pikeminnow exploitation rates are maintained at mean levels. This estimate, however, includes predator removal in the free flowing sections of the Hanford Reach and Snake River near Hells Canyon. The Friesen and Ward (1999) estimate is significantly more conservative than Rieman and Beamesderfer's (1990) who conjecture that up to a 50 percent reduction in predation on juvenile salmon could be achieved.

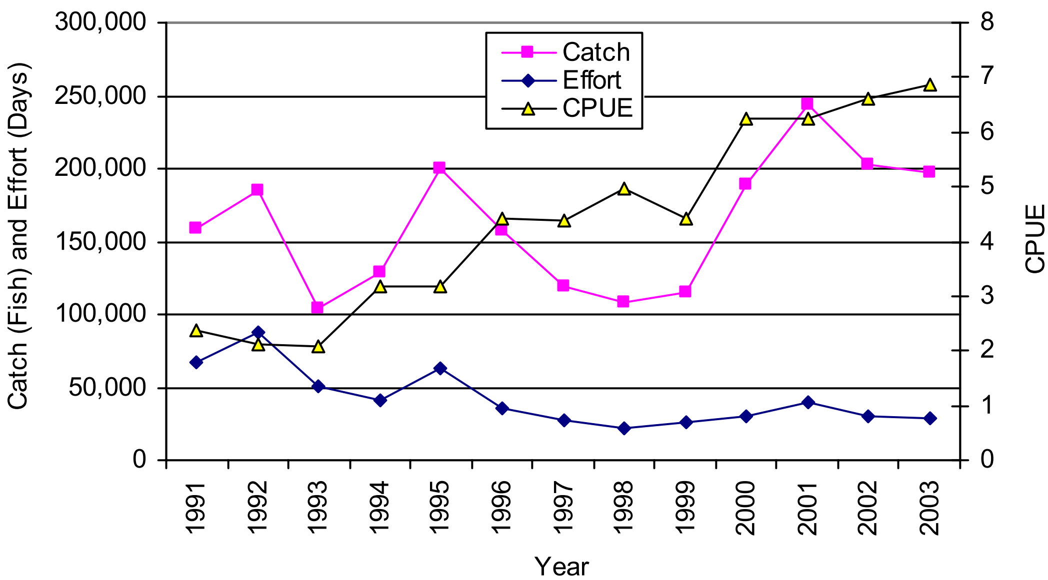
There has been an increasing trend in the share of catch by Tier 3 anglers (Figure I.2). These are experienced anglers with high avidity, which explains an increasing CPUE for the program (Figure I.3).

Figure I.2
Sport Reward Catch by Tier Group in 1995 to 2003



Source: Ward et. al. (October 24, 2002), NPMP personal communication March 2004, and Study.

Figure I.3
Sport Reward Catch, Effort, and Catch Per Unit Effort in 1991 to 2003



Source: Ward et. al. (October 24, 2002), NPMP personal communication March 2004, and Study.

C. Economic Analysis Approach

The study's overall goal is to evaluate the NPMP using economic considerations.[1] There are three analysis approaches used: determining net economic value (NEV), calculating regional economic impact (REI), and undertaking a cost-effectiveness analysis (CEA).[2] There are two

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1. Most economic analysis will be incomplete because not all changes in long range values, nonfinancial values, and external costs are addressed. Long range value changes are those that can be expected to occur after a plan's actions are absorbed. (When these future changes are included, the revenue or costs streams are reduced to annual net present values in order for them to be used in the analysis. The choice of the discount rate to use in calculating net present value is controversial [Hanley and Spash 1993].) Because of the uncertainty in knowing these adjustments, analysts generally assume the change in the short term will approximate what happens over the course of the long term. Short term value changes are the immediate gains or losses to be expected to occur if the status quo is changed.

   Impacts on national, state, and local economies are usually analyzed only in terms of dollar flows. Economic values can also be nonfinancial (no market information exists), as well as financial (prices exist from markets where traded goods are for well-defined property rights that are exclusive, transferable, and enforceable [Panayotou 1992]). For example, some people (termed non-users) who do not actually fish for salmonids may still place a value on the existence of the resource. Deriving this value must rely on expressed preference information (either real or hypothetical) gathered through surveys that address the particular setting and policy issues needing decisions. Because of lack of budget resources to do a more comprehensive analysis, the values of the non-users are generally either not included or are imputed from other studies. Such values can play a significant role in determining future programs related to the management of a natural resource and should be a criteria in any policymaking, but should be used carefully in the decision-making because of the difficulties in measuring such values.

   Nonmarket values include livability considerations, and livability is becoming more important as Pacific Northwest economies mature. Economies are becoming more dependent upon high-technology industries, which require a highly educated, highly skilled workforce. High technology firms do not have the usual locational requirements for being near markets or near manufacturing inputs, and as such, can decide to make capital investments based on other criteria. One of the competitive advantages in the Pacific Northwest is livability relative to other areas that makes it unnecessary to pay premium compensation for a degraded environment or for overcrowding. Scenic and productive river basins will play an important role in drawing the major components of economic growth: capital and a highly skilled work force.

   External costs are also not usually evaluated. Prices of products or services sold in the open market often do not reflect all the costs of making the product or providing the service. External costs are passed on to others in society, often in the form of dirty air, polluted water, or less biodiversity. External costs are difficult to identify and hard to quantify, but they can significantly decrease the value to society of commodity production. Although it would not be easy to allocate these costs to resource management plan strategies, they could make up a significant part of the costs of producing commodity outputs and should be evaluated along with market and nonmarket values.

2. Net economic value estimates utilized in this report should be viewed as general indicators. Specific application of the models for certain program effects or in selective geographic areas may not be appropriate.

   The present study did not address substitution. It could be that a proportion of anglers would fish for other target species anyway. Because these anglers turned in vouchers, it was assumed all of their economic impact was associated with the NPMP.

   The present study also did not address whether the anglers were resident within the economies being analyzed. Fishing expenditures can be considered as coming from disposable income, which would be spent on other local recreational opportunities if not spent on fishing. It can also be argued that if the NPMP was not available, residents might travel elsewhere in recreational pursuits, thereby taking money out of the economy.

aspects of the program that are included in the NEV: (1) the value for the recreational experience to fish for northern pikeminnow, and (2) the value realized from recreational and commercial fishing for the increased adult salmonids. The NEV is the sum of benefits minus costs. Benefits minus costs for recreational angling assume willingness-to-pay (WTP) estimates from other studies.[1] The REI analysis has three components: (1) the economic activity from northern pikeminnow fishing itself, (2) the economic activity from administering the program, and (3) the economic activity stirred up in the local economies by fishing for the increased adult salmonids. The economic activity for pikeminnow fishing assumes that the higher volume anglers are more akin to a commercial fishery than a recreational fishery. All anglers that reach the third tier are treated as a commercial operation. Because adult salmon are harvested in ocean fisheries, the increased smolt survival will benefit economies at ocean communities from Alaska to California as well as inland communities of the Columbia Basin. All of these economies are included in the analysis. The CEA compares the NPMP to several other smolt downstream survival improvement programs designed to achieve the same objectives.

Following chapters describe the methods and results for the different types of economic analysis approaches. Estimates of NEV and REI from recreational and commercial fishing are made using factors and procedures developed by management agencies, such as ODFW (Carter 1999), Pacific Fishery Management Council (PFMC) (2004), and the NOAA Fisheries (2000). The economic analysis relies heavily on the parameters and models developed by Radtke et al. (1999). Estimates for CEA use procedures developed by the NPCC Independent Economic Analysis Board (IEAB) (2004).

1. A literature search did not discover a benefit-cost analysis for recreational financial reward fishing, other than for tournament fishing events, so it was necessary to assume that northern pikeminnow fishing willingness-to-pay estimates on a per day basis were the same as for trips when angler motivations are to fish for other Columbia River Basin target species.

II. ECONOMIC ANALYSIS

A. Methods

Fishery resources in the Pacific Northwest provide all types of values to society. This includes values that can be measured by those that use the resources as well as values for those that do not use the resources. Measuring values for the non-users is much more difficult because there are no traditional market exchanges. The non-users have to be asked their hypothetical WTP to have the resource. For the purpose of this study, values derived from the act of fishing (by both recreational and commercial interests) is assessed quantitatively and non-user values are only qualitatively discussed.

The valuation is determined using two economic analysis approaches: NEV and REI. Both provide dollar estimates, but have quite different meaning, as explained in the following sections. A third economic analysis approach, called CEA, is also used. This type of analysis shows the cheaper way to accomplish an objective from a package of alternatives. The CEA method compares alternatives using the objective for increasing juvenile salmon downstream survival by one percent.

The modeling assumptions and procedures for the economic analysis approaches are shown in Table II.1. The economic analysis is for three effects from the NPMP: (1) harvesting northern pikeminnow, (2) program administration, and (3) harvesting the increased adult salmonid returns. The economic measurement regarding the increased salmonid adult returns assumes Friesen and Ward (1999) predation reduction estimates. The small economic effects from northern pikeminnow disposition after catch that is rendered for fish meal or compost is included in the northern pikeminnow harvesting effects.

The economic effects from harvesting the increased adult salmonids are dependent on assumptions used for estimating three variables: (1) downstream juvenile salmonid migration levels (including hatchery and wild), (2) smolt-to-adult survival rate (SAR), and (3) ocean and in-stream harvest management regimes. The estimates for these variables that rely on historical data will differ depending on the adopted period, or in the case of using policies for definitions, the assumed sideboard estimates for the policies. Table II.2 presents three alternatives to characterize the variables. The table's notes describe the historical periods used for averages and the other policy assumptions.

At present, total downstream migrating smolts are most likely close to 200 million, as mentioned by Hankin and Richards (2000). However, the Artificial Production Review and Evaluation (APRE) projected hatchery related releases at 208 million for the 2004 year (APRE 2003). Depending on the number of estimated naturally spawning adults, the total amount of smolts that are entering the Columbia/Snake system according to the APRE estimate are about 330 million. The Columbia River Fish Passage Center (CRFPC) estimates the actual hatchery smolt releases at 143 million or 68.8 percent of planned (Sando 2003). Therefore, including the estimated natural produced smolts, the total smolt downstream migration would be an expected 226 million.

Table II.1
Modeling Assumptions for Economic Analysis Approaches by Program Effects

<table>
<tr><th rowspan="4" colspan="2">Economic Analysis Approaches</th><th colspan="5">Program Effects</th></tr>
<tr><th colspan="3">Operation and Administration</th><th colspan="2">Increased Adult Salmonid Returns</th></tr>
<tr><th colspan="2">Angler Effort</th><th rowspan="2">Administration</th><th colspan="2">Fisheries</th></tr>
<tr><th>Highliner</th><th>Recreational</th><th>Commercial</th><th>Recreational</th></tr>
<tr><td rowspan="2">NEV</td><td>Method</td><td>Use REI method for highliner revenues; assume 70% revenues for value</td><td>Use REI method for angler days; assume northern pikeminnow fishing WTP per angler day is same as other target species (salmon, etc.); use benefit transfer values; assume zero passive use values</td><td>Opportunity costs for using budgeted funds on other fish and wildlife programs or returning funds to electricity rate base</td><td>Use REI method for commercial revenues; assume 70% revenues for value</td><td>Use REI method for recreational days; assume user WTP per angler day benefit transfer values; discuss passive use values for non-use of returning adults</td></tr>
<tr><td>Unit</td><td>70% x $4,325</td><td>$52 per day</td><td>Not calculated</td><td>Varies by geographic fishery - see Table II.4</td><td>Varies by geographic fishery - see Table II.4</td></tr>
<tr><td rowspan="3">REI</td><td rowspan="2">Method</td><td rowspan="2">Use NPMP participation results for payments to Tier 3 anglers; use FEAM small salmon vessel category budget for expenditures; use IMPLAN sector multipliers</td><td rowspan="2">Use NPMP participation results for effort (angler days); assume Oregon Angler Survey expenditures per angler days; use IMPLAN sector multipliers</td><td rowspan="2">Use IMPLAN sector multipliers and budget labor and other cost line items</td><td colspan="2">Use NPMP exploitation rate effects on downstream survival improvements; assume SAR for that brood year; assume ocean and in-stream harvest rates</td></tr>
<tr><td>Assume allocation for commercial use; use ocean and in-stream per pound weight and ex-vessel price to develop revenues for ocean, lower river non-Indian, and upriver tribal fisheries; use FEAM salmon fisheries budgets for expenditures; use IMPLAN sector multipliers</td><td>Assume allocation for recreational use; assume CPUE to develop total angler days; assume Oregon Angler Survey per day expenditures; use IMPLAN sector multipliers</td></tr>
<tr><td>Unit</td><td>$7.1 per fish that includes $0.25 per pound for pikeminnow disposition</td><td>$30 per day fishing without consideration for pikeminnow disposition</td><td>Actual expenditures and IMPLAN sector multipliers</td><td>Varies by geographic fishery - see Table II.4</td><td>Varies by geographic fishery - see Table II.4</td></tr>
<tr><td rowspan="2">CEA</td><td>Method</td><td></td><td></td><td>Compare NPMP costs to other passage improvement projects</td><td></td><td></td></tr>
<tr><td>Unit</td><td></td><td></td><td>Per 1% downstream survival improvement</td><td></td><td></td></tr>
</table>

Notes:
1. The NPMP has in the past had other operational methods, such as dam angling and site-specific gillnet fishing. These methods were discontinued after 2002, so effects' assumptions are not included in the table.
2. The REI table statements only describe how economic contribution measured by personal income is developed. REI can also be measured as jobs and industry output.

Source: Study.

Table II.2
Hatchery Release, Smolt-to-Adult Survival Rates, and Harvest Level Assumptions for Three Alternatives Considered for Estimating Adult Salmonid Returns-to-Fisheries

	Assumptions		
Alternatives	Hatchery Production	SAR	Harvests Regime
I	CRFPC Estimate	1970's-1990's Average	30-year average
II	APRE Estimate	1970's-1990's Average	1980's average
III	APRE Estimate	Doubling the Runs Objective	Double 1980's average

Notes:
1. Columbia River Fish Passage Center (CRFPC) estimate is 143 million. Hatchery production Artificial Production Review and Evaluation (APRE) estimates are 208 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; and "1980's" was 1981 to 1989. SAR assumptions for the "Run Doubling Objective" case are the survival rates that would be required to meet the objectives.
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).
5. These three alternatives may be viewed as situations or goals for Columbia River anadromous fish management.

Source: Adapted from Radtke et al. (1999).

SAR's have been increasing in the last few years, and reducing juvenile salmonid predation through the NPMP is just one small effect on the multiple causes of smolt mortality. It is difficult to adopt a SAR to use for a particular brood year in this study as reflective to what might happen as a result of ocean conditions, harvest management regimes, and other smolt mortality influences. Assumed average SAR's by hatchery release area and species are shown in Table II.3. Different periods used in calculating averages will have quite different results.

Ocean and in-stream harvest management regimes are set by many overlapping jurisdictions that are responding to international and national treaties, as well as biological conservation concerns. Harvest levels will vary dramatically from year to year. Economic concerns for harvesters prompted the NPCC to set a goal for doubling the runs over 1980's level adult returns in order to support higher opportunities for inriver fisheries. The goal has now been abandoned in favor of more specific conservation objectives. Predicting how harvest management may change geographic fisheries is problematic and a wide range is used for this study to encompass how higher adult return may benefit economies through commercial and recreational fisheries.

1. Net Economic Value

NEV attempts to measure the benefits received by those that use the fish less costs and the value people place on the fish resource without using it. In general, benefits are measured by willingness to pay and costs by opportunity costs. Opportunity costs reflect the foregone benefits from the use of the fish. The economic values to "nonusers" include existence values (knowledge of continual existence of the resource), bequest values (preserving the resource for future generations), and option values (users having the option to use the resource in the future).

Table II.3
Smolt-to-Adult Survival Rates for Columbia River Basin Hatchery Origin Fish by Areas of Releases for the Three Alternatives

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette
Coho					
I. 30-year average	NA	1.20%	1.20%	2.50%	1.20%
II. 30-year average	NA	1.20%	1.20%	2.50%	1.20%
III. Run Doubling Objective	NA	2.98%	2.98%	5.80%	2.98%
Spring/Summer Chinook					
I. 30-year average	0.37%	0.37%	0.37%	0.97%	0.97%
II. 30-year average	0.37%	0.37%	0.37%	0.97%	0.97%
III. Run Doubling Objective	0.79%	0.79%	0.79%	2.03%	2.04%
Fall Chinook					
I. 30-year average	0.60%	0.60%	0.60%	0.32%	NA
II. 30-year average	0.60%	0.60%	0.60%	0.32%	NA
III. Run Doubling Objective	1.45%	1.45%	1.45%	0.77%	NA
Steelhead					
I. 30-year average	0.70%	0.70%	0.70%	0.40%	0.40%
II. 30-year average	0.70%	0.70%	0.70%	0.40%	0.40%
III. Run Doubling Objective	3.11%	3.11%	3.11%	1.78%	1.78%

Notes: 1. Rates expressed as representative percents of hatchery reared smolts released divided by adults contributing to fisheries plus adults returning to hatcheries. Survival rates are best estimates based on information provided by the "Annual Coded Wire Program - Missing Production Groups" annual reports (Fuss et al. 1994 and Garrison et al. 1995) and compiled from Pastor (1995, 1996) and Smith (1998) databases.
2. Smolt-to-adult survival rate assumptions for the "Run Doubling Objective" case are the survival rates that would be required to meet the objective.

Source: Adapted from Radtke et al. (1999).

The non-user values are sometimes called passive use values, to differentiate user values that are sometimes called active use values.

The following sections discuss how NEV may be calculated when related to effects from the NPMP. The sections are for resource user recreational and commercial fishing. A third section below discusses passive use values.

a. Recreational Fishing

The recreational fishing economic values are related to the act of fishing. A fishing act is generally defined as an activity carried out on a per trip or per day basis. The estimated values per day for anadromous fish fishing are listed in Table II.4. The values are from various other studies brought together to establish comparable levels for what people would be willing to pay for the fishing experience. Researchers refer to the method of relating values in one fishery and

Table II.4
Anadromous Fish Net Economic Value and Regional Economic Impacts Modeling Factors

	Commercial Per Fish		Recreational Per Day		Days	Recreational Per Fish	
	REI	NEV	REI	NEV	Per Fish	REI	NEV
Species: Coho							
Ocean							
Alaska	21.29	10.20	60.00	51.43	1.00	60.00	51.43
British Columbia	18.15	8.70	60.00	51.43	1.00	60.00	51.43
Washington ocean	12.49	5.99	60.00	51.43	1.00	60.00	51.43
Washington Puget Sound	16.90	8.67	60.00	51.43	1.00	60.00	51.43
Oregon	17.43	9.17	60.00	51.43	1.00	60.00	51.43
California	20.65	9.35	60.00	51.43	1.00	60.00	51.43
Columbia Basin inland							
Freshwater sport							
Mainstem	--	--	60.00	51.43	1.00	60.00	51.43
Tributary	--	--	60.00	51.43	1.00	60.00	51.43
Gillnet	15.15	8.99	--	--		--	--
Tribal	15.15	8.99	--	--		--	--
Other	--	--	--	--		--	--
Hatchery surplus market	11.94	7.28	--	--		--	--
Hatchery carcass	2.00	1.23	--	--		--	--
Species: Spring/Summer Chinook							
Ocean							
Alaska	69.15	33.83	60.00	51.43	1.00	60.00	51.43
British Columbia	69.99	34.30	60.00	51.43	1.00	60.00	51.43
Washington ocean	48.31	23.68	60.00	51.43	1.00	60.00	51.43
Washington Puget Sound	41.22	21.19	60.00	51.43	1.00	60.00	51.43
Oregon	42.05	21.65	60.00	51.43	1.00	60.00	51.43
California	--	--	60.00	51.43	1.00	60.00	51.43
Columbia Basin inland							
Freshwater sport							
Mainstem	--	--	60.00	51.43	2.00	120.00	102.86
Tributary	--	--	60.00	63.23	2.00	120.00	126.46
Gillnet	98.59	49.95	--	--		--	--
Tribal	98.59	49.95	--	--		--	--
Other	--	--	--	--		--	--
Hatchery surplus market	49.12	26.87	--	--		--	--
Hatchery carcass	2.00	1.23	--	--		--	--
Species: Fall Chinook							
Ocean							
Alaska	69.15	33.83	60.00	51.43	1.00	60.00	51.43
British Columbia	69.99	34.30	60.00	51.43	1.00	60.00	51.43
Washington ocean	48.31	23.68	60.00	51.43	1.00	60.00	51.43
Washington Puget Sound	41.22	21.19	60.00	51.43	1.00	60.00	51.43
Oregon	42.05	21.65	60.00	51.43	1.00	60.00	51.43
California	53.80	22.53	60.00	51.43	1.00	60.00	51.43
Columbia Basin inland							
Freshwater sport							
Mainstem	--	--	60.00	51.43	1.50	90.00	77.15
Tributary	--	--	60.00	63.23	2.00	120.00	126.46
Gillnet	41.22	23.53	--	--		--	--
Tribal	41.22	23.53	--	--		--	--
Other	--	--	--	--		--	--
Hatchery surplus market	29.75	18.25	--	--		--	--
Hatchery carcass	2.00	1.23	--	--		--	--
Species: Summer/Winter Steelhead							
Ocean							
Alaska	--	--	60.00	52.85	1.00	60.00	52.85
British Columbia	22.28	11.44	--	--		--	--
Washington ocean	--	--	--	--		--	--
Washington Puget Sound	--	--	--	--		--	--
Oregon	--	--	60.00	52.85	1.00	60.00	52.85
California	--	--	--	--		--	--
Columbia Basin inland							
Freshwater sport							
Mainstem	--	--	60.00	52.85	2.00	120.00	105.70
Tributary	--	--	60.00	63.23	2.00	120.00	126.46
Gillnet	--	--	--	--		--	--
Tribal	16.89	9.99	--	--		--	--
Other	--	--	--	--		--	--
Hatchery surplus market	14.21	8.73	--	--		--	--
Hatchery carcass	2.00	1.23	--	--		--	--

Notes:
1. Average 1998 dollars per fish. See text for an explanation on how REI and NEV are derived.
2. Hatchery sales include carcass and egg sales.
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).

Source: Radtke et al. (1999).

setting to another as a benefit transfer approach. Each recreational fishing experience may create its own value based on the species, geographic area fished, and other variables. The value may or may not be similar to another experience. A review of studies in the Pacific Northwest supported the estimate of $52 per day as a general guideline for the NEV from the recreational fishing experience for both salmonids and northern pikeminnow fishing.[1]

b. Commercial Fishing

To compute the NEV from commercial fishing, the costs of harvest (fuel, repairs, labor, etc.) should be subtracted from the gross revenues. Because the fishing season is of short duration, most fishing boats are not limited to salmon fishing. The investment in boat and gear is also used for other fisheries. Also, at low levels of total salmon harvest and with small incremental changes in salmon production, it is often argued that any increased harvest could be taken with almost the same amount of labor, fuel, ice, etc. as before. Since the current fisheries (both the harvesting sector and processing sector) are greatly overcapitalized, in use of fixed and operating capital as well as labor, this is a plausible assumption. This assumption implies that almost no additional costs are involved and gross benefits are close to net benefits.

Generally, any valuation of salmon species involves a geographic area and a salmon species for which there are many substitutes. In such cases, the demand curve is relatively flat. That is, if consumers are faced with a rise in the price of one type of salmon in one area, they will simply shift their consumption to an alternative salmon product. In such cases, there are no extra benefits that could be counted resulting from consumers' willingness to pay different prices for a specific salmon product. Therefore, most economic valuations involving salmon will center on the benefits that a producer receives from the harvesting and processing of salmon.

The assumption of full employment is implicit in most benefit and cost analysis. But unemployment and excess fishing capacity, both transitory and chronic, seem to prevail in many Pacific coastal communities dependent on commercial fishing. Changes in markets or fishing opportunities may make it necessary for people and capital to change occupations and/or locations. Various factors make it difficult for this to happen quickly enough to prevent a period of unemployment and idle capacity.

The Water Resources Council (1979) suggests that when "idle boats" are available, the only incremental costs of increased harvest will be the operating costs.[2]

Rettig and McCarl (1984) make recommendations on the calculations of commercial fisheries NEV's. Their recommendations range from 50 to 90 percent of ex-vessel prices.[3] Because

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1 See Radtke et. al. (1999) for the review of these studies.

