US Army Corps of Engineers
Walla Walla District

Lower Snake River Juvenile Salmon Migration Feasibility Study

Recreation and Tourism Analysis

Foreword

This document is the product of the U.S. Army Corps of Engineers' (Corps) efforts to involve the region in the development of the *Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement (FR/EIS)*. The Corps has reached out to regional stakeholders (states, tribes, Federal agencies, organizations and individuals) for their input and development of various work products. This and various other products associated with the development of the EIS were authored and developed by these regional stakeholders and contractors. Please note that this document is a draft or preliminary report and is subject to change or revision. Although the Corps has acquired this document as part of its EIS process, the opinions and/or findings expressed herein do not necessarily reflect the official policy or position of the Corps. The Corps will review and incorporate information from these products into our analysis and development of the Draft FR/EIS.

The Recreation Workgroup, a Drawdown Regional Economic Workgroup (DREW) subgroup, has completed a preliminary report on the recreation and tourism analysis for the Lower Snake River Juvenile Salmon Migration Feasibility Study. Recreation