2. The estimates of "net value" of tribal harvest may be conservative. This conservative approach may be balanced by assumption of ex-vessel prices that may be received by in-river tribal harvests (Water Resources Council 1979).

3. In many small coastal communities, there are no substitutes for the processor involved in the primary processing of salmon. Much of the salmon is partially processed on board the boat. For these reasons, the harvesting and primary processing is included. Wholesale and retail margins are not included. The basic reason is that demand curve is expected to be flat, thereby no appreciable "surplus." For retailers selling seafood, there are also a host of substitutes available.

primary processing is an integral part of producing salmon, a portion of the primary processor margins are also used to calculate the NEV of commercial fishing. Huppert and Fluharty (1996) utilized only the harvesting ex-vessel price and concluded that "All of these estimates are at or below the 50 percent net earnings rates suggested by Rettig or McCarl." (Rettig and McCarl 1984). (Processor margin is the difference between their purchase price, ex-vessel price, and their sales price.)

In periods of reductions, the 90 percent rule would be appropriate. However, if the total salmon harvest increases, it might not be appropriate to use the 90 percent level. A more appropriate level might be the 50 percent level (the lower level recommended by Rettig and McCarl (1984)). In a situation where new resources (capital and labor) were needed to harvest and process a greater amount of salmon, the actual additional costs of harvesting and processing would have to be deducted from the ex-vessel price and the processors' margin in order to arrive at the NEV of additional salmon harvest.[1]

Because it is difficult to collect data on the commercial salmon fishing industry for specific areas and specific gears and almost impossible to compare such estimates on a wide geographic and industry basis, a general guidance may be to present information on ex-vessel basis (properly defined so as to be comparable) and on a first level primary processing basis. (This being the minimal amount of processing required to move the fish out of the region - dressing, icing, packing, etc.) The first level processor basis should be used because in many areas tendering costs and other costs and incentives of specific fisheries may not reflect the actual ex-vessel prices. It may also be argued that the first level processing in any area is inseparable from the harvesting component.

A portion of the ex-vessel and ex-processor prices are therefore used as measures to facilitate guidelines in any of net value of commercial salmon fishing. Specific fisheries with acceptable data can be investigated to determine the net value of the fishery. For this analysis, in order not to complicate the presentation, a 70 percent margin is used to represent an "average" NEV for most commercial salmon harvested. The 70 percent margin is applied over a range of annual prices. The remaining 30 percent represents additional expenses of harvesting and primary processing required to produce a consumer product from Columbia River Basin anadromous fish runs.

The above reasoning is also applied to the northern pikeminnow "commercial" fishery. These are the Tier 3 level anglers. Because there are no specific studies on this fishery, a very general rule and economic value approach is used in this report.

c. Passive Use Values

Economic value is very precisely defined as the relative value of a good or service, or what someone would be willing to give up (pay) in exchange for that good or service. This definition

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1. Chronic underemployment of human and capital resources in rural areas on tribal lands may result in very low incremental costs resulting from increased harvest opportunity. Other studies have suggested that the average cost increase with increased harvest opportunities may be two to nine percent (Barclay and Morley 1977). A two percent cost was utilized by Meyer in the Elwha Study (Meyer et al. 1995).

describes an anthropocentric view of value, that is, value to people (Goulder and Kennedy 1997). For a fishery resource to have economic value, people must be willing to give up other valuable resources (which can be represented by money) in order to have the fishery resource. Clearly this makes economic value a function of people's preferences and their ability to pay.

When measuring economic value, it is not necessary to know why people value a resource (e.g., for nutritional, biological, or recreation reasons), but rather how much they value it relative to other things (Tietenberg 1996). This makes it clear that economics is the appropriate tool when the objective is to allocate scarce resources. (A scarce resource is defined as a resource that people desire and need and of which there is a limited amount. A resource such as air may not fit this definition unless clean air becomes polluted.) For example, if something of value must be given up to save native fish populations, society needs to know whether the native fish are worth more than what must be given up. Information about the biological, nutritional, or recreational value of fish will certainly affect people's willingness to pay for the resource, but the economist does not need to know the motives behind people's willingness to pay in order to make socially efficient resource allocations. The calculation for social efficiency requires information on the total value of resources, that value being the result of many different motives. While recognizing that total value is the goal, there are methodological issues related to the measurement of economic value that have led to distinctions among different types of economic value.

People may value a particular resource such as the fishery because they either use the resource currently, or they intend to use it at some time in the future. Current and future use value can be either direct or indirect. An example of direct use value would be the willingness of anglers to pay for access to the salmon in ocean fisheries. This may be actual price paid, which may be market price or any price that may not signal a "market clearing" price; an angler may be willing to pay more than he is being charged on the market.[1] An example of indirect use value would be the willingness of a reader to pay for a magazine account of a fishing trip to the Pacific Northwest. In both cases, someone had to actually use the site or resource in order for something of value to be produced.

There are some people who are willing to pay for a resource, even though they never intend to use it. This type of non-use value is called existence value, because people are willing to pay to ensure that a resource exists, without knowing that they will ever actually use the resource. The motive for existence value may be that people want to ensure that a resource exists for future generations to enjoy. Some economists have separated this type of existence value into separate categories called bequest and option values, but they may be a subset of existence value. Some have described these values as a kind of insurance premium, to guarantee that the resource will be available when, and if, future use is desired by them or for others.

Economists have defined and occasionally measured values associated with the simple presence of a fish population. The value is reckoned as the amount that people (defined appropriately) would be willing to pay to assure the existence of a fish stock, or to pay for a specified increase in the fish stock. For example, Olsen, Richards and Scott (1991) found that people who claimed

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1. Panayotou (1992) showed that for ecosystem goods and services, commercial markets fail to adequately capture the true value. Their common property nature prevents formation of efficient markets. The markets that do exist are fraught with imperfections that lead to undervaluation and/or over estimation.

no intention to catch or eat salmon from the Columbia River were still willing to pay on average $26.52 per year per household ($35.66 in 2003 dollars) to obtain a doubling of the salmon run size. Non-use values of this sort are non-exclusive, meaning that everyone who values the fish run obtains this value simultaneously (as contrasted with consumptive user values which accrue only to those catching fish in competition with others). Hence, assuming (1) that all households enjoy this non-use value, (2) that a doubling of the fish run means 2.5 million fish per year, and (3) that there are roughly 2.0 million households in the relevant region, that value of doubling the run would be $70.24 million/year.[1]

More recently, Layton, Brown and Plummer (1999) have estimated an individual value function for a variety of fish categories (including Columbia basin migratory fish) among Washington residents. Completed for the Washington Department of Ecology, that study developed a means of estimating WTP for any given increase in fish population from an assumed current level, and for two different "without program" fish population projections. For example, for a current fish population of two million and a projected stable future population of two million in the Columbia Basin, Layton, et al. find that the typical Washington household would be WTP $119.04 per year ($128.50 in 2003 dollars) for a 50 percent increase in the migratory fish population. This represents the total (use plus non-use) value for the fish population increase. With a total of two million households holding such values, the overall value per fish is a remarkable $268.08 ($289.38 in 2003 dollars). This particular estimate pertains to a rather broad class of fish, including all the salmon and steelhead stocks in the Columbia Basin.

It is likely that the fishery resources including salmonids provide all of the above described use and non-use values to society. The decision about which ones to focus on for measurement is a function of the resource allocation question being asked. For example, if a particular fishery resource is not threatened with extinction, there is no need to measure the existence value of that resource. Since society would not be deciding whether to allocate scarce resources to save the fishery, the existence value is not relevant. If the policy decision under consideration is whether to invest resources to increase the fish populations, then the values which are measured must correspond to only the increase in fish numbers. In other words, total use value would not be the appropriate value to compare with the value of the resources necessary to increase the population by some incremental amount. Given the different types of policy decisions which might be relevant, as well as the fact that the existence of some Pacific Northwest fish populations may be in question, measurements of both total and marginal values are likely to be useful to decision makers.

This discussion is included because some of these passive use values exist not only for salmonids, but also the northern pikeminnow. The northern pikeminnow has historical and cultural values that also should be considered in program designs having to do with exploitation. The present NPMP goals are to manage population levels and are not an extirpation program.

2. Regional Economic Impacts

The NEV of the fishery resource has been defined as people's willingness to give up resources of value (money) to have the fishery resource. A common mistake that is often made in economic

1. Olsen, et al. take this as roughly the number of households in the Washington, Oregon, Idaho region in 1989.

analysis is to include the costs associated with using the fishery resource (e.g. travel costs, lodging costs, equipment) as part of the NEV from the resource. These associated costs, or expenditures, are instead the source of local or REI's associated with use of the fishery.

The NEV must represent the value of the fishery resource itself, and not the value of the related travel and equipment items. 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 no longer available to be used 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.

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 financial 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 that specific river would be lost. It must be assumed that one river's fishing was preferred over (had greater value than) those of the other rivers or activities, or the anglers wouldn't have chosen the original site in the first place. Their net willingness to pay for the chosen fishery versus other fisheries or activities would be a loss to society. 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. REI, therefore, describe the local or regional effects on jobs and income associated with any specific area chosen as the point of interest.

The calculations for REI in this report are in personal income impacts. 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 a per job factor.

The above example should make it clear why local economies are often more concerned about REI than NEV, especially when the economic values are in the form of consumer surplus. If anglers are willing to pay some amount of money over and above their costs, but don't actually have to pay, the consumers get to take that surplus or value home with them in the form of "unextracted" income. It is not immediately obvious to local businesses that the consumer surplus generated from any specific fishery has any impact on the local economy. On the other hand, money spent on lodging, food, supplies, guides, etc., has a direct impact on local businesses and on personal income in the local area.

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 society's resources efficiently. REI's are important in assessing the distributional impacts of the different allocation possibilities on the financial economies of areas. It may often be the case that society will want to invest in a less valuable resource 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 they are giving up in order to achieve the redistribution of economic activity or development.

Some of the REI may be new to an area, some of these may be considered a transfer from one region or industry to another. This issue is not considered in this study. For example, the expenditures on the NPMP for the sport fishing program may be a transfer from electricity paying consumers in Portland or California to anglers and businesses in eastern Oregon. These are allocation and equity issues and are not addressed.

a. Input/Output Models

Economic input/output (I/O) models are used to estimate the REI from resource changes or to calculate the contributions of an industry to a regional economy. 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 U.S. Forest Service has developed a computer system called IMPLAN which can be used to construct county or multi-county I/O models for any region in the U.S.[1] The regional I/O models used by the Forest Service are derived from technical coefficients of a national I/O model and localized estimates of total gross outputs by sectors.[2] 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 generate the REI from ocean salmon harvests.[3] The FEAM model process is outlined in Figure II.1. 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.

b. Regional Economic Impacts Model Application

On the commercial side, representative budgets from the fish harvesting sector and the primary fish processing sector are used to estimate the impacts of changes. On the recreational side, charter operator budgets and recreational fishermen destination expenditures provide the basic data. The individual expenditure categories are used as input into the IMPLAN I/O model to estimate the total community income impacts.

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1. The IMPLAN model is now being offered for general use by the Minnesota IMPLAN Group (Olson et al. 1993).
2. 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.
3. The FEAM was developed for the West Coast Fisheries Development Foundation by Hans Radtke and William Jensen in 1986.

Figure II.1
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

Source: Study.

i. Commercial Fishing Regional Economic Impacts

Representative budgets from the fish harvesting sector and the fish processing sector are used to estimate the REI from commercial salmon fishing. The commercial salmon fisheries budget data are from the FEAM. REI by species and geographic region used in this report are listed in Table II.4. Part of the carcass and hatchery surplus sales creates economic activity and the REI for this use is separately listed in Table II.4.

The FEAM model approach was also used for estimating the northern pikeminnow REI for the high volume anglers (highliners). It was assumed these anglers acted more as a commercial fisherman than a recreational angler. Table II.5 shows an analogous commercial fisherman's annual budget. The economic multipliers for the budget expenditures are also shown. The total REI is summed over the expenditure categories. In 2002 for example, each of the 125 fisherman in this highliner category catches 709 fish and receives $4,254. The total REI for harvesting is $4,796 or $6.76 per fish. Fish meal or fish compost processing generally adds another $0.25 per pound and a northern pikeminnow average weight is about 1.1 pounds. Therefore, the total REI is estimated to be $7.04 per fish.

ii. Recreational Fishing Regional Economic Impacts

ODFW sponsored a comprehensive survey to compile information about angler characteristics, expenditures, and preferences of recreational anglers (The Research Group 1991). This study also estimated REI for seven management zones, eight species categories, and four water types. The REI estimates were completed with the same process of disaggregating the IMPLAN model and estimating impacts relating to specific expenditure categories, as is explained for commercial fisheries. This study has been used as the basis for showing the annual economic impacts of West Coast salmon fisheries (PFMC 2004). Assumptions from PFMC model are extended to calculating the impacts from salmon harvested in Alaska and British Columbia.

The REI estimates associated with recreationally-fished ocean salmon are shown in Table II.4. Factors affecting these estimates include the means of fishing, expenditures patterns, and success ratios. (It is assumed there will be legal access to the fish during the time they become available in any specific area.) The REI per salmon/steelhead harvested recreationally varies considerably

Table II.5
Comparable Commercial Fishing Operation for Highliner Anglers in 2002

Vessel : Other Small General Boat
Vessel count : 125

Product Name	Quantity		Revenue
Pikeminnow Reward $	709	fish each	$4,254

Variable Expenses	Quantity	Personal Income Coefficient	Personal Income
Vessel/Engine Repair	$200	0.68	$136
Gear Repair/Replace.	$100	0.73	$73
Fuel & Lubricants	$200	0.29	$58
Food & Supplies	$200	0.66	$132
Ice & Bait	$200	0.86	$172
Dues & Fees	$100	1.11	$111
Transportation	$200	0.63	$126
Miscellaneous	$100	1.24	$124
Crew Shares and/or Net Income	$854	1.89	$1,614
Total Variable Expenses	$2,154		
Fixed Expenses			
Insurance	$1,000	1.12	$1,120
Moorage	$500	0.94	$470
Interest Expense	$0	--	--
Depreciation	$0	--	--
Licenses	$400	1.03	$412
Miscellaneous	$200	1.24	$248
Total Fixed Expenses	$2,100		
Total Expenses	$4,254		
Net Income	$0		
		Total REI	$4,796
		with processing	$195
			$4,991

Notes: 1. Processing generally adds $0.25 per pound for fish meal and it is assumed each fish weighs 1.1 pounds.
Source: Study.

by geographic area whether a fishing trip was guided or used a boat. Both of these fishing modes have higher expenditures per day than bank fishing, and therefore have higher REI.

Since estimating procedures usually start with catch numbers and REI's are based on expenditures per angler day, per day catch success rate is an important assumption. For ocean fishing, one fish per day success rates are used. This may range widely, depending upon area and species. Within the Columbia Basin, the success rates vary from species to species and by geographic area. Carter (1999) utilizes a one fish per day success rate for ocean fishing and up to two days per fish success rates for inland fishing. For tributaries above the Columbia/Snake confluence, two days per non-retained fish success rates are utilized (Bowler, July 1999). For steelhead retained, the fish per day success rate is 5.88 days.

For the northern pikeminnow recreational fishery, study results from The Research Group (1991) were used to estimate expenditure patterns and resulting REI from recreational fishing per day. The estimated REI for fishing in the Columbia River adjusted to 2002 dollars is $30 per day. These are comparable to $15.11 to $17.65 per day expenditure and resulting REI reported in Hanna and Pampush (1990). An informal survey to test a possible survey tool explained in another chapter found the respondents listed expenditures between $7.50 and $40 per day. Based on this background information the $30 per day is probably a reasonable estimate for northern pikeminnow fishing expenditures.

iii. Catch Utilization

Hanna and Pampush (1990) analyzed the potential for using catch for human consumption and the carcass for fish meal and liquid fertilizer. Their conclusion was that there would be little food fish demand and insufficient quantities for any specialty market for the fish meal and liquid fertilizer. Oregon State statutes dictate that game fish have to be utilized, so at present the gathered northern pikeminnows are held in cold storage and then at year's end taken to a rendering plant where they are combined with other animal protein for use as feed or a fertilizer additive. The FEAM estimates the economic impacts for other types of fish by-products usage to be about $0.25 per pound. It was decided to use this same estimate as the measure for final disposition of the northern pikeminnow.

3. Cost-Effectiveness Analysis

CEA compares the costs and results of alternative actions, or groups of actions, that could be taken to accomplish a specific quantifiable objective. The essential requirements are a measurable objective (or reasonable proxy) and the economic costs of various actions that could be taken to achieve that objective.

A CEA is, fundamentally, a comparison of forecasts of what would happen under at least two alternative courses of action. An action scenario is an action or a group of actions that might be packaged together to accomplish the same objectives. CEA compares their costs and amount of accomplishment (effectiveness) to the status quo scenario.

CEA can be used to search for and identify scenarios that meet the cost-effectiveness criteria defined by the Northwest Power Planning Act (NPPA). The example analysis of predation of juvenile passage in this report seeks to identify scenarios that are expected to increase the objective (juvenile survival) and reduce net costs (power losses plus costs of actions). This criterion is intended to be consistent with the intent of the NPPA. The cost-effectiveness of the NPMP is compared to other suggested programs that seek to increase juvenile survival and reduce projected power loss due to summer spill.

CEA has a number of inherent limitations. A particular limitation is where there are multiple objectives that cannot be measured in common units, and so cannot be compared on the same basis. In such cases, there is no definitive basis for choosing among scenarios based on cost-effectiveness unless one scenario happens to be the best for all the objectives. One of the most important limitations of CEA is that it does not consider whether the given objective has a value that is greater than its cost. CEA seeks to meet an objective, but it does not address the value of meeting the objective. The objective is taken as a given. CEA cannot identify the scenario with the most economic benefit because the economic benefit of the objective is not considered.

CEA can be used, however, to identify efficiency improvements. If we are able to produce more fish at less cost, that is clearly an efficiency improvement, even if the most efficient result is to produce more fish at higher cost or fewer fish at lower cost. In many cases, it is not practical or even desirable to place dollar estimates on the objective, and CEA is the best tool for this situation. For example, most economists would agree that it is difficult to place a dollar value on wild salmon and steelhead. But for CEA, all that is needed is a measure of effectiveness.

For this study, past studies, critiques, and reports are used to identify the expected increase in juvenile salmonid survival rates due to decreased predation by northern pikeminnow. The information provided is taken as given without an evaluation of the biological certainty of the information. The primary focus of this evaluation is to analyze the NPMP in relation to other programs as suggested by the IEAB.

B. Results

1. Net Economic Value

This study does not attempt to measure the program's total benefits over time in relation to its costs. It only provides simple one-time estimates of NEV from fishing for northern pikeminnow and anadromous fish due to the NPMP. Table II.6 describes the catch and reward payouts for the NPMP in 2002. The assumed expenditures for the highliners (all anglers in the Tier 3 category) evaluated as a commercial fishery are shown in Table II.5. The estimated NEV from northern pikeminnow fishing is $0.4 million for the highliners and $1.4 million for the recreational fishery, or a total of $1.8 million in 2002 (Table II.7). Depending on which alternative is used to estimate hatchery releases, SAR, and harvest levels, the NEV of the anadromous fish fisheries (recreational and commercial) ranges from $1.8 to $6.8 million (Table II.8). Passive use values are not quantitatively analyzed.

2. Regional Economic Impacts

Expenditures in any region will create jobs and therefore personal income. I/O modeling estimates the final distribution of these impacts without regard to the source of the initial expenditure. In the case of the NPMP, there are three components for created expenditures. These are the expenditures related to pikeminnow angling, the administrative program itself, and the estimated increase in economic activity related to harvesting salmonids that survived to adulthood due to decreased predation on juveniles passing through the Columbia/Snake River systems. Each component was evaluated separately.

a. Sport Fishing Reward Program

A total of $1.0 million was paid out for a total of 199,220 fish in 2002 (Table II.6). The highliner category contains 125 anglers (five percent) that catch 44 percent or 88,630 fish. The REI of this highliner category is estimated to be $0.6 million (Table II.7). The estimated REI of the other 2,340 recreational anglers who fished 26,771 days is estimated to be $0.8 million. Therefore, the total pikeminnow fishing REI is estimated to be $1.4 million.

b. Program Administration

During 2002 the NPMP project was budgeted for a total of $2.8 million (Table II.9). The total REI was $3.5 million, with the assumption that the sport reward program was about $1.4 million. However, the sport reward money will be spent by anglers, which is counted separately. Also, the dam-angling and site-specific angling was discontinued after 2002. Therefore, the impact of administrative spending is $2.1 million. The actual program administration expenditures vary from year-to-year, so the choice for using the proposed budget in 1999 should be viewed as providing a representative REI for these types of expenditures.

c. Increased Adult Salmonid Fishing

The objective of the NPMP is to increase the downstream survival of juvenile salmonids produced in the Columbia Basin so that more are available to harvest and return to spawn. The expected increase in ocean and in-stream harvests ranges from 72,585 to 264,754, depending on the estimate for downstream salmonid migration numbers, SAR's, and harvest management regimes. The resulting REI ranges from $2.7 to $9.9 million (Table II.8).

3. Cost-Effectiveness Analysis

a. Comparison With External Programs

As previously explained, CEA differs from NEV and REI economic analysis approaches. CEA instead asks the question: given a particular objective, which is the least cost way of achieving it? Thus, it facilitates choice among options, but cannot answer whether or not any or all of the options are worth doing. CEA is used instead of NEV and REI analysis when there are difficulties in associating monetary values with outcomes, but where the outcomes can be defined or quantified in non-monetary fashion (Pearce 1992).

Table II.6
Northern Pikeminnow Fishery Angler Activity in 2002

	Catch	Rewards
Tier 1	54,903	$219,612
Tier 2	55,687	$278,435
Tier 3	88,630	$531,780
	199,220	$1,029,827

Tags returned ($100):	160	$16,000
Coupons returned ($4):	2,001	$8,004
Total fish paid:	199,380	
Total reward dollars paid:		$1,053,831
Total northern pikeminnow caught including vouchers not submitted	202,068	

Number of anglers @ Tier 1	2,153
Number of anglers @ Tier 2	187
Number of anglers @ Tier 3	125
Number of separate anglers	2,465

Number of anglers with 10 fish or less:	1,536
Number of anglers with 2 fish or less:	636
Total angler days:	30,521
CPUE:	6.62

Table II.7
Economic Analysis Results for Northern Pikeminnow Fishery Angler Activity in 2002

Assumptions

1) Anglers considered commercial operations numbered 125 receiving an average revenue of $4,254 per year and they catch 88,630 fish or 709 each. Use FEAM model for "Other Small General Boat" with $4,991 for REI and 70% revenues for NEV.

2) If Tier 3 (125 anglers) fished 30 days each and caught 88,630 fish, then Tier 1 (2,153 anglers) and Tier 2 (187 anglers) caught 144,317 fish (62 each) in 26,771 days at average of $213 per year. Use 1991 Oregon Angler Survey and Economic Study for Columbia River adjusted to 2002 at $30 per day for REI, and Radtke et al. (1999) adjusted to 2002 at $52 per day for NEV.

Results

	NEV	REI
Highliner	$372,225	$623,875
Recreational	$1,392,092	$803,130
Total	$1,764,317	$1,427,005

Source: Study.

Table II.8
Net Economic Value and Regional Economic Impacts From Harvests of Columbia River Basin Produced Salmon and Steelhead Due to Increased Outmigration Survival

	Harvestable Adults	NEV	REI
Alternative I	72,585	$1,797,295	$2,689,240
Alternative II	105,580	$2,614,292	$3,911,689
Alternative III	264,754	$6,757,260	$9,854,343

Notes: 1. Table estimates depend on several factors, including outmigrants, SAR's, and harvest management levels. See Table II.2 for an explanation of the assumptions used for these factors.
Source: Radtke et al. (1999) and Study.

Table II.9
Regional Economic Impacts From Program Administration at Columbia River Area Economies in 2002

Costs by Agency for the Northern Pikeminnow Management Program

Agency	2002 Budget ($)	% of Total	IMPLAN Sector	IMPLAN Coefficient	REI
PSMFC (Program Administration)	$198,990	7.0%	#502	1.06	$210,929
WDFW (Sport-Reward Implementation)	$1,173,384	41.5%	#523	1.23	$1,443,262
PSMFC (Sport-Reward Money)	$1,000,000	35.4%	Table II.7	--	$1,427,005
CRITFC, TRIBES			Household		
Dam-angling	$40,800	1.4%	consump	1.22	$49,776
Site-specific angling	$43,540	1.5%	-tion coef.	1.22	$53,119
ODFW (Program Evaluation)	$369,078	13.1%	#523	1.23	$453,966
Total	$2,825,792	100.0%			$3,638,057
Minus sport reward money					$1,427,005
Minus dam and site specific angling					$102,895
Adjusted total					$2,108,158

Source: Study.

The Northwest Power Act requires that projects and approaches considered by the NPCC to achieve biological objectives be cost-effective. For example, some interests in the region are considering if it is possible to achieve targeted levels of juvenile salmonid survival with reduced spill offset by other techniques for reducing mortality (IEAB 2004).

The estimated biological effects of the NPMP on juvenile salmonids are shown in Table II.10. Costs of the NPMP are shown in comparison to total northern pikeminnow harvest in Table II.11. The average annual cost for the period 1991 to 1996 covered in the Friesen and Ward (1999) analysis was $4.7 million; however, more recently in the 1997 to 2003 costs have been close to or under $3.0 million annually.

Table II.10
Effects of Northern Pikeminnow Management Program 1991 to 1996

Mean annual consumption of juvenile salmonids by northern pikeminnow:

Without NPMP	15.2 million
With NPMP	11.4 million
Reduction	3.8 million
Percentage	25%

Notes: 1. The modeling for this table is done on a five year rotation. ODFW is updating the model in 2004, but results were not available at the time of study publication.
Source: Friesen and Ward (1999).

Table II.11
Northern Pikeminnow Management Program Costs and Harvests 1990 to 2004

Year	NPMP Cost	Total NPM Harvest	Cost per NPM Harvested
1990	$1,241,813	17,330	$71.66
1991	$5,259,629	200,070	$26.29
1992	$6,846,410	223,538	$30.63
1993	$4,253,600	125,286	$33.95
1994	$3,670,707	154,555	$23.75
1995	$4,311,186	214,383	$20.11
1996	$3,846,248	168,158	$22.87
1997	$3,730,347	125,370	$29.75
1998	$3,259,230	114,887	$28.37
1999	$3,306,000	119,850	$27.58
2000	$3,104,592	190,441	$16.30
2001	$2,779,992	244,168	$11.39
2002	$2,825,792	202,068	$13.98
2003 (estimated)	$2,601,745	197,977	$13.14
2004 (preliminary BPA)	$2,220,000		
1991 to 1996 Average	$4,697,963	180,998	$25.96
1997 to 2003 Average	$3,090,692	170,562	$20.10
1991 to 2003 Average	$4,033,449	175,379	$23.00

Source: Adapted from Hankin and Richards (2000)

The cost per reduction in predation of one viable outmigrant juvenile salmonid can be estimated with the 1991 to 1996 cost and pikeminnow predation estimates and some additional information. Friesen and Ward (1999) estimated a reduction of 3.8 million juvenile losses annually for the 1991 to 1996 NPMP. By way of comparison, Hankin and Richards (2000) suggested that total system losses of downstream migrants were 111 to 119 million of 200 million emigrating juvenile salmonids. Petersen, et al. (1994) estimated 22 percent of juvenile salmonids consumed by northern pikeminnow were already dead. They further estimated that 69 percent of consumption takes place within 10 kilometers upstream and downstream of dam tailraces. To take this additional factor into account, we assumed that juveniles consumed by pikeminnow outside the 10 kilometer proximity zones near the dams were all alive prior to being eaten. Adjusting downward, the mean number of viable juvenile salmonids saved by the NPMP was (1 minus 0.69 times 0.22) or 85 percent of the 3.8 million juveniles not consumed or 3.2 million juvenile salmonids. The estimated average cost per "saved" juvenile salmonid for 1991 to 1996 is roughly $4.7 million divided by 3.2 million juveniles equals $1.47 per juvenile saved.

Based on the estimate of 200 million total outmigrants (Hankin and Richards 2000), the adjusted number of 3.2 million juveniles not consumed were 1.62 percent of the total. The cost per one percent savings of juvenile salmonids amounts to about $4.7 million divided by 1.62 percent equals $2.90 million. This estimate reflects the approximate cost per one percent juvenile "savings" for the NPMP at the scale of the program during the 1991 to 1996 period. (Under alternative total smolt release assumptions, it is assumed that the percentage not consumed is the same.)

These annual costs of a one percent savings of juvenile salmonids compare favorably to the preliminary estimates of the costs of other methods of increasing juvenile survival by one percent as indicated in IEAB (2004), as shown in Table II.12.

Table II.12
Cost-Effectiveness Analysis Using Selected Downstream Migration Survival Improvement Actions

	Species		
Selected Passage Actions	Fall Chinook	Spring/Summer Chinook	Steelhead
August spill at Ice Harbor	$600	No effect	No effect
Extended length screens at Lower Granite	$12	$3	$6
Extended length screens at Little Goose	$23	$7	$14
Corner collector at Bonneville	$95	$95	$158
NPMP at 1991-96 level	$2.91 (all stocks combined)		

Notes: 1. Table values are annual costs (millions of dollars) per one percent increase in salmonid downstream migration survival.
2. NPMP costs include administration and research costs, while structural project costs do not.

Source: IEAB (2004) for other actions and Study for NPMP.

b. Application for Evaluating External Program Alternatives

The usefulness of CEA can be shown using the example for the NPMP being proposed as a tool to offset reduced spill at one or more hydroelectric dams. Several factors will influence the feasibility of this proposal. Among the factors is the cost-effectiveness of an expanded NPMP - the additional cost of an offsetting increase in juvenile salmon survival to maintain the overall survival rate should spill be reduced or eliminated.

The additional cost per one percent increase in juvenile savings can be estimated using the information above, assuming that NPMP costs are linear with regard to program expansion and savings of juvenile salmonids. Assuming total outmigrants number about 200 million juvenile salmonids, a one percent increase in surviving outmigrants amounts to about two million (or more under alternative smolt release estimates) additional juveniles, compared to the projected number of 2,964,000 saved juveniles under the NPMP as indicated above. Based either on the cost per "saved" juvenile or the cost per percent increase in juvenile survival, expected annual costs would be about $2.90 million per one percent increase, provided the program can be expanded according to a linear cost function. As indicated above, this would compare favorably to the costs of some of the other methods of increasing juvenile survival by one percent or some portion thereof.

The simple cost-effectiveness estimate of an NPMP expansion developed above depends critically upon the assumption that the costs of program expansion increase proportionally to the current cost per juvenile saved. Some costs may increase only moderately as program size increases, e.g., administrative costs. Further analysis of northern pikeminnow harvests for the different program structures and cost levels that have occurred since the program's inception may provide additional information on potential economies of scale. More recent program costs have been lower than in most years since 1991 to 1996. As noted in Friesen and Ward (1999), "A detailed cost analysis of removal efforts among the different fisheries and areas would further enhance evaluations of effectiveness." Research is needed to bring compensation mortality into the analysis of the alternatives.

Using the lower average cost per harvested pikeminnow average for 1997 to 2003, an approximation of the more recent costs of producing a one percent increase in juvenile salmon can be calculated. It is assumed the program saved about the same number of juveniles as it did in 1991 to 1996. Under these assumptions, the cost per one percent annual increase in saved juveniles is about $1.91 million per year. This probably understates the cost somewhat because, as shown in Table II.11, about 10,000 fewer pikeminnow were harvested annually on average during the later period.

None of the estimates of reductions in juvenile predation for particular programs and structural improvements seem to take into account the compensatory losses by other downstream sources of mortality. Hankin and Richards (2000) note that actual savings of juvenile salmonids from the NPMP depends not only on the reduction in the force of pikeminnow predation, but also on the intensity of all other forces of mortality.

It may be difficult to increase NPMP harvest of northern pikeminnow in direct proportion to an enhancement in program size or cost beyond a certain level. As noted in Takata and Ward (2002), "Although some modest reductions in predation have been achieved since 1999, further reductions are likely to be minimal if exploitation continues at mean 1995 to 2001 levels. Even if exploitation rates remain near the exceptionally high levels seen in 2001, relative predation will not decline to any significant extent. We assume that juvenile salmonid predation will probably not change much from 76 percent of the pre-program level."

One aspect of the difficulty concerns the effectiveness of the sport reward system to encourage additional angler effort and associated catch. The 2001 reward increase allegedly led to a large increase in angler fraud, making it difficult to assess the actual effect of increased rewards on the pikeminnow catch and population in the project area (State, Federal and Tribal Fisheries Joint Technical Staff 2004). Increasing the reward per fish may not be effective in achieving the desired level of increased pikeminnow harvest. This suggests that large rewards for specially tagged fish in the project area may be the best way to significantly increase the scale of the sport reward fishery. Determining what the size and number of these rewards should be to produce the desired increase in northern pikeminnow removal would most likely require some adjustments as time progressed.

More importantly, the major limitations of the CEA on reaching juvenile survival targets are numerous biological and cost uncertainties (IEAB 2004). The cost to increase juvenile salmonid survival will not be proportional to cost if there are significant interactions between spill and northern pikeminnow predation.

Zimmerman and Ward (1999) indicated spill may reduce predation by about 50 percent. A report by the State, Federal and Tribal Fisheries Joint Technical Staff (2004) has suggested that reduced spill would probably tend to reduce the number of juvenile salmonids saved at current NPMP levels. The hypothesis that a one to two percent increase in the pikeminnow exploitation rate would result in savings of 0.7 to 1.4 million juvenile salmonids may be suspect in their view. According to the report, predation on juvenile salmonids by northern pikeminnow will likely increase in the absence of spill, adding to the number of salmonids required to be saved by any offset measure. If so, reducing spill would increase the cost of achieving the total desired increase in the number or percent of juveniles saved compared to the savings under the current spill and NPMP situation.

The report has also expressed skepticism about basing the results of an expanded NPMP witnessed in the 2001 reward increases. Because of the wide confidence limits around estimates of the NPMP's exploitation rate on northern pikeminnow, the report indicated an increase of one to two percent in the pikeminnow exploitation rate is probably not substantial enough to realize any detectable reductions in predation on juvenile salmonids. In other words, it will probably be impossible to verify the efficacy of this offset under the existing monitoring programs.

III. REWARD SYSTEM EVALUATION

A. Participant Surveys

The Hanna and Pampush studies starting in 1989 through 1993 addressed social, regulatory, and enforcement issues related to the NPMP. Their studies provided monitoring data useful for evaluating angler characteristics and behavior and evaluating the program operational design. The studies began when the program was starting and provide useful baseline information. They addressed such issues as the need for promotion and angler training material, policies and levels of enforcement, structuring, reward amounts, and providing for convenient catch verification mechanisms. The studies also reviewed the feasibility for other alternative operations, such as the catch utilization as human food.

The studies were discontinued in 1993 and comprehensive angler economic preference information has not been surveyed since then. This is unfortunate because much has changed in the last 10 years. The general economic conditions, smolt passage programs, NPMP awareness, and even the pikeminnow population has changed. Survey information related to economic considerations can provide valuable feedback that should influence the efficiency and effectiveness of NPMP operations.

Certain information required to evaluate the NPMP can only be generated through user surveys. Angler motivation, response to payment structures, and identification of operational conflicts especially need user survey information. A secondary benefit of surveys is acquisition of characteristic and behavior data to provide sound economic analysis modeling results. Creel staff interviews provide important information, but can bias findings towards negative feedback from the more vocal complainers and overlook aspects of the program that are successful.

The recommendations by Hankin and Richards (2000) to further study the tiered reward system would require the survey information. Also, their recommendation that promotion costs can be lowered could be dispelled with the survey information if it is shown awareness levels are very low and that advertising and training costs will increase participation.

It is recommended that new surveys be conducted on a regular basis to provide the economic and operational data for the proper monitoring of the program. Surveys should be administered to those that participate and anglers that do not participate.

In the case of participants, a well designed sampling plan would provide valid results and thereby lower survey administrative costs and decrease user inconvenience. Incentives could be offered for being interviewed in order to increase response rates. With this in mind, the Hanna and Pampush (1993) survey questionnaire was reviewed for content and ambiguousness. A new instrument was designed to meet several objectives. First, the content must be similar so that straightforward comparisons could be made with baseline data to show trends. Second, preference information has to be included to determine any participation barriers. The following general categories of information need to be included:

- Angler characteristics
- Trip data

- Preferred fishing locale and method
- Equipment used
- Fishing type (northern pikeminnow targeted or incidental)
- Motivations for fishing and reasons why anglers might not fish more frequently
- Satisfaction with fishing experiences
- Perceptions of the NPMP
- Satisfaction with current NPMP operations
- Suggestions for improving NPMP
- Preferences for receiving information about NPMP
- Payment level and structuring reactions

Third, the instrument has to be designed to remove biases from knowledge (too specific) and frustration (too long leading to respondent fatigue). A new suggested survey instrument is presented as a draft in Appendix A.

There is a lot of goodwill generated by the NPMP. A survey administration plan can capitalize on this goodwill by ensuring an adequate response rate. The survey can either be administered as an exit interview or as mail-out with telephone follow-up. Controlled exit interviews are always better for accuracy and response rate reasons, so it is not recommended a mail-out questionnaire be used. A telephone follow-up will allow questions to be more detailed and assess complete trip information. Response rate should not be a problem, especially if the survey is designed to ask respondents to help improve an already popular program. However, with changes in telephone answering etiquette with surveys having to compete with telephone solicitors, the emphasis should be on getting as much behavior and belief information during the exit interview.

A certain stratification of participants should have a special subset of questions. New entrants and those with that exist the fishery may have important feedback about awareness and operation problems. The list for this strata can be obtained post-survey if the survey instrument and result database is properly constructed.

A non-participant market survey should also be undertaken. Non-participant lists would be from angler license databases. The survey would determine levels of awareness, perceptions about payment structures, and other program operation design in order to determine any participation barriers that need to be overcome.

B. Trial Survey Results

A trial telephone survey was administered using the new instrument. A list was generated using 2002 participants. The list was stratified by five levels of participation corresponding to effort, and a random sample was drawn from each strata. The effort categories were: one trip, two trips, three to five, six to 40, and greater than 40. A list of 40 households was identified. Each household on the list was called at least once. The response rate was about 30 percent. The definition for non-response includes households that did not answer or answering machine, wrong or disconnected telephone numbers, uncompleted interviews, as well as refusals.

The purpose of the trial survey was an informal test of the survey instrument. The reactions of the respondents are noted below.

- Age. The respondents ranged from a 72 year old retiree to a 16 year old girl. Most respondents were in the 25 to 50 year range.
- Location. About half of the respondents lived and fished in the lower Columbia. The others lived and fished in the middle Columbia and the Snake River system.
- Traveled. The range of travel to fishing site ranged from a couple of miles to over 100 miles. For most participants, it is a daily outing close to home. Retirees tend to make the experience an outing where they will stay over several nights on the banks of the river in their RV.
- Party size. Very few fished by themselves. Young people and females took part in the experience as a group or family outing. The participants that harvested a number of fish on the upper end of the scale tended to fish by themselves.
- Fishing method. Most respondents fished off the bank. The type of bait or tackle varied. However, worms were mentioned as the bait of choice. Other bait mentioned was chicken livers, chicken skin, and/or cut up fish of any type. Some used "plastic stuff," spinners or spoons.
- Number of fish caught. The contacted respondents' effort, catch, and payoff ranged as follows:

- Effort	1 to 61 trips
- Catch	1 to 1,442 pikeminnows turned in
- Reward paid	$4 to $8,152 reward

  This information was known to the interviewer from program records, but was asked as a test for memory bias.
- Expenditure per trip range. The expenditure per day ranged from $7.50 to $40.00.

Other information of respondents:

- Ages of those participating range from the low teens to those in their 70's. A majority of the participants were concentrated in the 31 to 50 age range.
- Most participants are concentrated in the lower Columbia.
- Most participants travel less than 20 miles and spend about five to seven hours fishing per trip. For most fishermen, it is a one day experience with no out of area overnight stay.
- The average party size was about two people.
- The most common method reported was fishing from shore.
- The most common type of bait or tackle was worms, followed by a variety of spinners and plastic plugs, etc.
- The catch ranged from none to several hundred per day. The average is about five fish per day.

Every participant responded favorably to this trial survey.

The major reason for participating in the NPMP is the recreational experience (alone and with friends or family) and knowing that they are participating in a salmon enhancement program. The added incentive is to cover costs and bring in a few dollars. Payment for catches was rated "not important" by two respondents. Generally, the reaction is that they are having a good time, they are convinced they are doing something good for the environment, and they have a chance to cover expenses and maybe even make some extra spending money.

Most are very pleased about the program but have some suggestions to make it a better program.

1) Education and Information. Most felt that not enough is known about the program. More information about the program is needed in local news media and local sporting stores. Also, some respondents suggested a training program for beginners and even for those who have participated in the past. One suggestion was made to start a "master pikeminnow catcher" program, patterned after the master hunter or master gardener programs. Along these lines, suggestions were made for a certification program for pikeminnow anglers. This certification would include not only techniques, but also ethics. Such a program could then be used to loosen the rules about participation, and check-in.

2) Check-in and Check-out System. A common complaint was the daily check-in and the driving that this sometimes involves. A suggestion was to allow a two to three day check-in or an advance check-in so that anglers who fish and stay overnight on the banks do not have to drive back and forth. Such a program could be implemented with numerical "cut offs" to discourage fraud. A suggestion was also made to make the payoff more responsive (quicker) and reduce the size limit, perhaps to seven inches.

3) Reward System. For most people, the reward system is the main criteria for their participation. Not knowing anything about the limited amount of total funds available, all respondents thought it to be a good idea to increase the per fish reward and to loosen the tier system. The weekly or monthly awards received a cold or lukewarm response. Almost everyone agreed that an increase in tagged fish rewards would generate more of the "casino" effect. Increase the number of $1,000 tags and perhaps decrease the $5,000 tags. Knowing that a $1,000 fish was caught in an area would get them to go to those areas more often.

C. Angler Demand

While there may be some opportunities to increase angler participation and therefore up the exploitation rate, more market information is needed to identify the factors that will affect angler demand. It could be that only training and promotion is needed. It could also be that the tiered reward system needs changing. However, controlled market response information is lacking at the present. Past information relating effort to changes in the reward amount has also been accompanied by changed fishing conditions. This clouds inferences that can be made about angler participation and program accomplishments.

The potential effects on angler participation with an increase in special-reward tagged fish are conceptually illustrated in Figure III.1.

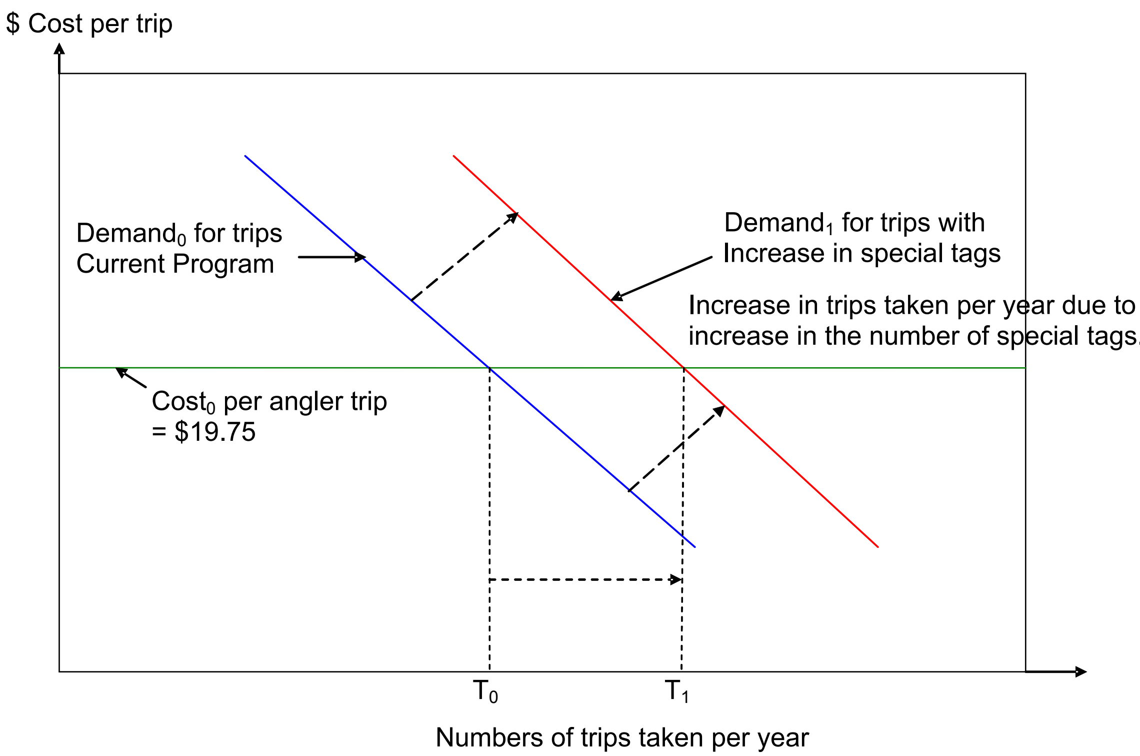
In Figure III.1a, T_0 angler trips are taken annually under the current reward structure. When the number of special-reward tagged fish is increased, and the level of the reward is increased, the demand for fishing trips is expected to shift out. Under the new reward structure, T_1 trips will be taken. It is expected that the number of northern pikeminnow harvested would also increase.

On the other hand, if the cost of taking an angler trip increases, perhaps as a result of a large increase in the cost of gasoline, we would anticipate the possibility of a decrease in the number of annual trips taken by sport reward anglers.

In Figure III.1b, T_0 angler trips are taken annually under the current reward structure. When the cost of taking an angler trip increases, the supply of fishing trips shifts up. At the new, higher cost level, T_1 trips will be taken. In this case the number of trips taken by sport reward anglers decreases. This would probably result in fewer northern pikeminnow being harvested.

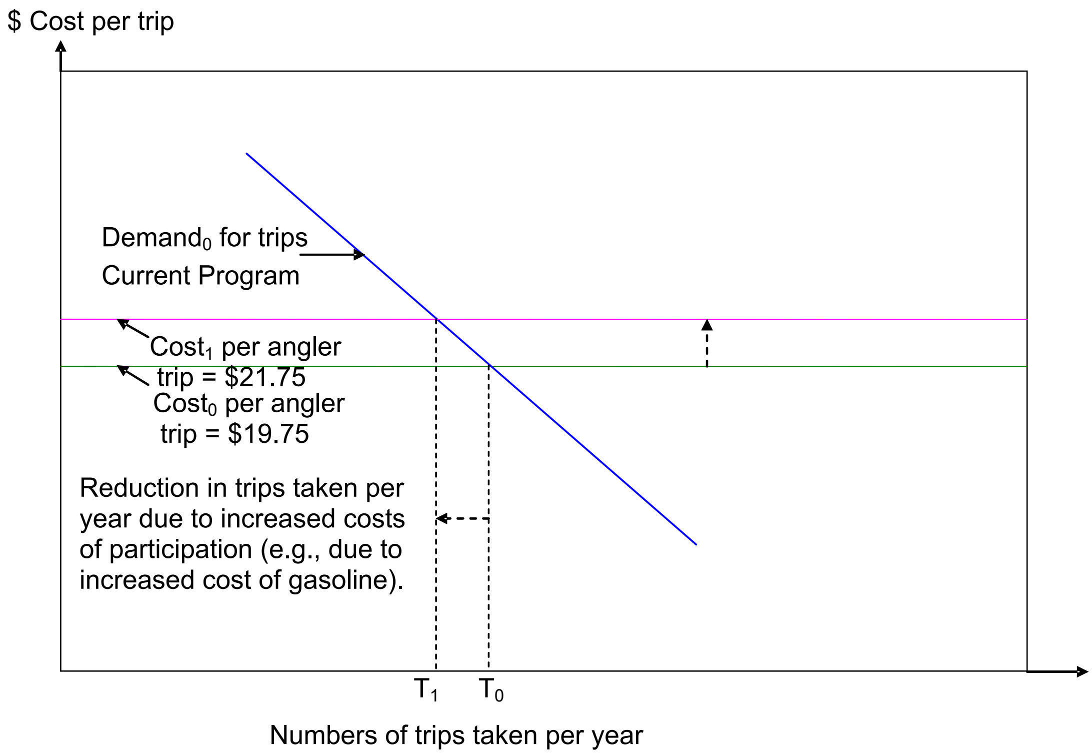
Finally, we may encounter circumstances where costs per angler trip are increasing at the same time a new, more generous reward structure is implemented. Figure III.1c shows this situation.

Figure III.1a
Angler Demand Curve for Reward Changes and Trip Cost Assumptions



Source: Study.

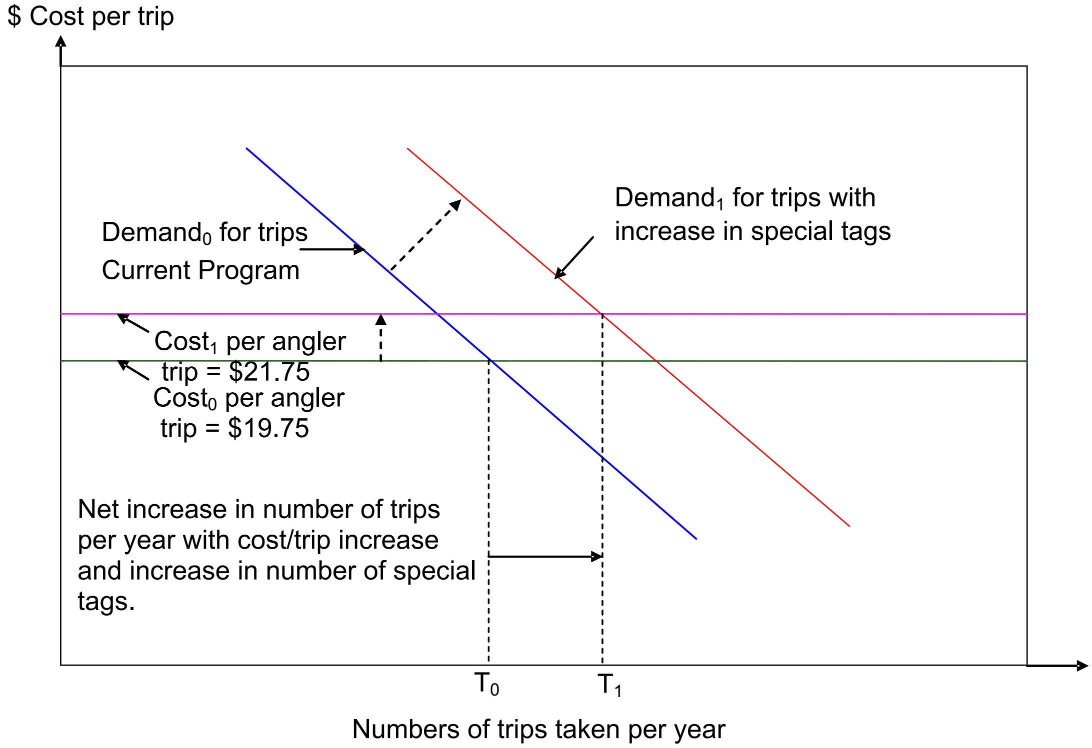
Figure III.1b
Angler Demand Curve for Reward Changes and Trip Cost Assumptions



Source: Study.

In Figure III.1c, T_0 angler trips are taken annually under the current reward structure and cost per trip. When the number of special-reward tagged fish is increased, and the level of the reward is increased, the demand for fishing trips shifts out, but the increased cost of participation shifts up the line designating cost per trip. The net effect is for a new level of trips, T_1, to be taken. T_1 in this figure is greater than the number of angler trips shown in Figure III.1b, but less than the number of trips taken in the situation depicted in Figure III.1c. Ultimately, that is why program managers will have to be flexible in setting reward levels and the structure of rewards to achieve desired levels of angler effort and pikeminnow harvest.

Figure III.1c
Angler Demand Curve for Reward Changes and Trip Cost Assumptions



Source: Study.

IV. SUMMARY AND DISCUSSION

A. Previous Economic Studies' Recommendations

Two previous groups have reviewed the economic considerations of the NPMP. The NPCC sponsored a biological and economic evaluation of the NPMP in 2000 (Hankin and Richards 2000) and Hanna and Pampush reviewed the economic, social and legal feasibility of the NPMP from 1990 through 1993. Some of the economic recommendations of the review by Hankin and Richards (2000) are:

- A modest $2.50 per fish reward be provided also for smaller fish so as to encourage their capture and removal from the northern pikeminnow population.
- The relative cost-effectiveness of tribal fisheries, as compared to the sport-reward fishery, is poor.
- A reduction of the number of agencies involved in the NPMP should be considered in order to further reduce costs.
- Further study of the tired reward system is needed. Such a study can only be made through questionnaires sent to current and past participants.
- The NPMP suffers from a very large turnover even among the core group of highly successful fishers. It may be possible to promote both participation and retention of anglers by changing the reward system.
- Promotion costs should be reduced.

The Hankin and Richards study also noted that, "... due to concerns about the accuracy of the estimated number of smolts saved by the program and the many other causes or mortality, benefits have not been quantified using monetary values of adult salmon and steelhead." They continue, "The use of adult predators removed is appropriate to measure the internal cost-effectiveness of the NPMP, but it provides no information to compare the NPMP with other programs that are aimed at improving smolt survival. For example, flow augmentation, smolt transportation, spill, fish-friendly turbine designs, and bypass systems all share the goal of improved smolt survival. Although the cost per smolt saved may be less for the NPMP than for some of these other Columbia River programs that are intended to reduce losses of smolts during their downstream migration, comparing the cost-effectiveness of the NPMP to other projects was beyond the scope of our review. Therefore, we remind readers that the analysis ... is intended only to indicate internal cost-effectiveness of NPMP and its components. Even the least cost-effective components of the NPMP may have favorable cost-efficiency when compared to other Columbia Basin projects, but this analysis cannot confirm or deny this."

Hanna and Pampush (1990) concluded, "On the basis of the survey data, the sport-reward fishery was popular with its participants. The sport-reward fishery was the most cost effective fishery on all counts: monitoring costs per fish removed, monitoring costs per unit effort, monitoring costs per smolt saved, total direct cost per fish removed, total direct costs per unit effort, and total direct costs per smolt saved." These researchers found little market potential for commercial use of northern pikeminnow carcasses.

Hanna and Pampush in various years' publications identified the stakeholders in the NPMP as did other researchers.

- Agencies that are part of the NPMP by showing that they are tangibly doing something for salmon recovery - many recovery projects are not as public.

- Hydropower supporters because removing pikeminnows is simpler than changing dams or dam operation to decrease the vulnerability of juvenile salmonids to predators.

- Hatchery advocates because removing pikeminnows is easier than changing hatchery practices and because attention is shifted to pikeminnows, instead of problems with hatchery fish that make them vulnerable to predators.

- Fishers because they can fish, be paid to do so, and also have a sense of power that they are helping salmon recovery.

- Native Americans by providing revenue and involvement in salmon recovery management (e.g. Hanna and Pampush (1993), Hankin and Richards (2000)).

Beamesderfer (2000) stated: "Nobody would be willing to pay millions of dollars for pikeminnow bounties unless it was a substitute for more costly or politically unpalatable measures." The present study address the admonition by providing measures for the economic contribution using NEV, REI, and CEA economic analysis approaches.

B. Summary of the Present Study Economic Analysis

The above mentioned economic studies pointed to the difficulties in obtaining data and using relationships to accomplish an economic analysis. While the economic evaluation of the program itself is relatively straightforward, defining the relationship between northern pikeminnow predation, juvenile salmonid downstream survival, and increased harvestable adults is problematic. The present study makes some progress in showing these relationships using existing information and models.

The present study shows the basic economic information that may be used to evaluate the NPMP in terms of net economic value (NEV), regional economic impacts (REI), and cost-effectiveness analysis (CEA) as compared to other external programs having similar objectives. Table IV.1 summarizes the results.

- The program's NEV creates an estimated $1.8 million in wealth to the nation because of the northern pikeminnow fishery and another $1.8 to $6.8 million from anadromous fish fishing. This does not include any measurement of passive use value for the increased

Table IV.1
Northern Pikeminnow Management Program Economic Evaluation in 2002

	Net Economic Value	Regional Economic Impacts	Cost-Effectiveness
NPMP budget			$2.8
Northern pikeminnow fishery	$1.8	$1.4	
NPMP administration		$2.1	
Subtotal NPMP		$3.5	
Anadromous fish fishing	$1.8 to $6.8	$2.7 to $9.9	
NPMP at existing program level	$3.6 to $8.6	$6.2 to $13.4	$2.9 for one percent increase in survival

Notes: 1. Table values are in millions.
Source: Study.

salmonid adult returns or negative passive value associated with the exploitation of the northern pikeminnow.

- A program budget of $2.8 million will generate about $2.1 million in REI's and about $1.4 million in the regional economies where northern pikeminnow fishing takes place. Fishing for salmon and steelhead resulting from increased adults surviving to harvest will generate another from $2.7 million to $9.9 million in economies from Alaska to California on the West Coast and inland in the Columbia River Basin. In total, the act of fishing for northern pikeminnow and anadromous fish may create up to $13.4 million in REI. In terms of full time equivalent jobs at $30,000 each, this is equal to the employment of about 446 people. Since many of these jobs will be seasonal, the actual number of positions may be much higher than the stated full time equivalent job estimates.

- In terms of cost-effectiveness, NPMP budget and accomplishments during the 1991 to 1996 period costs an estimated $2.9 million per year per one percent increase in survival for juvenile salmonids. This compares favorably with other selected passage actions, such as improved screening at specific inriver sites.

C. Present Study's Recommendations

1. Findings

1. The sport fishing reward component of the NPMP, in general, has a very favorable reputation among anglers that participate in the program. Participants appreciate participating in a salmon enhancement program. The competitiveness and compensation incentive generates significant effort. Increasing effort needs to play off these motivation factors.

2. There are a limited number of methods to cull or displace this species to decrease predation rates. There have been extensive investigations and pilot programs to determine the cost-effectiveness of these methods during the evolution of the NPMP. The sport fishing reward program has been the most cost effective.

3. The existing program contributes to the Pacific Northwest economy. While some of these contributions may be considered "transfers" from one economic sector and geographic region to another, the NPMP does bring income and employment to rural areas.

4. The existing NPMP is cost-effective when compared to alternative external programs for increasing downstream migration survival. Any expansion of the program should be evaluated on the marginal effects of an expanded program.

5. The existing program evaluation depends on the biological evaluation of exploitation on the problem size class and the effects on salmonid survival rates. More research should be made on discovering stock differential increased survival rates so that the evaluation can be extended to stocks of concern.

6. It was a very revealing discovery that almost 15 percent of the predation was on dead juveniles. Increased knowledge and certainty of these biological/environmental data will lead to more accurate evaluation of economic considerations.

7. Research has shown there is recruitment to the offending size class at a predictable rate, therefore not having a payment on fish less than 200 mm fork length is not justified. Consideration should be given to rewarding for a reduced length size class. This would be more of a social incentive, since the smaller size classes are more difficult to catch. This would also introduce accounting problems because there are no existing methods for payments based on size classes.

8. Information about catch and effort before and after changes to payments cannot be used to infer angler response relationships. Past information relating effort to changes in the reward amount has also been accompanied by changed fishing conditions. This clouds inferences that can be made about angler participation and program accomplishments.

2. Conclusions

The conclusion of the present study research is that:

1. An effective northern pikeminnow removal program is needed to mitigate for the increased predation brought about from the dams' generated slack water, i.e. the development of the existing hydrosystem has made this program necessary. The NPMP addresses this need without a parallel concern for eradicating the species by only targeting the larger offending size class.

2. The existing NPMP is as cost-effective as other example physical and operational hydrosystem alteration programs being considered for increasing downstream migration survival. Based on available data, the present NPMP compares favorably with other selected passage actions, such as improved screening at specific inriver sites.

3. Except for the highliner anglers, participants will spend far more money than they realize in rewards. This greatly multiplies the economic impacts per NPMP reward dollar. From a local economic development perspective, it is much better to have participation by low catch anglers than it is to have highliner type anglers. From a program cost-effectiveness perspective, it is better to encourage highliner participation.

4. There are biological and management limits to how much the NPMP can accomplish. This latest research concludes that reduction in predation on juvenile salmon will most likely not be able to be reduced below the present 25 percent level.

5. Due to the uncertainty in predation modeling and lack of information about angler's propensities to participate in the northern pikeminnow fishery, it is not clear that an increased budget for prompting more northern pikeminnow effort will calculate linearly to the CEA measure. Much more information is necessary to accurately model the angler response to payment levels and the relationship between increased effort, higher exploitation rates, and reduced predation levels.

6. To be useful in comparing the economic analysis to other programs with similar goals and for use in ESA-listing program analysis, it is important that smolt origin differential mortality is known. It could be that wild production suffers more or less predation than hatchery origin smolts. It could be that some species released in some hatcheries could have different predation rates. Additional PIT tag system research would be needed for such studies.[1]

7. The following are suggested ways to improve the sport fishing reward program operations that were garnered from an informal survey of 2002 participants.

   a. Increase number of "lottery" type tags and raise the prize amount.
   b. Make the "check in - check out" system easier to use by allowing multi-day validation periods.
   c. Encourage new entrants and improve skills of past participants through training programs. Perhaps a master angler program patterned after the master gardener or master hunter would work. These could also be the voluntary "eyes and ears" of the program. There seems to be a high level of awareness of the NPMP and generic advertising can probably be minimized. While Hankin and Richards (2000) advised against promotion costs, awareness and education should be viewed as necessary to expand the program.

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1. The Passive Integrated Transponder (PIT) information system database contains species and location specific data for the following: tagging, release, monitored release, recapture, mortality. It is available for researchers studying downstream survival.

d. Reduce the emphasis on discovering "cheaters." They are a small in number and, after all, they do reduce the northern pikeminnow population, even if it's from non-targeted stocks. There should be enforcement mechanisms, but if other fisheries serve as an example, the best information about fraud comes from other anglers.

8. It appears the NPMP suffers from a very large turnover even among the core group of highly successful fishers. Initial angler demand can probably be related to the financial rewards, but there is rapid attrition after discovering the work needed to catch even modest amounts of the larger size class. The trends show the highliner category is catching an increasing share. It is important to keep recruiting new anglers into this role.

9. There is insufficient market information to predict the effort response from changing the tiered reward system and payment levels. Periodic participant economic preference surveys and non-participant market surveys should be reinstituted.

10. It is recommended that decision makers consider more than the short-term financial values captured in the present study analysis. There are stakeholders and non-participants that hold social interests and non-economic values in the program.

V. BIBLIOGRAPHY

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.

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.

Beamesderfer, R.C.P. "Managing Fish Predators and Competitors: Deciding When Intervention is Effective and Appropriate." *Fisheries* 25(6): 18-23. 2000.

Beamesderfer, R.C., and B.E. Rieman. "Abundance and Distribution of Northern Squawfish, Walleyes, and Smallmouth Bass in John Day Reservoir, Columbia River." *Transactions of the American Fisheries Society* 120:439-447. 1991.

Beamesderfer, R. C. P., D. L. Ward, and A. A. Nigro. "Evaluation of the Biological Basis for a Predator Control Program on Northern Squawfish *(Ptychocheilus Oregonensis)* in the Columbia and Snake Rivers." *Canadian Journal of Fisheries and Aquatic Sciences* 53:2898-2908. 1996.

Bowler, Bert. Idaho Department of Fish and Game. Personal communication. July 30, 1999.

Brown, L.R., and P.B. Moyle. "The Impact of Squawfish on Salmonid Populations: A Review." *North American Journal of Fisheries Management* 1:104-111. 1981.

Buchanan, D.V., R.M. Hooton, and J.R. Moring. Northern Squawfish *(Ptychocheilus Oregonensis)* Predation on Juvenile Salmonids in Sections of the Willamette River Basin, Oregon. *Canadian Journal of Fisheries and Aquatic Sciences* 38:360-364. 1981.

Carter, Chris. Coastal Salmonid and Willamette Trout Hatchery Program Review. Appendix C - Economic Considerations. Oregon Department of Fish and Wildlife. Draft. March 15, 1999.

Friesen, T. A., and D. L. Ward. Biological Characteristics of Columbia River Walleye in Relation to Northern Pikeminnow Management. Oregon Department of Fish and Wildlife, Information Report 2000-05. Clackamas, Oregon. 2000.

Friesen, T. A., and D. L. Ward. "Management of Northern Pikeminnow and Implications for Juvenile Salmon Survival in the Lower Columbia and Snake Rivers." *North American Journal of Fisheries Management* 19:406-420. 1999.

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.

Gadomski, D. M., and J. A. Hall-Griswold. "Predation by Northern Squawfish on Live and Dead Juvenile Chinook Salmon." *Transactions of the American Fisheries Society* 121: 680-685. 1992.

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.

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.

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

Hanna, Susan and Jon Pampush. Economic, Social, and Legal Feasibility of the 1993 Northern Squawfish Removal Fisheries and Fish Distribution System. Report I. Department of Agricultural and Resource Economics, Oregon State University. 1993.

Hanna, Susan and Jon Pampush. "Economic, Social, and Legal Feasibility of Commercial, Sport and Bounty Fisheries on Northern Squawfish." Oregon State University. Report B in: Nigro, Anthony A. Development of a System-wide Predator Control Program: Stepwise Implementation of a Predation Index Predator Control Fisheries and Evaluation Plan in the Columbia River Basin. Prepared for U.S. Dept. of Energy, Bonneville Power Administration, Environment, Fish and Wildlife Division, Portland, Oregon. 1990.

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.

Independent Economic Analysis Board (IEAB). Juvenile Passage Cost Effectiveness Analysis for the Columbia River Basin: Description and Preliminary Analysis. Northwest Power and Conservation Council. Document IEAB 2004-01. January 2004.

Knutsen, C. J., and D. L. Ward. "Biological Characteristics of Northern Pikeminnow in the Lower Columbia and Snake Rivers Before and After Sustained Exploitation." *Transactions of the American Fisheries Society* 128:1008-1019. 1999.

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.

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.

National Marine Fisheries Service (NOAA Fisheries), Office of Sustainable Fisheries. Guidelines for Economic Analysis of Fishery Management Actions. Silver Spring, Maryland. Revised August 16, 2000.

Northern Pikeminnow Management Program (NPMP). Online brochure. http://www.pikeminnow.org/directions.html. 2004.

Northwest Fisheries Science Center, National Marine Fisheries Service, NOAA. Predation on Salmonids Relative to the Federal Columbia River Power System. White paper. Seattle, Washington. http://www.nwfsc.noaa.gov/publications/whitepapers/Predation.PDF. March 2000.

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.

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

Pacific Fishery Management Council (PFMC). Review of 2003 Ocean Salmon Fisheries. Pacific Fishery Management Council. February 2004.

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

Parker, R.M., M.P. Zimmerman, and D.L. Ward. "Variability in Biological Characteristics of Northern Squawfish in the Lower Columbia and Snake Rivers." *Transactions of the American Fisheries Society* 124:335-346. 1995.

Pastor, Stephen M. Annual Coded Wire Program, Missing Production Groups, Annual Reports 1995 and 1996. U.S. Fish and Wildlife Service. Prepared for U.S. Department of Energy, Bonneville Power Administration, Portland. Project no. 89-065.

Pearce, D.W. The MIT Dictionary of Modern Economics, Fourth Edition. The MIT Press. Cambridge, MA. 1992.

Petersen, J. H. Compensatory Feeding Following a Predator Removal Program: Detection and Mechanisms. Report submitted to Bonneville Power Administration. 2001.

Petersen, J. H. "Importance of Spatial Pattern in Estimating Predation on Juvenile Salmonids in the Columbia River." *Transactions of the American Fisheries Society* 123:924-930. 1994.

Petersen, J. H., D. M. Gadomski, and T. P. Poe. "Differential Predation by Northern Pikeminnow *(Ptychocheilus Oregonensis)* on Live and Dead Juvenile Salmonids in the Bonneville Dam Tailrace (Columbia River)." *Canadian Journal of Fisheries and Aquatic Sciences* 51:1197-1204. 1994.

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.

The Research Group. Oregon Angler Survey and Economic Study. Prepared for Oregon Department of Fish and Wildlife. Portland, Oregon. 1991.

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.

Rieman, B.E., and R.C. Beamesderfer. "Dynamics of a Northern Squawfish Population and the Potential to Reduce Predation on Juvenile Salmonids in a Columbia River Reservoir." *North American Journal of Fisheries Management* 10:228-241. 1990.

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

Smith, Steve. National Marine Fisheries Service, Portland, Oregon. Personal communication. August 5, 1998.

State, Federal and Tribal Fisheries Agencies Joint Technical Staff. Agencies and tribes review comments – Bonneville Power Administration Summer Spill Analysis. Columbia River Inter-tribal Fish Commission, Idaho Department of Fish and Game, Nez Perce Tribe, Oregon Department of Fish and Wildlife, Shoshone Bannock Tribe, US Fish and Wildlife Service, Washington Department of Fish and Wildlife. 2004.

Takata, Howard K. and David L. Ward. Development of a System-Wide Predator Control Program: Fisheries Evaluation. Report E. Oregon Department of Fish and Wildlife. January 2002.

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

Vigg, S., T. P. Poe, L.A. Prendergast, and H.C. Hansel. "Rates of Consumption of Juvenile Salmonids and Alternative Prey Fish by Northern Squawfish, Walleyes, Smallmouth Bass, and Channel Catfish in John Day Reservoir, Columbia River." *Transactions of the American Fisheries Society* 120:421-438. 1991.

Ward, David L., Ken Collis, James H. Petersen, Daniel D. Roby, Susan P. Barnes. Predator Control Program (Mainstem/Systemwide Province) Program Summary. Draft. Prepared for the Northwest Power Planning Council. Available online at http://www.cbfwa.org/files/province/systemwide/subsum/021024Predation.pdf. October 24, 2002.

Ward, D.L., J.H. Petersen, and J.J. Loch. "Index of Predation on Juvenile Salmonids by Northern Squawfish in the Lower and Middle Columbia River and in the Lower Snake River." *Transactions of the American Fisheries Society* 24:321-334. 1995.

Ward, D. L., and M. P. Zimmerman. "Response of Smallmouth Bass to Sustained Removals of Northern Pikeminnow in the Lower Columbia and Snake Rivers." *Transactions of the American Fisheries Society* 128:1020-1035. 1999.

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.

Zimmerman, M. P., and D. L. Ward. "Index of Predation on Juvenile Salmonids by Northern Pikeminnow in the Lower Columbia River Basin From 1994-96." *Transactions of the American Fisheries Society* 128:995-1007. 1999.

APPENDIX A

Questionnaire

PIKEMINNOW SPORT REWARD PROGRAM
PERSONAL INTERVIEW
SURVEY QUESTIONNAIRE

Precode Information

Telephone:
Name and residence address:
Qualifying pikeminnow catch in 2002:
Effort in 2002:
Location code for majority of trips:

Interview Information

Interview date: ____________
Interviewee gender (do not ask): Male _____ Female _____
Interview Results (circle code):

01 No answer	05 Business phone	09 Terminate survey
02 Busy	06 Disconnect	10 Other [specify]
03 Answering machine	07 Language barrier	____________________
04 Respondent not available	08 Refused	20 Complete

Interview duration: ____________ minutes

INTRODUCTION DIALOG

Hello, this is _______________ with The Research Group in Corvallis, Oregon. We have been asked by the Pikeminnow Sport Reward Program sponsors to find more information about fishing participants. To do this, we are calling randomly selected households to ask a few questions of those that submitted for voucher awards. The survey will take about five minutes and I think you will find it interesting. We are not selling anything, we just want to hear your views about the Program.

TERMINATE DIALOG

This completes the interview. If you want, you can tell me any comments you might have about the survey or Program. Otherwise, thank you very much for your time. We really appreciate your cooperation. Goodbye.

____
____

CALL BACK DIALOG

Your response is really valuable for statistical reasons. Would there be a better time I could call you or another member of your household to complete the interview?

___________ Other person to call and telephone number if given
___________ Call back time and date
___________ Other disposition code (see interview results codes)

I. Screening Question

Did you participate in the Pikeminnow Sport Reward Program in 2003?

1. Yes --> Go to Question II.A.
2. No, or DK, NA, R --> Speak Termination Dialog.

II. Participation and Evaluation Questions

A. Please answer the following questions as they pertain to the 2003 season. All responses will be held in the strictest of confidence.

A1. How many fishing trips do you usually make per year? The number would include all trips and not just ones when pikeminnow are caught.

1. 0
2. l-5
3. 6-10
4. 11-15
5. 16-20
6. 21-25
7. >25
8. DK, NA, R

A2. Years you have been a sport fisherman:

1. <1
2. 1-3
3. 4-5
4. 6-7
5. 8-9
6. 10 or more
7. DK, NA, R

A3. Do you plan to participate in the 2004 Pikeminnow Sport Reward Program?

1. Yes
2. No --> Go to Question A5
3. DK, NA, R --> Go to Question A5

A4. Will you be targeting pikeminnow or just participate in the Program if you happen to catch a pikeminnow?

1. Target
2. Not-target
3. DK, NA, R

A5. How did you generally hear about the Program?

1. Newspaper
2. Radio
3. TV
4. Word of mouth
5. State fishery agency
6. Other (please specify) ______________________________
7. DK, NA, R

A6. How important are the following factors in your participation in the Program? I will read you the factors, and you tell me whether it is "very important," "of some importance," or "not important."

	Very important	Of some importance	Not important	DK, NA, R
1. Payment for pikeminnow catches	____	____	____	____
2. Recreational opportunity	____	____	____	____
3. Covering expenses for fishing other targeted species	____	____	____	____
4. Participating in a salmon enhancement program	____	____	____	____

A7. This is an important question. Would a different reward system motivate you to fish more or less for pikeminnow? I will read you a list of system changes, and when I am done, you tell me which one of these would motivate you to fish the most and which the least. [Read list in random order.]

1. Increase per fish reward $1?
2. Relax the annual tiers by 100 fish?
3. Have $1,000 awards for most caught in weekly tournaments?
4. Have monthly random drawings with $1,000 prizes for those that fished during that month?
5. Increase number of specially tagged fish, but keep $5,000 prize the same?
6. Increase $5,000 prize for specially tagged fish, but keep the same number of tags?

B. Please answer the following questions as they pertain to a typical trip in 2003.

B1. Usual number of anglers in your party:

1. ____________ people
2. DK, NA, R

B2. Average age of people usually in your fishing trip:

1. 14-20
2. 21-30
3. 31-40
4. 41-50
5. 51-60
6. 61-70
7. >70
8. Varies too much to avg.
9. DK, NA, R

B3. Usual number of hours per trip spent fishing for pikeminnow:

1. ____________ hours per trip
2. DK, NA, R

B4. Usual miles traveled (one way) to fish:

1. <20
2. 20-39
3. 40-59
4. 60-79
5. 80-99
6. 100 or more
7. DK, NA, R

B5. If staying away from home, usual number of overnight days you stay in the area:

1. < 1 --> Go to Question B7
2. 1
3. 2
4. 3
5. 4
6. 5
7. >5
8. DK, NA, R

B6. Type of accommodation when you stay overnight:

1. Motel
2. State park
3. National park campground
4. Private campground
5. Friend or relative
6. Other (please specify) _______________
7. DK, NA, R

B7. Usual primary reason for the fishing trips when pikeminnow are caught:

1. Pikeminnow
2. Other fish
3. Combination of other fish and pikeminnow
4. Nonfishing activity
5. Other (please specify) _________
6. DK, NA, R

B8. Approximate amount spent on a typical trip by all party members in the following categories:

1. Restaurants: $ _____________
2. Grocery store: $ _____________
3. Accommodations: $ _____________
4. Gas: $ _____________
5. Fishing supplies: $ _____________
6. Bait: $ _____________
7. Other (please specify): _________________________________ $ _____________
8. DK, NA, R

B9. Primary fishing method your party used:

1. Boat, anchored
2. Boat, drifting
3. Boat, trolling
4. Shore
5. Angling, surface
6. Angling, bottom
7. Other (please specify): _________________________________
8. DK, NA, R

B10. Primary bait or tackle your party used:

1. Worms
2. Cut fish bait
3. Spinners
4. Spoons
5. Flatfish
6. Surface plugs
7. Hook and line with 1 hook
8. Hook and line with >l hook
9. Other (please specify): _________________________________
10. DK, NA, R

C. Please provide me some evaluation information about the Program.

C1. Were the 2003 check stations conveniently located for you?

1. _____ Yes --> Go to Question C3
2. _____ No
3. DK, NA, R --> Go to Question C3

C2. What new locations would you propose?

1. _____________________________
2. DK, NA, R

C3. Please tell us how many complaints in the following categories you heard from anglers. As I read you a list, you tell me "many complaints," "some," "few," or "none."

	Many	Some	Few	None	DK, NA, R
1. Boat Ramps					
a. Overcrowding on boat ramps	____	____	____	____	____
b. Size of boat ramps	____	____	____	____	____
c. Time waiting to launch	____	____	____	____	____
d. Other (specify) ______________	____	____	____	____	____
______________________________					
2. Fishing					
a. Crowding with other anglers	____	____	____	____	____
b. Crowding with commercial fishermen	____	____	____	____	____
c. Gear damage from crowding with anglers	____	____	____	____	____
d. Gear damage from crowding with commercial fishermen	____	____	____	____	____
e. Boats passing too fast	____	____	____	____	____
f. Jet skiers	____	____	____	____	____
g. Water skiers	____	____	____	____	____
h. Litter in water	____	____	____	____	____
i. Litter on banks	____	____	____	____	____
j. Other (specify) ______________	____	____	____	____	____
______________________________					
3. Registration and Check-In					
a. Registration processing time	____	____	____	____	____
b. Registration processing paperwork	____	____	____	____	____
c. Problems with other anglers	____	____	____	____	____
d. Check-in time	____	____	____	____	____
e. Check-in paperwork	____	____	____	____	____
f. Fish quality requirements	____	____	____	____	____
g. Other (specify) ______________	____	____	____	____	____
______________________________					

C4. Did you or your party hear compliments about the operation of the Program?

1. _____ Yes
2. _____ No --> Go to Question C6
3. DK, NA, R --> Go to Question C6

C5. Please specify the compliment:

1. ____
2. DK, NA, R

C6. We would like your evaluation of several parts of the Program's operation, and want to hear about any recommendations you have for change. I will mention a part and you tell me whether it's "good," "fair," or "poor." Then tell me any recommendation you might have for improvement.

1. a. Operating hours: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

2. a. Registration process: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

3. a. Fish check-in process: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

4. a. Data forms: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

5. a. Data collection process: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

6. a. Staffing: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

7. a. Equipment: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

8. a. Interaction with public: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

9. a. Station security: good ____ fair ____ poor ____ DK, NA, R ____
   b. Recommendations: ____
   ____

C7. Do you have other recommendations about the Program?

1. Yes (specify) ____
   ____
   ____
2. No
3. DK, NA, R

Speak the Terminate Dialog.

APPENDIX B

Increase in Harvestable Adults, Regional Economic Impacts, and Net Economic Values of Anadromous Fishing Due to Increased Salmonid Juvenile Survival of the Northern Pikeminnow Management Program

APPENDIX B

Increase in Harvestable Adults, Regional Economic Impacts, and Net Economic Values of Anadromous Fishing Due to Increased Salmonid Juvenile Survival of the Northern Pikeminnow Management Program

Contents:

Summary Table
Regional Economic Impact and Net Economic Value Results
by Alternatives for Ocean, Inland, and Hatchery Harvests

	Coho		Spring/Summer Chinook		Fall Chinook		Summer/Winter Steelhead		Total	
Regional Economic Impact										
Alternative I										
Ocean	560,089	71%	122,937	34%	883,590	68%	1,496	1%	1,568,112	58%
Inland	199,446	25%	133,961	37%	384,969	29%	207,392	91%	925,768	34%
Hatchery	33,012	4%	103,352	29%	38,940	3%	20,057	9%	195,360	7%
Total	792,546	100%	360,249	100%	1,307,499	100%	228,945	100%	2,689,240	100%
Alternative II										
Ocean	814,689	71%	178,820	34%	1,285,244	68%	2,176	1%	2,280,929	58%
Inland	290,108	25%	194,855	37%	559,965	29%	301,666	91%	1,346,594	34%
Hatchery	48,018	4%	150,332	29%	56,640	3%	29,174	9%	284,165	7%
Total	1,152,815	100%	524,008	100%	1,901,849	100%	333,017	100%	3,911,689	100%
Alternative III										
Ocean	1,897,002	71%	376,288	34%	3,098,545	68%	9,671	1%	5,381,506	55%
Inland	675,798	25%	409,400	37%	1,351,061	29%	1,340,807	91%	3,777,066	38%
Hatchery	112,029	4%	317,584	29%	136,516	3%	129,643	9%	695,772	7%
Total	2,684,829	100%	1,103,272	100%	4,586,122	100%	1,480,120	100%	9,854,343	100%
Net Economic Value										
Alternative I										
Ocean	447,716	74%	65,376	30%	497,317	65%	845	0%	1,011,253	56%
Inland	139,336	23%	92,095	43%	244,054	32%	197,204	94%	672,688	37%
Hatchery	20,166	3%	56,953	27%	23,910	3%	12,325	6%	113,354	6%
Total	607,218	100%	214,424	100%	765,280	100%	210,373	100%	1,797,295	100%
Alternative II										
Ocean	651,234	74%	95,093	30%	723,383	65%	1,229	0%	1,470,939	56%
Inland	202,674	23%	133,958	43%	354,993	32%	286,846	94%	978,472	37%
Hatchery	29,333	3%	82,843	27%	34,778	3%	17,928	6%	164,881	6%
Total	883,241	100%	311,894	100%	1,113,154	100%	306,003	100%	2,614,292	100%
Alternative III										
Ocean	1,516,487	74%	200,122	30%	1,743,763	65%	5,460	0%	3,465,832	51%
Inland	471,879	23%	281,375	43%	856,340	32%	1,274,899	94%	2,884,494	43%
Hatchery	68,435	3%	175,010	27%	83,823	3%	79,665	6%	406,934	6%
Total	2,056,802	100%	656,508	100%	2,683,927	100%	1,360,023	100%	6,757,260	100%

Table 1a

Project: Economic Evaluation of the NPMP
Statement: Adult Returns Due to NPMP
Date: July 15, 2004
Filter: Alternative I

Outmigrants:	CRFPC Estimate
SAR's	1970's-1990's Average
Contribution to Fisheries:	30-year Average
Unaltered Population Predation Rate:	8.0%
Predation Reduction:	25.0%
Inriver Survival Factor	2.35
Other Mortality	5.0%

Notes:

1. Outmigrant estimates are hatchery releases. The CRFPC hatchery release estimate is 143 million (68.8% planned from Sandos 2003) and the APRE estimate is 208 million. The outmigrant estimate for natural production is assumed to be a share of hatchery releases. The share is 5% coho, 30% spring/summer Chinook, 50% fall Chinook, and 30% summer/winter steelhead.
2. Predation reduction estimates from Friesen, Thomas A. and David L. Ward (1999).
3. The SAR for the "doubling the runs" scenario is the rate necessary to double the harvest from the 1980's Columbia River Basin anadromous fish contribution to fisheries. The hypothetical SAR's are pretty close to what is seen in 1999-2000 brood year return rates.
4. Inriver survival factor accounts for the saved juveniles not experiencing the passage mortality causes included in the overall SAR (Hankin and Richards 2000).
5. Other mortality accounts for differential effects on saved juveniles, such as predation from terns.

Stocks	Snake R.	U. Columbia	M. Columbia	L. Columbia	Willamette	Total
Coho						
Outmigrants	-	645,846	1,885,872	23,542,369	977,996	27,052,084
SAR's		1.20%	1.20%	2.50%	1.20%	
Unaltered Predation	-	51,668	150,870	1,883,390	78,240	2,164,167
Predation Reduction	-	12,917	37,717	470,847	19,560	541,042
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	-	28,837	84,204	1,051,167	43,668	1,207,876
Adult Returns	-	346	1,010	26,279	524	28,160
Spring/Summer Chinook						
Outmigrants	2,434,829	6,226,316	6,510,356	5,459,868	7,837,396	28,468,765
SAR's	0.37%	0.37%	0.37%	0.97%	0.97%	
Unaltered Predation	194,786	498,105	520,828	436,789	626,992	2,277,501
Predation Reduction	48,697	124,526	130,207	109,197	156,748	569,375
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	108,715	278,005	290,687	243,783	349,940	1,271,130
Adult Returns	402	1,029	1,076	2,365	3,394	8,266
Fall Chinook						
Outmigrants	891,620	17,939,983	34,923,345	111,827,230	-	165,582,178
SAR's	0.60%	0.60%	0.60%	0.32%	0.32%	
Unaltered Predation	71,330	1,435,199	2,793,868	8,946,178	-	13,246,574
Predation Reduction	17,832	358,800	698,467	2,236,545	-	3,311,644
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	39,811	801,020	1,559,327	4,993,086	-	7,393,244
Adult Returns	239	4,806	9,356	15,978	-	30,379
Summer/Winter Steelhead						
Outmigrants	13,407,612	1,417,207	557,978	3,923,427	1,523,203	20,829,428
SAR's	0.70%	0.70%	0.70%	0.40%	0.40%	
Unaltered Predation	1,072,609	113,377	44,638	313,874	121,856	1,666,354
Predation Reduction	268,152	28,344	11,160	78,469	30,464	416,589
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	598,650	63,278	24,914	175,181	68,011	930,034
Adult Returns	4,191	443	174	701	272	5,781
Total						
Outmigrants	16,734,061	26,229,352	43,877,551	144,752,895	10,338,595	241,932,454
Adult Survival Due to NPMP	4,832	6,624	11,616	45,322	4,190	72,585

Table 1b

Project: Economic Evaluation of the NPMP
Statement: Adult Returns Due to NPMP
Date: July 15, 2004
Filter: Alternative II

Outmigrants:	APRE Estimate
SAR's	1970's-1990's Average
Contribution to Fisheries:	1980's Average
Unaltered Population Predation Rate:	8.0%
Predation Reduction:	25.0%
Inriver Survival Factor	2.35
Other Mortality	5.0%

Notes:

1. Outmigrant estimates are hatchery releases. The CRFPC hatchery release estimate is 143 million (68.8% planned from Sandos 2003) and the APRE estimate is 208 million. The outmigrant estimate for natural production is assumed to be a share of hatchery releases. The share is 5% coho, 30% spring/summer Chinook, 50% fall Chinook, and 30% summer/winter steelhead.
2. Predation reduction estimates from Friesen, Thomas A. and David L. Ward (1999).
3. The SAR for the "doubling the runs" scenario is the rate necessary to double the harvest from the 1980's Columbia River Basin anadromous fish contribution to fisheries. The hypothetical SAR's are pretty close to what is seen in 1999-2000 brood year return rates.
4. Inriver survival factor accounts for the saved juveniles not experiencing the passage mortality causes included in the overall SAR (Hankin and Richards 2000).
5. Other mortality accounts for differential effects on saved juveniles, such as predation from terns.

Stocks	Snake R.	U. Columbia	M. Columbia	L. Columbia	Willamette	Total
Coho						
Outmigrants	-	939,429	2,743,134	34,244,035	1,422,564	39,349,161
SAR's		1.20%	1.20%	2.50%	1.20%	
Unaltered Predation	-	75,154	219,451	2,739,523	113,805	3,147,933
Predation Reduction	-	18,789	54,863	684,881	28,451	786,983
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	-	41,945	122,481	1,528,996	63,517	1,756,940
Adult Returns	-	503	1,470	38,225	762	40,960
Spring/Summer Chinook						
Outmigrants	3,541,631	9,056,615	9,469,771	7,941,762	11,400,045	41,409,824
SAR's	0.37%	0.37%	0.37%	0.97%	0.97%	
Unaltered Predation	283,330	724,529	757,582	635,341	912,004	3,312,786
Predation Reduction	70,833	181,132	189,395	158,835	228,001	828,196
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	158,134	404,378	422,825	354,600	509,012	1,848,949
Adult Returns	585	1,496	1,564	3,440	4,937	12,023
Fall Chinook						
Outmigrants	1,296,924	26,094,969	50,798,466	162,660,584	-	240,850,942
SAR's	0.60%	0.60%	0.60%	0.32%	0.32%	
Unaltered Predation	103,754	2,087,597	4,063,877	13,012,847	-	19,268,075
Predation Reduction	25,938	521,899	1,015,969	3,253,212	-	4,817,019
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	57,908	1,165,140	2,268,151	7,262,795	-	10,753,995
Adult Returns	347	6,991	13,609	23,241	-	44,188
Summer/Winter Steelhead						
Outmigrants	19,502,316	2,061,428	811,618	5,706,901	2,215,606	30,297,870
SAR's	0.70%	0.70%	0.70%	0.40%	0.40%	
Unaltered Predation	1,560,185	164,914	64,929	456,552	177,249	2,423,830
Predation Reduction	390,046	41,229	16,232	114,138	44,312	605,957
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	870,778	92,043	36,239	254,813	98,927	1,352,800
Adult Returns	6,095	644	254	1,019	396	8,408
Total						
Outmigrants	24,340,870	38,152,441	63,822,989	210,553,283	15,038,215	351,907,798
Adult Survival Due to NPMP	7,028	9,635	16,897	65,925	6,095	105,580

Table 1c

Project: Economic Evaluation of the NPMP
Statement: Adult Returns Due to NPMP
Date: July 15, 2004
Filter: Alternative III

Outmigrants:	APRE Estimate
SAR's	Doubling the Runs Objective
Contribution to Fisheries:	Double 1980's Average
Unaltered Population Predation Rate:	8.0%
Predation Reduction:	25.0%
Inriver Survival Factor	2.35
Other Mortality	5.0%

Notes:

1. Outmigrant estimates are hatchery releases. The CRFPC hatchery release estimate is 143 million (68.8% planned from Sandos 2003) and the APRE estimate is 208 million. The outmigrant estimate for natural production is assumed to be a share of hatchery releases. The share is 5% coho, 30% spring/summer Chinook, 50% fall Chinook, and 30% summer/ winter steelhead.
2. Predation reduction estimates from Friesen, Thomas A. and David L. Ward (1999).
3. The SAR for the "doubling the runs" scenario is the rate necessary to double the harvest from the 1980's Columbia River Basin anadromous fish contribution to fisheries. The hypothetical SAR's are pretty close to what is seen in 1999-2000 brood year return rates.
4. Inriver survival factor accounts for the saved juveniles not experiencing the passage mortality causes included in the overall SAR (Hankin and Richards 2000).
5. Other mortality accounts for differential effects on saved juveniles, such as predation from terns.

Stocks	Snake R.	U. Columbia	M. Columbia	L. Columbia	Willamette	Total
Coho						
Outmigrants	-	939,429	2,743,134	34,244,035	1,422,564	39,349,161
SAR's		2.98%	2.98%	5.80%	2.98%	
Unaltered Predation	-	75,154	219,451	2,739,523	113,805	3,147,933
Predation Reduction	-	18,789	54,863	684,881	28,451	786,983
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	-	41,945	122,481	1,528,996	63,517	1,756,940
Adult Returns	-	1,250	3,650	88,682	1,893	95,475
Spring/Summer Chinook						
Outmigrants	3,541,631	9,056,615	9,469,771	7,941,762	11,400,045	41,409,824
SAR's	0.79%	0.79%	0.79%	2.03%	2.04%	
Unaltered Predation	283,330	724,529	757,582	635,341	912,004	3,312,786
Predation Reduction	70,833	181,132	189,395	158,835	228,001	828,196
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	158,134	404,378	422,825	354,600	509,012	1,848,949
Adult Returns	1,249	3,195	3,340	7,198	10,384	25,366
Fall Chinook						
Outmigrants	1,296,924	26,094,969	50,798,466	162,660,584	-	240,850,942
SAR's	1.45%	1.45%	1.45%	0.77%	0.77%	
Unaltered Predation	103,754	2,087,597	4,063,877	13,012,847	-	19,268,075
Predation Reduction	25,938	521,899	1,015,969	3,253,212	-	4,817,019
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	57,908	1,165,140	2,268,151	7,262,795	-	10,753,995
Adult Returns	840	16,895	32,888	55,924	-	106,546
Summer/Winter Steelhead						
Outmigrants	19,502,316	2,061,428	811,618	5,706,901	2,215,606	30,297,870
SAR's	3.11%	3.11%	3.11%	1.78%	1.78%	
Unaltered Predation	1,560,185	164,914	64,929	456,552	177,249	2,423,830
Predation Reduction	390,046	41,229	16,232	114,138	44,312	605,957
Adjusted Reduction (predation reduction times inriver survival factor less other mortality)	870,778	92,043	36,239	254,813	98,927	1,352,800
Adult Returns	27,081	2,863	1,127	4,536	1,761	37,367
Total						
Outmigrants	24,340,870	38,152,441	63,822,989	210,553,283	15,038,215	351,907,798
Adult Survival Due to NPMP	29,170	24,202	41,005	156,339	14,038	264,754

Table 2a.1
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Coho

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	NA	346	1,010	26,279	524	28,160
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	0	--	0
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	7	20	1,183	10	1,220
b) Sport	NA	1	2	131	1	135
Washington ocean						
a) Commercial	NA	2	5	527	5	539
b) Sport	NA	35	101	3,942	105	4,182
Washington Puget Sound						
a) Commercial	NA	--	--	13	--	13
b) Sport	NA	--	--	13	--	13
Oregon						
a) Commercial	NA	17	51	3,154	52	3,274
b) Sport	NA	22	66	3,154	68	3,310
California						
a) Commercial	NA	5	15	263	16	299
b) Sport	NA	3	10	131	10	155
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	2	5	1,314	5	1,326
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	17	51	7,198	52	7,318
c) Tribal C & S	NA	152	444	--	--	596
Other	NA	1	4	--	4	10
Hatchery						
Hatchery requirement	NA	35	101	1,261	52	1,449
Hatchery surplus market	NA	23	68	1,998	71	2,160
Hatchery surplus carcass	NA	23	68	1,998	71	2,160

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Table 2a.2
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild)
by Geographic Region (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Spring/Summer Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	402	1,029	1,076	2,365	3,394	8,266
West Coast Harvest						
Alaska						
a) Commercial	10	26	27	213	305	581
b) Sport	--	--	--	2	3	6
British Columbia						
a) Commercial	20	51	54	260	373	759
b) Sport	2	5	5	24	34	70
Washington ocean						
a) Commercial	4	10	11	95	136	255
b) Sport	4	10	11	24	34	83
Washington Puget Sound						
a) Commercial	2	5	5	0	0	13
b) Sport	--	--	--	1	1	2
Oregon						
a) Commercial	2	5	5	24	34	70
b) Sport	2	5	5	24	34	70
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	236	339	576
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	236	339	576
c) Tribal C & S	13	34	35	--	--	82
Other	12	31	32	--	--	75
Hatchery						
Hatchery requirement	93	238	249	209	300	1,090
Hatchery surplus market	119	304	318	509	730	1,979
Hatchery surplus carcass	119	304	318	509	730	1,979

Table 2a.3
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild)
by Geographic Region (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Fall Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	239	4,806	9,356	15,978	NA	30,379
West Coast Harvest						
Alaska						
a) Commercial	14	288	561	240	NA	1,104
b) Sport	0	0	1	--	NA	1
British Columbia						
a) Commercial	60	1,202	2,339	3,196	NA	6,796
b) Sport	5	96	187	479	NA	767
Washington ocean						
a) Commercial	11	216	421	1,917	NA	2,565
b) Sport	5	96	187	1,598	NA	1,886
Washington Puget Sound						
a) Commercial	0	0	0	--	NA	0
b) Sport	0	0	0	--	NA	0
Oregon						
a) Commercial	4	72	140	479	NA	695
b) Sport	1	24	47	160	NA	232
California						
a) Commercial	0	0	0	80	NA	80
b) Sport	0	0	0	16	NA	16
Columbia Basin inland						
a) Freshwater sport						
Mainstem	2	48	94	799	NA	943
Tributary	--	--	--	--	NA	--
b) Gillnet	29	577	1,123	1,758	NA	3,486
c) Tribal C & S	63	1,267	2,465	--	NA	3,795
Other	0	7	14	--	NA	21
Hatchery						
Hatchery requirement	34	687	1,337	4,280	NA	6,337
Hatchery surplus market	6	113	220	488	NA	827
Hatchery surplus carcass	6	113	220	488	NA	827

Table 2a.4
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Summer/Winter Steelhead

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	4,191	443	174	701	272	5,781
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	1	0	0	0	0	2
British Columbia						
a) Commercial	42	4	2	7	3	58
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						
a) Commercial	--	--	--	--	--	--
b) Sport	1	0	0	0	0	2
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	257	27	11	315	122	733
Tributary	771	82	32	--	--	885
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	686	72	29	--	--	787
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	718	76	30	210	82	1,116
Hatchery surplus market	857	91	36	84	33	1,100
Hatchery surplus carcass	857	91	36	84	33	1,100

Table 2b.1
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild)
by Geographic Region (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: Coho

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	NA	503	1,470	38,225	762	40,960
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	0	--	0
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	10	29	1,720	15	1,775
b) Sport	NA	1	3	191	2	197
Washington ocean						
a) Commercial	NA	3	7	766	8	784
b) Sport	NA	50	147	5,734	152	6,083
Washington Puget Sound						
a) Commercial	NA	--	--	19	--	19
b) Sport	NA	--	--	19	--	19
Oregon						
a) Commercial	NA	25	73	4,587	76	4,762
b) Sport	NA	33	96	4,587	99	4,814
California						
a) Commercial	NA	8	22	382	23	435
b) Sport	NA	5	15	191	15	226
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	3	7	1,911	8	1,929
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	25	73	10,469	76	10,644
c) Tribal C & S	NA	221	645	--	--	866
Other	NA	2	6	--	6	14
Hatchery						
Hatchery requirement	NA	50	147	1,835	76	2,108
Hatchery surplus market	NA	34	99	2,906	103	3,142
Hatchery surplus carcass	NA	34	99	2,906	103	3,142

Table 2b.2
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: Spring/Summer Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	585	1,496	1,564	3,440	4,937	12,023
West Coast Harvest						
Alaska						
a) Commercial	15	37	39	310	444	845
b) Sport	--	--	--	3	5	8
British Columbia						
a) Commercial	29	75	78	378	543	1,104
b) Sport	3	7	8	34	49	102
Washington ocean						
a) Commercial	6	15	16	138	197	372
b) Sport	6	15	16	34	49	120
Washington Puget Sound						
a) Commercial	3	7	8	0	0	19
b) Sport	--	--	--	1	1	3
Oregon						
a) Commercial	3	7	8	34	49	102
b) Sport	3	7	8	34	49	102
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	344	494	838
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	344	494	838
c) Tribal C & S	19	49	51	--	--	119
Other	18	45	47	--	--	109
Hatchery						
Hatchery requirement	136	347	362	304	436	1,585
Hatchery surplus market	173	442	462	740	1,062	2,879
Hatchery surplus carcass	173	442	462	740	1,062	2,879

Table 2b.3
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: Fall Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	347	6,991	13,609	23,241	NA	44,188
West Coast Harvest						
Alaska						
a) Commercial	21	419	817	349	NA	1,605
b) Sport	0	1	1	--	NA	2
British Columbia						
a) Commercial	87	1,748	3,402	4,648	NA	9,885
b) Sport	7	140	272	697	NA	1,116
Washington ocean						
a) Commercial	16	315	612	2,789	NA	3,732
b) Sport	7	140	272	2,324	NA	2,743
Washington Puget Sound						
a) Commercial	0	0	0	--	NA	0
b) Sport	0	0	0	--	NA	0
Oregon						
a) Commercial	5	105	204	697	NA	1,011
b) Sport	2	35	68	232	NA	337
California						
a) Commercial	0	0	0	116	NA	116
b) Sport	0	0	0	23	NA	23
Columbia Basin inland						
a) Freshwater sport						
Mainstem	3	70	136	1,162	NA	1,372
Tributary	--	--	--	--	NA	--
b) Gillnet	42	839	1,633	2,557	NA	5,070
c) Tribal C & S	92	1,842	3,586	--	NA	5,520
Other	1	10	20	--	NA	30
Hatchery						
Hatchery requirement	50	999	1,944	6,225	NA	9,218
Hatchery surplus market	8	164	320	711	NA	1,203
Hatchery surplus carcass	8	164	320	711	NA	1,203

Table 2b.4
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: Summer/Winter Steelhead

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	6,095	644	254	1,019	396	8,408
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	2	0	0	0	0	3
British Columbia						
a) Commercial	61	6	3	10	4	84
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						
a) Commercial	--	--	--	--	--	--
b) Sport	2	0	0	0	0	3
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	374	40	16	459	178	1,066
Tributary	1,122	119	47	--	--	1,287
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	997	105	41	--	--	1,144
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	1,045	110	43	306	119	1,623
Hatchery surplus market	1,246	132	52	122	47	1,599
Hatchery surplus carcass	1,246	132	52	122	47	1,599

Table 2c.1
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild)
by Geographic Region (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: Coho

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	NA	1,250	3,650	88,682	1,893	95,475
West Coast Harvest						
Alaska						
a) Commercial	NA	--	--	1	--	1
b) Sport	NA	--	--	--	--	--
British Columbia						
a) Commercial	NA	25	73	3,991	38	4,127
b) Sport	NA	2	7	443	4	457
Washington ocean						
a) Commercial	NA	6	18	1,778	19	1,821
b) Sport	NA	125	365	13,302	379	14,171
Washington Puget Sound						
a) Commercial	NA	--	--	44	--	44
b) Sport	NA	--	--	44	--	44
Oregon						
a) Commercial	NA	62	182	10,642	189	11,076
b) Sport	NA	81	237	10,642	246	11,206
California						
a) Commercial	NA	19	55	887	57	1,017
b) Sport	NA	12	36	443	38	530
Columbia Basin inland						
a) Freshwater sport						
Mainstem	NA	6	18	4,434	19	4,478
Tributary	NA	--	--	--	--	--
b) Gillnet	NA	62	182	24,289	189	24,723
c) Tribal C & S	NA	549	1,602	--	--	2,151
Other	NA	5	15	--	15	35
Hatchery						
Hatchery requirement	NA	125	365	4,257	189	4,936
Hatchery surplus market	NA	84	246	6,742	256	7,328
Hatchery surplus carcass	NA	84	246	6,742	256	7,328

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Table 2c.2
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: Spring/Summer Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	1,249	3,195	3,340	7,198	10,384	25,366
West Coast Harvest						
Alaska						
a) Commercial	31	80	84	648	935	1,777
b) Sport	--	--	--	7	10	18
British Columbia						
a) Commercial	62	160	167	792	1,142	2,323
b) Sport	6	16	17	72	104	215
Washington ocean						
a) Commercial	12	32	33	288	415	781
b) Sport	12	32	33	72	104	254
Washington Puget Sound						
a) Commercial	6	16	17	1	1	41
b) Sport	--	--	--	2	3	5
Oregon						
a) Commercial	6	16	17	72	104	215
b) Sport	6	16	17	72	104	215
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	--	--	--	720	1,038	1,758
Tributary	--	--	--	--	--	--
b) Gillnet	--	--	--	720	1,038	1,758
c) Tribal C & S	41	104	109	--	--	254
Other	37	96	100	--	--	234
Hatchery						
Hatchery requirement	289	740	774	636	918	3,357
Hatchery surplus market	369	943	987	1,548	2,234	6,081
Hatchery surplus carcass	369	943	987	1,548	2,234	6,081

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Table 2c.3
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: Fall Chinook

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	840	16,895	32,888	55,924	NA	106,546
West Coast Harvest						
Alaska						
a) Commercial	50	1,014	1,973	839	NA	3,876
b) Sport	0	2	3	--	NA	5
British Columbia						
a) Commercial	210	4,224	8,222	11,185	NA	23,840
b) Sport	17	338	658	1,678	NA	2,690
Washington ocean						
a) Commercial	38	760	1,480	6,711	NA	8,989
b) Sport	17	338	658	5,592	NA	6,605
Washington Puget Sound						
a) Commercial	0	0	0	--	NA	0
b) Sport	0	0	0	--	NA	0
Oregon						
a) Commercial	13	253	493	1,678	NA	2,437
b) Sport	4	84	164	559	NA	812
California						
a) Commercial	0	0	0	280	NA	280
b) Sport	0	0	0	56	NA	56
Columbia Basin inland						
a) Freshwater sport						
Mainstem	8	169	329	2,796	NA	3,302
Tributary	--	--	--	--	NA	--
b) Gillnet	101	2,027	3,947	6,152	NA	12,226
c) Tribal C & S	221	4,452	8,667	--	NA	13,340
Other	1	24	48	--	NA	73
Hatchery						
Hatchery requirement	120	2,414	4,698	14,980	NA	22,211
Hatchery surplus market	20	397	774	1,710	NA	2,901
Hatchery surplus carcass	20	397	774	1,710	NA	2,901

Table 2c.4
Estimated Columbia River Basin Salmon/Steelhead Production in Terms of Surviving Adults (Hatchery and Wild) by Geographic Region (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: Summer/Winter Steelhead

	Snake River	Upper Columbia	Middle Columbia	Lower Columbia	Willamette	Number of smolts released and fish harvested in area
Survived adults due to NPMP	27,081	2,863	1,127	4,536	1,761	37,367
West Coast Harvest						
Alaska						
a) Commercial	--	--	--	--	--	--
b) Sport	8	1	0	1	1	11
British Columbia						
a) Commercial	271	29	11	45	18	374
b) Sport	--	--	--	--	--	--
Washington ocean						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Washington Puget Sound						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Oregon						
a) Commercial	--	--	--	--	--	--
b) Sport	8	1	0	1	1	11
California						
a) Commercial	--	--	--	--	--	--
b) Sport	--	--	--	--	--	--
Columbia Basin inland						
a) Freshwater sport						
Mainstem	1,661	176	69	2,041	792	4,740
Tributary	4,984	527	207	--	--	5,718
b) Gillnet	--	--	--	--	--	--
c) Tribal C & S	4,430	468	184	--	--	5,083
Other	--	--	--	--	--	--
Hatchery						
Hatchery requirement	4,642	491	193	1,361	528	7,215
Hatchery surplus market	5,538	585	230	543	211	7,107
Hatchery surplus carcass	5,538	585	230	543	211	7,107

Table 3a.1

Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Coho	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Upper Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	126	60	42	36	167	2%	96	2%
Washington ocean	22	10	2,076	1,780	2,098	29%	1,790	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	302	159	1,350	1,157	1,651	23%	1,315	25%
California	107	49	208	178	315	4%	227	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	104	89	104	1%	89	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	262	156	0	0	262	4%	156	3%
Tribal	2,301	1,366	0	0	2,301	32%	1,366	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	279	170	0	0	279	4%	170	3%
Hatchery carcass	116	71	0	0	116	2%	71	1%
Total with hatchery surplus utilization					7,293	100%	5,279	100%
Total without hatchery surplus utilization					6,898		5,038	
Middle Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	367	176	121	104	488	2%	280	2%
Washington ocean	63	30	6,063	5,197	6,126	29%	5,227	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	881	463	3,941	3,378	4,821	23%	3,841	25%
California	313	142	606	520	919	4%	661	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	303	260	303	1%	260	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	765	454	0	0	765	4%	454	3%
Tribal	6,720	3,988	0	0	6,720	32%	3,988	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	814	497	0	0	814	4%	497	3%
Hatchery carcass	339	208	0	0	339	2%	208	1%
Total with hatchery surplus utilization					21,296	100%	15,416	100%
Total without hatchery surplus utilization					20,143		14,711	

Species: **Coho**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	6	3	0	0	6	0%	3	0%
British Columbia	21,464	10,288	7,884	6,758	29,347	4%	17,046	3%
Washington ocean	6,581	3,156	236,513	202,731	243,093	32%	205,887	36%
Washington Puget Sound	222	114	788	676	1,010	0%	790	0%
Oregon	54,966	28,918	189,210	162,185	244,176	33%	191,102	33%
California	5,427	2,457	7,884	6,758	13,310	2%	9,215	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	78,838	67,577	78,838	11%	67,577	12%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	109,044	64,706	0	0	109,044	15%	64,706	11%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	23,855	14,545	0	0	23,855	3%	14,545	3%
Hatchery carcass	6,519	4,009	0	0	6,519	1%	4,009	1%
Total with hatchery surplus utilization					749,197	100%	574,879	100%
Total without hatchery surplus utilization					718,824		556,325	
Willamette								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	190	91	63	54	253	2%	145	1%
Washington ocean	65	31	6,288	5,390	6,354	43%	5,421	47%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	913	481	4,087	3,503	5,001	34%	3,984	34%
California	325	147	629	539	953	6%	686	6%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	314	269	314	2%	269	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	794	471	0	0	794	5%	471	4%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	845	515	0	0	845	6%	515	4%
Hatchery carcass	246	151	0	0	246	2%	151	1%
Total with hatchery surplus utilization					14,760	100%	11,643	100%
Total without hatchery surplus utilization					13,669		10,977	
Total								
Alaska	6	3	0	0	6	0%	3	0%
British Columbia	22,146	10,616	8,109	6,951	30,256	4%	17,567	3%
Washington ocean	6,731	3,228	250,940	215,097	257,671	33%	218,325	36%
Washington Puget Sound	222	114	788	676	1,010	0%	790	0%
Oregon	57,061	30,020	198,588	170,223	255,649	32%	200,243	33%
California	6,171	2,794	9,326	7,994	15,498	2%	10,789	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	79,559	68,195	79,559	10%	68,195	11%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	110,865	65,787	0	0	110,865	14%	65,787	11%
Tribal	9,022	5,354	0	0	9,022	1%	5,354	1%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	25,793	15,726	0	0	25,793	3%	15,726	3%
Hatchery carcass	7,219	4,440	0	0	7,219	1%	4,440	1%
Total with hatchery surplus utilization					792,546	100%	607,218	100%
Total without hatchery surplus utilization					759,535		587,052	

Table 3a.2

Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Spring/Summer Chinook	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	695	340	0	0	695	7%	340	6%
British Columbia	1,408	690	121	103	1,528	15%	793	14%
Washington ocean	194	95	241	207	436	4%	302	5%
Washington Puget Sound	83	43	0	0	83	1%	43	1%
Oregon	85	44	121	103	205	2%	147	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	1,295	656	0	0	1,295	12%	656	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	5,835	3,192	0	0	5,835	56%	3,192	56%
Hatchery carcass	424	261	0	0	424	4%	261	5%
Total with hatchery surplus utilization					10,502	100%	5,734	100%
Total without hatchery surplus utilization					4,243		2,282	
Upper Columbia								
Alaska	1,778	870	0	0	1,778	7%	870	6%
British Columbia	3,600	1,764	309	265	3,908	15%	2,029	14%
Washington ocean	497	244	617	529	1,114	4%	773	5%
Washington Puget Sound	212	109	0	0	212	1%	109	1%
Oregon	216	111	309	265	525	2%	376	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	3,313	1,678	0	0	3,313	12%	1,678	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	14,922	8,163	0	0	14,922	56%	8,163	56%
Hatchery carcass	1,084	667	0	0	1,084	4%	667	5%
Total with hatchery surplus utilization					26,856	100%	14,664	100%
Total without hatchery surplus utilization					10,850		5,834	
Middle Columbia								
Alaska	1,859	910	0	0	1,859	7%	910	6%
British Columbia	3,764	1,845	323	277	4,087	15%	2,121	14%
Washington ocean	520	255	645	553	1,165	4%	808	5%
Washington Puget Sound	222	114	0	0	222	1%	114	1%
Oregon	226	116	323	277	549	2%	393	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	3,464	1,755	0	0	3,464	12%	1,755	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	15,603	8,535	0	0	15,603	56%	8,535	56%
Hatchery carcass	1,134	697	0	0	1,134	4%	697	5%
Total with hatchery surplus utilization					28,082	100%	15,333	100%
Total without hatchery surplus utilization					11,345		6,101	

Species: Spring/Summer Chinook	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	14,717	7,200	142	122	14,859	12%	7,321	10%
British Columbia	18,206	8,922	1,419	1,216	19,624	16%	10,138	14%
Washington ocean	4,570	2,240	1,419	1,216	5,988	5%	3,456	5%
Washington Puget Sound	10	5	43	36	52	0%	41	0%
Oregon	994	512	1,419	1,216	2,413	2%	1,728	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	28,376	24,323	28,376	23%	24,323	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	23,314	11,812	0	0	23,314	19%	11,812	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	24,987	13,668	0	0	24,987	21%	13,668	19%
Hatchery carcass	1,435	883	0	0	1,435	1%	883	1%
Total with hatchery surplus utilization					121,049	100%	73,371	100%
Total without hatchery surplus utilization					94,627		58,820	
Willamette								
Alaska	21,125	10,335	204	175	21,329	12%	10,510	10%
British Columbia	26,133	12,807	2,037	1,746	28,170	16%	14,553	14%
Washington ocean	6,559	3,215	2,037	1,746	8,596	5%	4,961	5%
Washington Puget Sound	14	7	61	52	75	0%	60	0%
Oregon	1,427	735	2,037	1,746	3,464	2%	2,481	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	40,733	34,915	40,733	23%	34,915	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	33,466	16,955	0	0	33,466	19%	16,955	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	35,867	19,620	0	0	35,867	21%	19,620	19%
Hatchery carcass	2,060	1,267	0	0	2,060	1%	1,267	1%
Total with hatchery surplus utilization					173,760	100%	105,321	100%
Total without hatchery surplus utilization					135,832		84,434	
Total								
Alaska	40,175	19,655	346	296	40,520	11%	19,951	9%
British Columbia	53,110	26,028	4,207	3,606	57,317	16%	29,634	14%
Washington ocean	12,340	6,049	4,959	4,251	17,299	5%	10,300	5%
Washington Puget Sound	540	278	104	89	644	0%	367	0%
Oregon	2,949	1,518	4,207	3,606	7,156	2%	5,125	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	69,109	59,238	69,109	19%	59,238	28%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	56,779	28,767	0	0	56,779	16%	28,767	13%
Tribal	8,072	4,090	0	0	8,072	2%	4,090	2%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	97,214	53,179	0	0	97,214	27%	53,179	25%
Hatchery carcass	6,137	3,774	0	0	6,137	2%	3,774	2%
Total with hatchery surplus utilization					360,249	100%	214,424	100%
Total without hatchery surplus utilization					256,897		157,470	

Table 3a.3

Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Fall Chinook	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	991	485	1	1	992	9%	486	8%
British Columbia	4,180	2,048	287	246	4,466	42%	2,294	39%
Washington ocean	519	255	287	246	806	8%	500	8%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	151	78	72	61	222	2%	139	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	215	184	215	2%	184	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	1,182	674	0	0	1,182	11%	674	11%
Tribal	2,595	1,481	0	0	2,595	24%	1,481	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	167	103	0	0	167	2%	103	2%
Hatchery carcass	79	49	0	0	79	1%	49	1%
Total with hatchery surplus utilization					10,725	100%	5,911	100%
Total without hatchery surplus utilization					10,478		5,759	
Upper Columbia								
Alaska	19,941	9,755	29	25	19,969	9%	9,780	8%
British Columbia	84,095	41,212	5,767	4,944	89,862	42%	46,156	39%
Washington ocean	10,448	5,121	5,767	4,944	16,216	8%	10,065	8%
Washington Puget Sound	1	1	1	1	2	0%	2	0%
Oregon	3,031	1,561	1,442	1,236	4,473	2%	2,797	2%
California	1	1	1	1	3	0%	2	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	4,326	3,708	4,326	2%	3,708	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	23,773	13,571	0	0	23,773	11%	13,571	11%
Tribal	52,206	29,801	0	0	52,206	24%	29,801	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	3,364	2,063	0	0	3,364	2%	2,063	2%
Hatchery carcass	1,599	984	0	0	1,599	1%	984	1%
Total with hatchery surplus utilization					215,793	100%	118,928	100%
Total without hatchery surplus utilization					210,830		115,881	
Middle Columbia								
Alaska	38,818	18,991	56	48	38,874	9%	19,039	8%
British Columbia	163,706	80,227	11,227	9,624	174,933	42%	89,851	39%
Washington ocean	20,339	9,970	11,227	9,624	31,567	8%	19,593	8%
Washington Puget Sound	2	1	3	2	5	0%	3	0%
Oregon	5,901	3,038	2,807	2,406	8,708	2%	5,444	2%
California	3	1	3	2	5	0%	3	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	8,420	7,218	8,420	2%	7,218	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	46,278	26,418	0	0	46,278	11%	26,418	11%
Tribal	101,628	58,013	0	0	101,628	24%	58,013	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	6,548	4,017	0	0	6,548	2%	4,017	2%
Hatchery carcass	3,113	1,915	0	0	3,113	1%	1,915	1%
Total with hatchery surplus utilization					420,080	100%	231,514	100%
Total without hatchery surplus utilization					410,418		225,582	

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Species: **Fall Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	16,573	8,108	0	0	16,573	3%	8,108	2%
British Columbia	223,658	109,608	28,760	24,652	252,418	38%	134,260	33%
Washington ocean	92,627	45,403	95,867	82,174	188,494	29%	127,577	31%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	20,156	10,378	9,587	8,217	29,743	5%	18,595	5%
California	4,298	1,800	959	822	5,257	1%	2,622	1%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	71,900	61,631	71,900	11%	61,631	15%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	72,447	41,356	0	0	72,447	11%	41,356	10%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	14,532	8,915	0	0	14,532	2%	8,915	2%
Hatchery carcass	9,537	5,865	0	0	9,537	1%	5,865	1%
Total with hatchery surplus utilization					660,901	100%	408,928	100%
Total without hatchery surplus utilization					636,833		394,148	
Willamette								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Total								
Alaska	76,323	37,339	86	74	76,409	6%	37,413	5%
British Columbia	475,639	233,096	46,041	39,465	521,680	40%	272,561	36%
Washington ocean	123,934	60,748	113,148	96,987	237,082	18%	157,735	21%
Washington Puget Sound	3	2	4	4	7	0%	5	0%
Oregon	29,239	15,054	13,907	11,921	43,146	3%	26,975	4%
California	4,302	1,802	963	825	5,265	0%	2,627	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	84,861	72,740	84,861	6%	72,740	10%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	143,680	82,018	0	0	143,680	11%	82,018	11%
Tribal	156,428	89,295	0	0	156,428	12%	89,295	12%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	24,611	15,097	0	0	24,611	2%	15,097	2%
Hatchery carcass	14,329	8,812	0	0	14,329	1%	8,812	1%
Total with hatchery surplus utilization					1,307,499	100%	765,280	100%
Total without hatchery surplus utilization					1,268,559		741,371	

Table 3a.4

Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative I, Existing Smolt Releases (Hatchery and Wild) as Estimated by Friesen and Ward and Others)

Species: Summer/Winter Steelhead	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	0	0	75	66	75	0%	66	0%
British Columbia	934	479	0	0	934	1%	479	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	75	66	75	0%	66	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	30,850	27,173	30,850	20%	27,173	19%
Tributary	0	0	92,549	97,531	92,549	61%	97,531	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	11,579	6,849	0	0	11,579	8%	6,849	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	12,177	7,481	0	0	12,177	8%	7,481	5%
Hatchery carcass	3,151	1,938	0	0	3,151	2%	1,938	1%
Total with hatchery surplus utilization					151,390	100%	141,585	100%
Total without hatchery surplus utilization					136,062		132,166	
Upper Columbia								
Alaska	0	0	8	7	8	0%	7	0%
British Columbia	99	51	0	0	99	1%	51	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	8	7	8	0%	7	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	3,261	2,872	3,261	20%	2,872	19%
Tributary	0	0	9,783	10,309	9,783	61%	10,309	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	1,224	724	0	0	1,224	8%	724	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,287	791	0	0	1,287	8%	791	5%
Hatchery carcass	333	205	0	0	333	2%	205	1%
Total with hatchery surplus utilization					16,002	100%	14,966	100%
Total without hatchery surplus utilization					14,382		13,970	
Middle Columbia								
Alaska	0	0	3	3	3	0%	3	0%
British Columbia	39	20	0	0	39	1%	20	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	3	3	3	0%	3	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	1,284	1,131	1,284	20%	1,131	19%
Tributary	0	0	3,852	4,059	3,852	61%	4,059	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	482	285	0	0	482	8%	285	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	507	311	0	0	507	8%	311	5%
Hatchery carcass	131	81	0	0	131	2%	81	1%
Total with hatchery surplus utilization					6,300	100%	5,892	100%
Total without hatchery surplus utilization					5,662		5,500	

Species: **Summer/Winter Steelhead**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	0	0	13	11	13	0%	11	0%
British Columbia	156	80	0	0	156	0%	80	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	13	11	13	0%	11	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	37,839	33,330	37,839	95%	33,330	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,192	732	0	0	1,192	3%	732	2%
Hatchery carcass	588	362	0	0	588	1%	362	1%
Total with hatchery surplus utilization					39,801	100%	34,526	100%
Total without hatchery surplus utilization					38,020		33,432	
Willamette								
Alaska	0	0	5	4	5	0%	4	0%
British Columbia	61	31	0	0	61	0%	31	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	5	4	5	0%	4	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	14,690	12,940	14,690	95%	12,940	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	463	284	0	0	463	3%	284	2%
Hatchery carcass	228	140	0	0	228	1%	140	1%
Total with hatchery surplus utilization					15,452	100%	13,404	100%
Total without hatchery surplus utilization					14,761		12,980	
Total								
Alaska	0	0	104	92	104	0%	92	0%
British Columbia	1,288	661	0	0	1,288	1%	661	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	104	92	104	0%	92	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	87,924	77,446	87,924	38%	77,446	37%
Tributary	0	0	106,183	111,900	106,183	46%	111,900	53%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	13,285	7,858	0	0	13,285	6%	7,858	4%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	15,626	9,600	0	0	15,626	7%	9,600	5%
Hatchery carcass	4,431	2,725	0	0	4,431	2%	2,725	1%
Total with hatchery surplus utilization					228,945	100%	210,373	100%
Total without hatchery surplus utilization					208,888		198,048	

Table 3b.1
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: **Coho**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Upper Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	183	88	60	52	243	2%	139	2%
Washington ocean	31	15	3,020	2,589	3,052	29%	2,604	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	439	231	1,963	1,683	2,402	23%	1,913	25%
California	156	71	302	259	458	4%	329	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	151	129	151	1%	129	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	381	226	0	0	381	4%	226	3%
Tribal	3,348	1,987	0	0	3,348	32%	1,987	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	406	247	0	0	406	4%	247	3%
Hatchery carcass	169	104	0	0	169	2%	104	1%
Total with hatchery surplus utilization					10,609	100%	7,679	100%
Total without hatchery surplus utilization					10,034		7,328	
Middle Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	534	256	176	151	710	2%	407	2%
Washington ocean	92	44	8,819	7,559	8,910	29%	7,603	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	1,281	674	5,732	4,913	7,013	23%	5,587	25%
California	455	206	882	756	1,337	4%	962	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	441	378	441	1%	378	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	1,113	661	0	0	1,113	4%	661	3%
Tribal	9,775	5,801	0	0	9,775	32%	5,801	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,185	722	0	0	1,185	4%	722	3%
Hatchery carcass	492	303	0	0	492	2%	303	1%
Total with hatchery surplus utilization					30,977	100%	22,424	100%
Total without hatchery surplus utilization					29,300		21,399	

Species: Coho	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	8	4	0	0	8	0%	4	0%
British Columbia	31,220	14,965	11,467	9,830	42,688	4%	24,795	3%
Washington ocean	9,572	4,591	344,024	294,886	353,597	32%	299,477	36%
Washington Puget Sound	323	166	1,147	983	1,470	0%	1,149	0%
Oregon	79,951	42,063	275,219	235,909	355,171	33%	277,972	33%
California	7,893	3,574	11,467	9,830	19,361	2%	13,404	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	114,675	98,295	114,675	11%	98,295	12%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	158,612	94,120	0	0	158,612	15%	94,120	11%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	34,698	21,156	0	0	34,698	3%	21,156	3%
Hatchery carcass	9,482	5,831	0	0	9,482	1%	5,831	1%
Total with hatchery surplus utilization					1,089,760	100%	836,202	100%
Total without hatchery surplus utilization					1,045,580		809,214	
Willamette								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	277	133	91	78	368	2%	211	1%
Washington ocean	95	46	9,147	7,840	9,242	43%	7,886	47%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	1,329	699	5,945	5,096	7,274	34%	5,795	34%
California	472	214	915	784	1,387	6%	998	6%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	457	392	457	2%	392	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	1,155	685	0	0	1,155	5%	685	4%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,229	749	0	0	1,229	6%	749	4%
Hatchery carcass	358	220	0	0	358	2%	220	1%
Total with hatchery surplus utilization					21,469	100%	16,936	100%
Total without hatchery surplus utilization					19,883		15,967	
Total								
Alaska	8	4	0	0	8	0%	4	0%
British Columbia	32,213	15,441	11,796	10,111	44,009	4%	25,552	3%
Washington ocean	9,791	4,696	365,009	312,874	374,800	33%	317,569	36%
Washington Puget Sound	323	166	1,147	983	1,470	0%	1,149	0%
Oregon	82,999	43,666	288,860	247,601	371,859	32%	291,267	33%
California	8,977	4,065	13,566	11,628	22,543	2%	15,693	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	115,724	99,195	115,724	10%	99,195	11%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	161,261	95,692	0	0	161,261	14%	95,692	11%
Tribal	13,123	7,787	0	0	13,123	1%	7,787	1%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	37,517	22,875	0	0	37,517	3%	22,875	3%
Hatchery carcass	10,501	6,458	0	0	10,501	1%	6,458	1%
Total with hatchery surplus utilization					1,152,815	100%	883,241	100%
Total without hatchery surplus utilization					1,104,797		853,908	

Table 3b.2
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: Spring/Summer Chinook	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	1,011	495	0	0	1,011	7%	495	6%
British Columbia	2,048	1,003	176	150	2,223	15%	1,154	14%
Washington ocean	283	139	351	301	634	4%	439	5%
Washington Puget Sound	121	62	0	0	121	1%	62	1%
Oregon	123	63	176	150	299	2%	214	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	1,884	955	0	0	1,884	12%	955	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	8,488	4,643	0	0	8,488	56%	4,643	56%
Hatchery carcass	617	379	0	0	617	4%	379	5%
Total with hatchery surplus utilization					15,276	100%	8,341	100%
Total without hatchery surplus utilization					6,172		3,319	
Upper Columbia								
Alaska	2,587	1,265	0	0	2,587	7%	1,265	6%
British Columbia	5,236	2,566	449	385	5,685	15%	2,951	14%
Washington ocean	723	354	898	769	1,621	4%	1,124	5%
Washington Puget Sound	308	159	0	0	308	1%	159	1%
Oregon	315	162	449	385	763	2%	547	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	4,819	2,441	0	0	4,819	12%	2,441	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	21,705	11,873	0	0	21,705	56%	11,873	56%
Hatchery carcass	1,577	970	0	0	1,577	4%	970	5%
Total with hatchery surplus utilization					39,065	100%	21,330	100%
Total without hatchery surplus utilization					15,782		8,487	
Middle Columbia								
Alaska	2,705	1,323	0	0	2,705	7%	1,323	6%
British Columbia	5,475	2,683	469	402	5,944	15%	3,085	14%
Washington ocean	756	370	939	805	1,694	4%	1,175	5%
Washington Puget Sound	322	166	0	0	322	1%	166	1%
Oregon	329	169	469	402	798	2%	572	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	5,039	2,553	0	0	5,039	12%	2,553	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	22,695	12,415	0	0	22,695	56%	12,415	56%
Hatchery carcass	1,649	1,014	0	0	1,649	4%	1,014	5%
Total with hatchery surplus utilization					40,847	100%	22,303	100%
Total without hatchery surplus utilization					16,502		8,874	

Species: Spring/Summer Chinook	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	21,406	10,473	206	177	21,613	12%	10,650	10%
British Columbia	26,481	12,978	2,064	1,769	28,545	16%	14,747	14%
Washington ocean	6,647	3,258	2,064	1,769	8,710	5%	5,027	5%
Washington Puget Sound	14	7	62	53	76	0%	60	0%
Oregon	1,446	745	2,064	1,769	3,510	2%	2,514	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	41,275	35,380	41,275	23%	35,380	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	33,911	17,181	0	0	33,911	19%	17,181	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	36,345	19,882	0	0	36,345	21%	19,882	19%
Hatchery carcass	2,088	1,284	0	0	2,088	1%	1,284	1%
Total with hatchery surplus utilization					176,074	100%	106,724	100%
Total without hatchery surplus utilization					137,641		85,558	
Willamette								
Alaska	30,728	15,033	296	254	31,024	12%	15,287	10%
British Columbia	38,013	18,629	2,962	2,539	40,975	16%	21,168	14%
Washington ocean	9,541	4,677	2,962	2,539	12,504	5%	7,216	5%
Washington Puget Sound	20	10	89	76	109	0%	87	0%
Oregon	2,076	1,069	2,962	2,539	5,039	2%	3,608	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	59,249	50,786	59,249	23%	50,786	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	48,678	24,662	0	0	48,678	19%	24,662	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	52,172	28,539	0	0	52,172	21%	28,539	19%
Hatchery carcass	2,997	1,843	0	0	2,997	1%	1,843	1%
Total with hatchery surplus utilization					252,746	100%	153,197	100%
Total without hatchery surplus utilization					197,578		122,815	
Total								
Alaska	58,437	28,589	503	431	58,940	11%	29,020	9%
British Columbia	77,252	37,859	6,120	5,246	83,372	16%	43,105	14%
Washington ocean	17,949	8,798	7,214	6,183	25,163	5%	14,981	5%
Washington Puget Sound	786	404	151	129	937	0%	533	0%
Oregon	4,289	2,208	6,120	5,246	10,409	2%	7,454	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	100,524	86,166	100,524	19%	86,166	28%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	82,589	41,843	0	0	82,589	16%	41,843	13%
Tribal	11,742	5,949	0	0	11,742	2%	5,949	2%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	141,405	77,352	0	0	141,405	27%	77,352	25%
Hatchery carcass	8,927	5,490	0	0	8,927	2%	5,490	2%
Total with hatchery surplus utilization					524,008	100%	311,894	100%
Total without hatchery surplus utilization					373,675		229,052	

Table 3b.3
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: **Fall Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	1,442	705	2	2	1,444	9%	707	8%
British Columbia	6,079	2,979	417	357	6,496	42%	3,337	39%
Washington ocean	755	370	417	357	1,172	8%	728	8%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	219	113	104	89	323	2%	202	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	313	268	313	2%	268	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	1,719	981	0	0	1,719	11%	981	11%
Tribal	3,774	2,154	0	0	3,774	24%	2,154	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	243	149	0	0	243	2%	149	2%
Hatchery carcass	116	71	0	0	116	1%	71	1%
Total with hatchery surplus utilization					15,600	100%	8,598	100%
Total without hatchery surplus utilization					15,241		8,377	
Upper Columbia								
Alaska	29,005	14,190	42	36	29,047	9%	14,226	8%
British Columbia	122,322	59,946	8,389	7,191	130,711	42%	67,137	39%
Washington ocean	15,198	7,449	8,389	7,191	23,587	8%	14,640	8%
Washington Puget Sound	1	1	2	2	4	0%	3	0%
Oregon	4,409	2,270	2,097	1,798	6,507	2%	4,068	2%
California	2	1	2	2	4	0%	3	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	6,292	5,393	6,292	2%	5,393	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	34,580	19,739	0	0	34,580	11%	19,739	11%
Tribal	75,937	43,348	0	0	75,937	24%	43,348	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	4,893	3,001	0	0	4,893	2%	3,001	2%
Hatchery carcass	2,326	1,431	0	0	2,326	1%	1,431	1%
Total with hatchery surplus utilization					313,887	100%	172,989	100%
Total without hatchery surplus utilization					306,667		168,557	
Middle Columbia								
Alaska	56,463	27,623	82	70	56,545	9%	27,693	8%
British Columbia	238,122	116,696	16,331	13,998	254,453	42%	130,695	39%
Washington ocean	29,585	14,502	16,331	13,998	45,916	8%	28,500	8%
Washington Puget Sound	3	1	4	3	7	0%	5	0%
Oregon	8,584	4,419	4,083	3,500	12,666	2%	7,919	2%
California	4	2	4	3	8	0%	5	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	12,248	10,499	12,248	2%	10,499	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	67,315	38,426	0	0	67,315	11%	38,426	11%
Tribal	147,825	84,384	0	0	147,825	24%	84,384	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	9,525	5,843	0	0	9,525	2%	5,843	2%
Hatchery carcass	4,529	2,785	0	0	4,529	1%	2,785	1%
Total with hatchery surplus utilization					611,036	100%	336,754	100%
Total without hatchery surplus utilization					596,982		328,126	

Species: **Fall Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	24,107	11,794	0	0	24,107	3%	11,794	2%
British Columbia	325,327	159,433	41,834	35,858	367,160	38%	195,291	33%
Washington ocean	134,732	66,041	139,446	119,528	274,178	29%	185,570	31%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	29,318	15,095	13,945	11,953	43,263	5%	27,048	5%
California	6,252	2,618	1,394	1,195	7,646	1%	3,813	1%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	104,584	89,646	104,584	11%	89,646	15%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	105,379	60,155	0	0	105,379	11%	60,155	10%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	21,138	12,967	0	0	21,138	2%	12,967	2%
Hatchery carcass	13,872	8,531	0	0	13,872	1%	8,531	1%
Total with hatchery surplus utilization					961,327	100%	594,814	100%
Total without hatchery surplus utilization					926,318		573,316	
Willamette								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Total								
Alaska	111,017	54,312	126	108	111,142	6%	54,420	5%
British Columbia	691,850	339,055	66,970	57,405	758,821	40%	396,460	36%
Washington ocean	180,271	88,363	164,582	141,074	344,853	18%	229,437	21%
Washington Puget Sound	4	2	6	5	11	0%	8	0%
Oregon	42,531	21,898	20,229	17,339	62,760	3%	39,237	4%
California	6,257	2,620	1,401	1,201	7,658	0%	3,821	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	123,437	105,806	123,437	6%	105,806	10%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	208,992	119,301	0	0	208,992	11%	119,301	11%
Tribal	227,536	129,886	0	0	227,536	12%	129,886	12%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	35,798	21,960	0	0	35,798	2%	21,960	2%
Hatchery carcass	20,842	12,818	0	0	20,842	1%	12,818	1%
Total with hatchery surplus utilization					1,901,849	100%	1,113,154	100%
Total without hatchery surplus utilization					1,845,209		1,078,376	

Table 3b.4
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative II, NMFS Cap and 1970's and 1990's Actual Survival Rates)

Species: **Summer/Winter Steelhead**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	0	0	110	97	110	0%	97	0%
British Columbia	1,358	697	0	0	1,358	1%	697	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	110	97	110	0%	97	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	44,873	39,526	44,873	20%	39,526	19%
Tributary	0	0	134,619	141,866	134,619	61%	141,866	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	16,842	9,962	0	0	16,842	8%	9,962	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	17,712	10,882	0	0	17,712	8%	10,882	5%
Hatchery carcass	4,583	2,818	0	0	4,583	2%	2,818	1%
Total with hatchery surplus utilization					220,208	100%	205,945	100%
Total without hatchery surplus utilization					197,912		192,245	
Upper Columbia								
Alaska	0	0	12	10	12	0%	10	0%
British Columbia	144	74	0	0	144	1%	74	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	12	10	12	0%	10	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	4,743	4,178	4,743	20%	4,178	19%
Tributary	0	0	14,229	14,996	14,229	61%	14,996	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	1,780	1,053	0	0	1,780	8%	1,053	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,872	1,150	0	0	1,872	8%	1,150	5%
Hatchery carcass	484	298	0	0	484	2%	298	1%
Total with hatchery surplus utilization					23,276	100%	21,769	100%
Total without hatchery surplus utilization					20,920		20,321	
Middle Columbia								
Alaska	0	0	5	4	5	0%	4	0%
British Columbia	57	29	0	0	57	1%	29	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	5	4	5	0%	4	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	1,867	1,645	1,867	20%	1,645	19%
Tributary	0	0	5,602	5,904	5,602	61%	5,904	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	701	415	0	0	701	8%	415	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	737	453	0	0	737	8%	453	5%
Hatchery carcass	191	117	0	0	191	2%	117	1%
Total with hatchery surplus utilization					9,164	100%	8,571	100%
Total without hatchery surplus utilization					8,236		8,001	

Species: **Summer/Winter Steelhead**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	0	0	18	16	18	0%	16	0%
British Columbia	227	117	0	0	227	0%	117	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	18	16	18	0%	16	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	55,040	48,481	55,040	95%	48,481	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,734	1,065	0	0	1,734	3%	1,065	2%
Hatchery carcass	856	526	0	0	856	1%	526	1%
Total with hatchery surplus utilization					57,893	100%	50,221	100%
Total without hatchery surplus utilization					55,303		48,630	
Willamette								
Alaska	0	0	7	6	7	0%	6	0%
British Columbia	88	45	0	0	88	0%	45	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	7	6	7	0%	6	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	21,368	18,822	21,368	95%	18,822	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	673	414	0	0	673	3%	414	2%
Hatchery carcass	332	204	0	0	332	1%	204	1%
Total with hatchery surplus utilization					22,476	100%	19,497	100%
Total without hatchery surplus utilization					21,471		18,880	
Total								
Alaska	0	0	151	133	151	0%	133	0%
British Columbia	1,873	962	0	0	1,873	1%	962	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	151	133	151	0%	133	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	127,892	112,651	127,892	38%	112,651	37%
Tributary	0	0	154,451	162,766	154,451	46%	162,766	53%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	19,324	11,429	0	0	19,324	6%	11,429	4%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	22,729	13,963	0	0	22,729	7%	13,963	5%
Hatchery carcass	6,446	3,964	0	0	6,446	2%	3,964	1%
Total with hatchery surplus utilization					333,017	100%	306,003	100%
Total without hatchery surplus utilization					303,843		288,075	

Table 3c.1
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: **Coho**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Upper Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	454	217	150	129	604	2%	346	2%
Washington ocean	78	37	7,500	6,429	7,578	29%	6,466	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	1,089	573	4,875	4,179	5,964	23%	4,752	25%
California	387	175	750	643	1,137	4%	818	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	375	321	375	1%	321	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	947	562	0	0	947	4%	562	3%
Tribal	8,313	4,933	0	0	8,313	32%	4,933	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	1,007	614	0	0	1,007	4%	614	3%
Hatchery carcass	419	258	0	0	419	2%	258	1%
Total with hatchery surplus utilization					26,344	100%	19,070	100%
Total without hatchery surplus utilization					24,918		18,198	
Middle Columbia								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	1,325	635	438	375	1,763	2%	1,011	2%
Washington ocean	228	109	21,900	18,772	22,128	29%	18,881	34%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	3,181	1,673	14,235	12,202	17,416	23%	13,875	25%
California	1,131	512	2,190	1,877	3,321	4%	2,389	4%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	1,095	939	1,095	1%	939	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	2,765	1,641	0	0	2,765	4%	1,641	3%
Tribal	24,275	14,405	0	0	24,275	32%	14,405	26%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	2,942	1,794	0	0	2,942	4%	1,794	3%
Hatchery carcass	1,223	752	0	0	1,223	2%	752	1%
Total with hatchery surplus utilization					76,926	100%	55,685	100%
Total without hatchery surplus utilization					72,762		53,140	

Species: **Coho**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	19	9	0	0	19	0%	9	0%
British Columbia	72,431	34,719	26,605	22,805	99,035	4%	57,523	3%
Washington ocean	22,208	10,651	798,136	684,136	820,344	32%	694,786	36%
Washington Puget Sound	749	384	2,660	2,280	3,410	0%	2,665	0%
Oregon	185,487	97,585	638,509	547,308	823,996	33%	644,894	33%
California	18,313	8,292	26,605	22,805	44,917	2%	31,096	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	266,045	228,045	266,045	11%	228,045	12%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	367,979	218,359	0	0	367,979	15%	218,359	11%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	80,500	49,082	0	0	80,500	3%	49,082	3%
Hatchery carcass	21,998	13,528	0	0	21,998	1%	13,528	1%
Total with hatchery surplus utilization					2,528,243	100%	1,939,988	100%
Total without hatchery surplus utilization					2,425,746		1,877,377	
Willamette								
Alaska	0	0	0	0	0	0%	0	0%
British Columbia	687	329	227	195	914	2%	524	1%
Washington ocean	236	113	22,714	19,470	22,950	43%	19,583	47%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	3,299	1,736	14,764	12,655	18,063	34%	14,391	34%
California	1,173	531	2,271	1,947	3,444	6%	2,478	6%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	1,136	973	1,136	2%	973	2%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	2,868	1,702	0	0	2,868	5%	1,702	4%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	3,051	1,860	0	0	3,051	6%	1,860	4%
Hatchery carcass	890	547	0	0	890	2%	547	1%
Total with hatchery surplus utilization					53,316	100%	42,058	100%
Total without hatchery surplus utilization					49,375		39,651	
Total								
Alaska	19	9	0	0	19	0%	9	0%
British Columbia	74,897	35,901	27,420	23,503	102,316	4%	59,404	3%
Washington ocean	22,751	10,911	850,249	728,805	873,000	33%	739,716	36%
Washington Puget Sound	749	384	2,660	2,280	3,410	0%	2,665	0%
Oregon	193,056	101,568	672,382	576,344	865,439	32%	677,912	33%
California	21,003	9,510	31,816	27,271	52,819	2%	36,781	2%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	268,651	230,279	268,651	10%	230,279	11%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	374,558	222,263	0	0	374,558	14%	222,263	11%
Tribal	32,589	19,338	0	0	32,589	1%	19,338	1%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	87,500	53,350	0	0	87,500	3%	53,350	3%
Hatchery carcass	24,529	15,085	0	0	24,529	1%	15,085	1%
Total with hatchery surplus utilization					2,684,829	100%	2,056,802	100%
Total without hatchery surplus utilization					2,572,800		1,988,367	

Table 3c.2
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: **Spring/Summer Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	2,160	1,057	0	0	2,160	7%	1,057	6%
British Columbia	4,372	2,142	375	321	4,747	15%	2,464	14%
Washington ocean	604	296	750	642	1,353	4%	938	5%
Washington Puget Sound	257	132	0	0	257	1%	132	1%
Oregon	263	135	375	321	637	2%	456	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	4,023	2,038	0	0	4,023	12%	2,038	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	18,123	9,914	0	0	18,123	56%	9,914	56%
Hatchery carcass	1,317	810	0	0	1,317	4%	810	5%
Total with hatchery surplus utilization					32,617	100%	17,809	100%
Total without hatchery surplus utilization					13,178		7,086	
Upper Columbia								
Alaska	5,523	2,702	0	0	5,523	7%	2,702	6%
British Columbia	11,179	5,479	958	821	12,138	15%	6,300	14%
Washington ocean	1,543	756	1,917	1,643	3,460	4%	2,399	5%
Washington Puget Sound	658	338	0	0	658	1%	338	1%
Oregon	672	346	958	821	1,630	2%	1,167	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	10,289	5,213	0	0	10,289	12%	5,213	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	46,344	25,351	0	0	46,344	56%	25,351	56%
Hatchery carcass	3,367	2,071	0	0	3,367	4%	2,071	5%
Total with hatchery surplus utilization					83,408	100%	45,542	100%
Total without hatchery surplus utilization					33,698		18,120	
Middle Columbia								
Alaska	5,775	2,825	0	0	5,775	7%	2,825	6%
British Columbia	11,689	5,729	1,002	859	12,692	15%	6,588	14%
Washington ocean	1,614	791	2,004	1,718	3,618	4%	2,509	5%
Washington Puget Sound	688	354	0	0	688	1%	354	1%
Oregon	702	362	1,002	859	1,704	2%	1,221	3%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	0	0	0	0%	0	0%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	10,758	5,450	0	0	10,758	12%	5,450	11%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	48,458	26,508	0	0	48,458	56%	26,508	56%
Hatchery carcass	3,521	2,165	0	0	3,521	4%	2,165	5%
Total with hatchery surplus utilization					87,213	100%	47,619	100%
Total without hatchery surplus utilization					35,235		18,947	

Species: **Spring/Summer Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	44,799	21,917	432	370	45,231	12%	22,287	10%
British Columbia	55,420	27,159	4,319	3,702	59,739	16%	30,862	14%
Washington ocean	13,910	6,818	4,319	3,702	18,229	5%	10,520	5%
Washington Puget Sound	30	15	130	111	159	0%	126	0%
Oregon	3,027	1,558	4,319	3,702	7,346	2%	5,261	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	86,380	74,042	86,380	23%	74,042	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	70,969	35,956	0	0	70,969	19%	35,956	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	76,062	41,608	0	0	76,062	21%	41,608	19%
Hatchery carcass	4,369	2,687	0	0	4,369	1%	2,687	1%
Total with hatchery surplus utilization					368,484	100%	223,349	100%
Total without hatchery surplus utilization					288,053		179,054	
Willamette								
Alaska	64,624	31,616	623	534	65,247	12%	32,150	10%
British Columbia	79,944	39,178	6,230	5,340	86,174	16%	44,519	14%
Washington ocean	20,066	9,836	6,230	5,340	26,296	5%	15,176	5%
Washington Puget Sound	43	22	187	160	230	0%	182	0%
Oregon	4,366	2,248	6,230	5,340	10,597	2%	7,589	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	124,606	106,808	124,606	23%	106,808	33%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	102,374	51,867	0	0	102,374	19%	51,867	16%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	109,722	60,021	0	0	109,722	21%	60,021	19%
Hatchery carcass	6,303	3,876	0	0	6,303	1%	3,876	1%
Total with hatchery surplus utilization					531,549	100%	322,187	100%
Total without hatchery surplus utilization					415,524		258,291	
Total								
Alaska	122,880	60,116	1,055	904	123,935	11%	61,020	9%
British Columbia	162,604	79,688	12,885	11,044	175,489	16%	90,732	14%
Washington ocean	37,736	18,497	15,220	13,046	52,956	5%	31,543	5%
Washington Puget Sound	1,677	862	316	271	1,993	0%	1,133	0%
Oregon	9,030	4,649	12,885	11,044	21,915	2%	15,693	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	210,987	180,851	210,987	19%	180,851	28%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	173,343	87,823	0	0	173,343	16%	87,823	13%
Tribal	25,070	12,702	0	0	25,070	2%	12,702	2%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	298,708	163,401	0	0	298,708	27%	163,401	25%
Hatchery carcass	18,876	11,609	0	0	18,876	2%	11,609	2%
Total with hatchery surplus utilization					1,103,272	100%	656,508	100%
Total without hatchery surplus utilization					785,687		481,497	

Table 3c.3
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: **Fall Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	3,484	1,704	5	4	3,489	9%	1,709	8%
British Columbia	14,692	7,200	1,008	864	15,700	42%	8,064	39%
Washington ocean	1,825	895	1,008	864	2,833	8%	1,758	8%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	530	273	252	216	782	2%	489	2%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	756	648	756	2%	648	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	4,153	2,371	0	0	4,153	11%	2,371	11%
Tribal	9,121	5,206	0	0	9,121	24%	5,206	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	588	361	0	0	588	2%	361	2%
Hatchery carcass	279	172	0	0	279	1%	172	1%
Total with hatchery surplus utilization					37,701	100%	20,777	100%
Total without hatchery surplus utilization					36,833		20,245	
Upper Columbia								
Alaska	70,095	34,293	101	87	70,197	9%	34,379	8%
British Columbia	295,612	144,871	20,273	17,378	315,886	42%	162,248	39%
Washington ocean	36,728	18,003	20,273	17,378	57,001	8%	35,381	8%
Washington Puget Sound	3	2	5	4	9	0%	6	0%
Oregon	10,656	5,487	5,068	4,344	15,725	2%	9,831	2%
California	5	2	5	4	10	0%	6	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	15,205	13,033	15,205	2%	13,033	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	83,567	47,703	0	0	83,567	11%	47,703	11%
Tribal	183,514	104,757	0	0	183,514	24%	104,757	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	11,824	7,254	0	0	11,824	2%	7,254	2%
Hatchery carcass	5,622	3,457	0	0	5,622	1%	3,457	1%
Total with hatchery surplus utilization					758,559	100%	418,057	100%
Total without hatchery surplus utilization					741,113		407,346	
Middle Columbia								
Alaska	136,453	66,756	197	169	136,650	9%	66,926	8%
British Columbia	575,461	282,016	39,466	33,829	614,927	42%	315,845	39%
Washington ocean	71,497	35,046	39,466	33,829	110,963	8%	68,874	8%
Washington Puget Sound	7	3	10	8	17	0%	12	0%
Oregon	20,744	10,680	9,866	8,457	30,611	2%	19,138	2%
California	9	4	10	8	19	0%	12	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	29,599	25,372	29,599	2%	25,372	3%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	162,678	92,863	0	0	162,678	11%	92,863	11%
Tribal	357,243	203,928	0	0	357,243	24%	203,928	25%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	23,018	14,120	0	0	23,018	2%	14,120	2%
Hatchery carcass	10,944	6,731	0	0	10,944	1%	6,731	1%
Total with hatchery surplus utilization					1,476,670	100%	813,821	100%
Total without hatchery surplus utilization					1,442,707		792,970	

Species: **Fall Chinook**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	58,007	28,378	0	0	58,007	3%	28,378	2%
British Columbia	782,817	383,635	100,662	86,284	883,480	38%	469,920	33%
Washington ocean	324,200	158,912	335,541	287,615	659,741	29%	446,527	31%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	70,548	36,322	33,554	28,761	104,102	5%	65,084	5%
California	15,043	6,300	3,355	2,876	18,399	1%	9,176	1%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	251,656	215,711	251,656	11%	215,711	15%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	253,568	144,747	0	0	253,568	11%	144,747	10%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	50,862	31,201	0	0	50,862	2%	31,201	2%
Hatchery carcass	33,378	20,528	0	0	33,378	1%	20,528	1%
Total with hatchery surplus utilization					2,313,193	100%	1,431,272	100%
Total without hatchery surplus utilization					2,228,952		1,379,543	
Willamette								
Alaska	NA	NA	NA	NA	NA	NA	NA	NA
British Columbia	NA	NA	NA	NA	NA	NA	NA	NA
Washington ocean	NA	NA	NA	NA	NA	NA	NA	NA
Washington Puget Sound	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	NA	NA	NA	NA	NA	NA	NA	NA
California	NA	NA	NA	NA	NA	NA	NA	NA
Columbia Basin inland								
Freshwater sport								
Mainstem	NA	NA	NA	NA	NA	NA	NA	NA
Tributary	NA	NA	NA	NA	NA	NA	NA	NA
Gillnet	NA	NA	NA	NA	NA	NA	NA	NA
Tribal	NA	NA	NA	NA	NA	NA	NA	NA
Other	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery								
Hatchery surplus market	NA	NA	NA	NA	NA	NA	NA	NA
Hatchery carcass	NA	NA	NA	NA	NA	NA	NA	NA
Total with hatchery surplus utilization					NA	NA	NA	NA
Total without hatchery surplus utilization					NA		NA	
Total								
Alaska	268,039	131,132	304	260	268,343	6%	131,392	5%
British Columbia	1,668,583	817,722	161,409	138,355	1,829,992	40%	956,077	36%
Washington ocean	434,250	212,856	396,288	339,685	830,538	18%	552,540	21%
Washington Puget Sound	10	5	15	13	26	0%	18	0%
Oregon	102,478	52,762	48,741	41,779	151,218	3%	94,541	4%
California	15,057	6,305	3,371	2,889	18,428	0%	9,195	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	297,216	254,764	297,216	6%	254,764	9%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	503,967	287,684	0	0	503,967	11%	287,684	11%
Tribal	549,878	313,892	0	0	549,878	12%	313,892	12%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	86,293	52,936	0	0	86,293	2%	52,936	2%
Hatchery carcass	50,224	30,888	0	0	50,224	1%	30,888	1%
Total with hatchery surplus utilization					4,586,122	100%	2,683,927	100%
Total without hatchery surplus utilization					4,449,606		2,600,104	

Table 3c.4
Estimated Regional Economic Impacts and Net Economic Values by Geographic Region of Columbia River Basin Salmon/Steelhead Smolt Releases (Alternative III, Doubling of the 1980's Runs Objective - Double Survival Rates)

Species: **Summer/Winter Steelhead**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Snake River								
Alaska	0	0	487	429	487	0%	429	0%
British Columbia	6,034	3,098	0	0	6,034	1%	3,098	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	487	429	487	0%	429	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	199,365	175,607	199,365	20%	175,607	19%
Tributary	0	0	598,095	630,292	598,095	61%	630,292	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	74,828	44,259	0	0	74,828	8%	44,259	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	78,694	48,346	0	0	78,694	8%	48,346	5%
Hatchery carcass	20,361	12,522	0	0	20,361	2%	12,522	1%
Total with hatchery surplus utilization					978,351	100%	914,983	100%
Total without hatchery surplus utilization					879,296		854,115	
Upper Columbia								
Alaska	0	0	52	45	52	0%	45	0%
British Columbia	638	327	0	0	638	1%	327	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	52	45	52	0%	45	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	21,073	18,562	21,073	20%	18,562	19%
Tributary	0	0	63,220	66,623	63,220	61%	66,623	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	7,909	4,678	0	0	7,909	8%	4,678	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	8,318	5,110	0	0	8,318	8%	5,110	5%
Hatchery carcass	2,152	1,324	0	0	2,152	2%	1,324	1%
Total with hatchery surplus utilization					103,413	100%	96,715	100%
Total without hatchery surplus utilization					92,943		90,281	
Middle Columbia								
Alaska	0	0	20	18	20	0%	18	0%
British Columbia	251	129	0	0	251	1%	129	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	20	18	20	0%	18	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	8,297	7,308	8,297	20%	7,308	19%
Tributary	0	0	24,891	26,231	24,891	61%	26,231	69%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	3,114	1,842	0	0	3,114	8%	1,842	5%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	3,275	2,012	0	0	3,275	8%	2,012	5%
Hatchery carcass	847	521	0	0	847	2%	521	1%
Total with hatchery surplus utilization					40,716	100%	38,078	100%
Total without hatchery surplus utilization					36,593		35,545	

Species: **Summer/Winter Steelhead**	Total State Level Average REI	Total NEV	Total Recreational REI	Total Recreational NEV	Total REI	%	Total NEV	%
Lower Columbia								
Alaska	0	0	82	72	82	0%	72	0%
British Columbia	1,011	519	0	0	1,011	0%	519	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	82	72	82	0%	72	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	244,926	215,739	244,926	95%	215,739	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	7,715	4,740	0	0	7,715	3%	4,740	2%
Hatchery carcass	3,807	2,341	0	0	3,807	1%	2,341	1%
Total with hatchery surplus utilization					257,622	100%	223,483	100%
Total without hatchery surplus utilization					246,100		216,402	
Willamette								
Alaska	0	0	32	28	32	0%	28	0%
British Columbia	392	201	0	0	392	0%	201	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	32	28	32	0%	28	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	95,088	83,757	95,088	95%	83,757	97%
Tributary	0	0	0	0	0	0%	0	0%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	0	0	0	0	0	0%	0	0%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	2,995	1,840	0	0	2,995	3%	1,840	2%
Hatchery carcass	1,478	909	0	0	1,478	1%	909	1%
Total with hatchery surplus utilization					100,017	100%	86,764	100%
Total without hatchery surplus utilization					95,544		84,014	
Total								
Alaska	0	0	673	592	673	0%	592	0%
British Columbia	8,325	4,275	0	0	8,325	1%	4,275	0%
Washington ocean	0	0	0	0	0	0%	0	0%
Washington Puget Sound	0	0	0	0	0	0%	0	0%
Oregon	0	0	673	592	673	0%	592	0%
California	0	0	0	0	0	0%	0	0%
Columbia Basin inland								
Freshwater sport								
Mainstem	0	0	568,750	500,974	568,750	38%	500,974	37%
Tributary	0	0	686,205	723,146	686,205	46%	723,146	53%
Gillnet	0	0	0	0	0	0%	0	0%
Tribal	85,852	50,779	0	0	85,852	6%	50,779	4%
Other	0	0	0	0	0	0%	0	0%
Hatchery								
Hatchery surplus market	100,997	62,048	0	0	100,997	7%	62,048	5%
Hatchery carcass	28,646	17,617	0	0	28,646	2%	17,617	1%
Total with hatchery surplus utilization					1,480,120	100%	1,360,023	100%
Total without hatchery surplus utilization					1,350,477		1,280,358	

Table 4a
Regional Economic Impacts (REI) of Columbia River Basin
Produced Salmon/Steelhead by Geographic Areas

	Alt. I	%	Alt. II	%	Alt. III	%
Species: Coho						
Alaska	6	0.0%	8	0.0%	19	0.0%
British Columbia	30,256	3.8%	44,009	3.8%	102,316	3.8%
Washington ocean	257,671	32.5%	374,800	32.5%	873,000	32.5%
Washington Puget Sound	1,010	0.1%	1,470	0.1%	3,410	0.1%
Oregon	255,649	32.3%	371,859	32.3%	865,439	32.2%
California	15,498	2.0%	22,543	2.0%	52,819	2.0%
Columbia Basin inland						
Freshwater sport						
Mainstem	79,559	10.0%	115,724	10.0%	268,651	10.0%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	110,865	14.0%	161,261	14.0%	374,558	14.0%
Tribal	9,022	1.1%	13,123	1.1%	32,589	1.2%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	25,793	3.3%	37,517	3.3%	87,500	3.3%
Hatchery carcass	7,219	0.9%	10,501	0.9%	24,529	0.9%
Total with hatchery surplus utilization	792,546	100.0%	1,152,815	100.0%	2,684,829	100.0%
Total without hatchery surplus utilization	759,535		1,104,797		2,572,800	
Species: Spring/Summer Chinook						
Alaska	40,520	11.2%	58,940	11.2%	123,935	11.2%
British Columbia	57,317	15.9%	83,372	15.9%	175,489	15.9%
Washington ocean	17,299	4.8%	25,163	4.8%	52,956	4.8%
Washington Puget Sound	644	0.2%	937	0.2%	1,993	0.2%
Oregon	7,156	2.0%	10,409	2.0%	21,915	2.0%
California	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland						
Freshwater sport						
Mainstem	69,109	19.2%	100,524	19.2%	210,987	19.1%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	56,779	15.8%	82,589	15.8%	173,343	15.7%
Tribal	8,072	2.2%	11,742	2.2%	25,070	2.3%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	97,214	27.0%	141,405	27.0%	298,708	27.1%
Hatchery carcass	6,137	1.7%	8,927	1.7%	18,876	1.7%
Total with hatchery surplus utilization	360,249	100.0%	524,008	100.0%	1,103,272	100.0%
Total without hatchery surplus utilization	256,897		373,675		785,687	
Species: Fall Chinook						
Alaska	76,409	5.8%	111,142	5.8%	268,343	5.9%
British Columbia	521,680	39.9%	758,821	39.9%	1,829,992	39.9%
Washington ocean	237,082	18.1%	344,853	18.1%	830,538	18.1%
Washington Puget Sound	7	0.0%	11	0.0%	26	0.0%
Oregon	43,146	3.3%	62,760	3.3%	151,218	3.3%
California	5,265	0.4%	7,658	0.4%	18,428	0.4%
Columbia Basin inland						
Freshwater sport						
Mainstem	84,861	6.5%	123,437	6.5%	297,216	6.5%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	143,680	11.0%	208,992	11.0%	503,967	11.0%
Tribal	156,428	12.0%	227,536	12.0%	549,878	12.0%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	24,611	1.9%	35,798	1.9%	86,293	1.9%
Hatchery carcass	14,329	1.1%	20,842	1.1%	50,224	1.1%
Total with hatchery surplus utilization	1,307,499	100.0%	1,901,849	100.0%	4,586,122	100.0%
Total without hatchery surplus utilization	1,268,559		1,845,209		4,449,606	

Table 4a (continued)

	Alt. I	%	Alt. II	%	Alt. III	%
Species: Summer/Winter Steelhead						
Alaska	104	0.0%	151	0.0%	673	0.0%
British Columbia	1,288	0.6%	1,873	0.6%	8,325	0.6%
Washington ocean	0	0.0%	0	0.0%	0	0.0%
Washington Puget Sound	0	0.0%	0	0.0%	0	0.0%
Oregon	104	0.0%	151	0.0%	673	0.0%
California	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland						
Freshwater sport						
Mainstem	87,924	38.4%	127,892	38.4%	568,750	38.4%
Tributary	106,183	46.4%	154,451	46.4%	686,205	46.4%
Gillnet	0	0.0%	0	0.0%	0	0.0%
Tribal	13,285	5.8%	19,324	5.8%	85,852	5.8%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	15,626	6.8%	22,729	6.8%	100,997	6.8%
Hatchery carcass	4,431	1.9%	6,446	1.9%	28,646	1.9%
Total with hatchery surplus utilization	228,945	100.0%	333,017	100.0%	1,480,120	100.0%
Total without hatchery surplus utilization	208,888		303,843		1,350,477	
Species: Total						
Alaska	117,039	4.4%	170,241	4.4%	392,969	4.0%
British Columbia	610,541	22.7%	888,075	22.7%	2,116,123	21.5%
Washington ocean	512,052	19.0%	744,816	19.0%	1,756,494	17.8%
Washington Puget Sound	1,662	0.1%	2,417	0.1%	5,429	0.1%
Oregon	306,055	11.4%	445,179	11.4%	1,039,244	10.5%
California	20,763	0.8%	30,201	0.8%	71,247	0.7%
Columbia Basin inland						
Freshwater sport						
Mainstem	321,453	12.0%	467,577	12.0%	1,345,603	13.7%
Tributary	106,183	3.9%	154,451	3.9%	686,205	7.0%
Gillnet	311,324	11.6%	452,843	11.6%	1,051,869	10.7%
Tribal	186,807	6.9%	271,724	6.9%	693,389	7.0%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	163,243	6.1%	237,449	6.1%	573,497	5.8%
Hatchery carcass	32,117	1.2%	46,716	1.2%	122,274	1.2%
Total with hatchery surplus utilization	2,689,240	100.0%	3,911,689	100.0%	9,854,343	100.0%
Total without hatchery surplus utilization	2,493,880		3,627,524		9,158,571	

Table 4b
Net Economic Values (NEV) of Columbia River Basin
Produced Salmon/Steelhead by Geographic Areas

	Alt. I	%	Alt. II	%	Alt. III	%
Species: Coho						
Alaska	3	0.0%	4	0.0%	9	0.0%
British Columbia	17,567	2.9%	25,552	2.9%	59,404	2.9%
Washington ocean	218,325	36.0%	317,569	36.0%	739,716	36.0%
Washington Puget Sound	790	0.1%	1,149	0.1%	2,665	0.1%
Oregon	200,243	33.0%	291,267	33.0%	677,912	33.0%
California	10,789	1.8%	15,693	1.8%	36,781	1.8%
Columbia Basin inland						
Freshwater sport						
Mainstem	68,195	11.2%	99,195	11.2%	230,279	11.2%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	65,787	10.8%	95,692	10.8%	222,263	10.8%
Tribal	5,354	0.9%	7,787	0.9%	19,338	0.9%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	15,726	2.6%	22,875	2.6%	53,350	2.6%
Hatchery carcass	4,440	0.7%	6,458	0.7%	15,085	0.7%
Total with hatchery surplus utilization	607,218	100.0%	883,241	100.0%	2,056,802	100.0%
Total without hatchery surplus utilization	587,052		853,908		1,988,367	
Species: Spring/Summer Chinook						
Alaska	19,951	9.3%	29,020	9.3%	61,020	9.3%
British Columbia	29,634	13.8%	43,105	13.8%	90,732	13.8%
Washington ocean	10,300	4.8%	14,981	4.8%	31,543	4.8%
Washington Puget Sound	367	0.2%	533	0.2%	1,133	0.2%
Oregon	5,125	2.4%	7,454	2.4%	15,693	2.4%
California	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland						
Freshwater sport						
Mainstem	59,238	27.6%	86,166	27.6%	180,851	27.5%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	28,767	13.4%	41,843	13.4%	87,823	13.4%
Tribal	4,090	1.9%	5,949	1.9%	12,702	1.9%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	53,179	24.8%	77,352	24.8%	163,401	24.9%
Hatchery carcass	3,774	1.8%	5,490	1.8%	11,609	1.8%
Total with hatchery surplus utilization	214,424	100.0%	311,894	100.0%	656,508	100.0%
Total without hatchery surplus utilization	157,470		229,052		481,497	
Species: Fall Chinook						
Alaska	37,413	4.9%	54,420	4.9%	131,392	4.9%
British Columbia	272,561	35.6%	396,460	35.6%	956,077	35.6%
Washington ocean	157,735	20.6%	229,437	20.6%	552,540	20.6%
Washington Puget Sound	5	0.0%	8	0.0%	18	0.0%
Oregon	26,975	3.5%	39,237	3.5%	94,541	3.5%
California	2,627	0.3%	3,821	0.3%	9,195	0.3%
Columbia Basin inland						
Freshwater sport						
Mainstem	72,740	9.5%	105,806	9.5%	254,764	9.5%
Tributary	0	0.0%	0	0.0%	0	0.0%
Gillnet	82,018	10.7%	119,301	10.7%	287,684	10.7%
Tribal	89,295	11.7%	129,886	11.7%	313,892	11.7%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	15,097	2.0%	21,960	2.0%	52,936	2.0%
Hatchery carcass	8,812	1.2%	12,818	1.2%	30,888	1.2%
Total with hatchery surplus utilization	765,280	100.0%	1,113,154	100.0%	2,683,927	100.0%
Total without hatchery surplus utilization	741,371		1,078,376		2,600,104	

Table 4b (continued)

	Alt. I	%	Alt. II	%	Alt. III	%
Species: Summer/Winter Steelhead						
Alaska	92	0.0%	133	0.0%	592	0.0%
British Columbia	661	0.3%	962	0.3%	4,275	0.3%
Washington ocean	0	0.0%	0	0.0%	0	0.0%
Washington Puget Sound	0	0.0%	0	0.0%	0	0.0%
Oregon	92	0.0%	133	0.0%	592	0.0%
California	0	0.0%	0	0.0%	0	0.0%
Columbia Basin inland						
Freshwater sport						
Mainstem	77,446	36.8%	112,651	36.8%	500,974	36.8%
Tributary	111,900	53.2%	162,766	53.2%	723,146	53.2%
Gillnet	0	0.0%	0	0.0%	0	0.0%
Tribal	7,858	3.7%	11,429	3.7%	50,779	3.7%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	9,600	4.6%	13,963	4.6%	62,048	4.6%
Hatchery carcass	2,725	1.3%	3,964	1.3%	17,617	1.3%
Total with hatchery surplus utilization	210,373	100.0%	306,003	100.0%	1,360,023	100.0%
Total without hatchery surplus utilization	198,048		288,075		1,280,358	
Species: Total						
Alaska	57,458	3.2%	83,577	3.2%	193,014	2.9%
British Columbia	320,423	17.8%	466,078	17.8%	1,110,488	16.4%
Washington ocean	386,360	21.5%	561,988	21.5%	1,323,800	19.6%
Washington Puget Sound	1,162	0.1%	1,690	0.1%	3,817	0.1%
Oregon	232,434	12.9%	338,092	12.9%	788,738	11.7%
California	13,416	0.7%	19,514	0.7%	45,976	0.7%
Columbia Basin inland						
Freshwater sport						
Mainstem	277,620	15.4%	403,818	15.4%	1,166,867	17.3%
Tributary	111,900	6.2%	162,766	6.2%	723,146	10.7%
Gillnet	176,572	9.8%	256,837	9.8%	597,770	8.8%
Tribal	106,596	5.9%	155,052	5.9%	396,711	5.9%
Other	0	0.0%	0	0.0%	0	0.0%
Hatchery						
Hatchery surplus market	93,602	5.2%	136,151	5.2%	331,735	4.9%
Hatchery carcass	19,752	1.1%	28,730	1.1%	75,199	1.1%
Total with hatchery surplus utilization	1,797,295	100.0%	2,614,292	100.0%	6,757,260	100.0%
Total without hatchery surplus utilization	1,683,941		2,449,411		6,350,326	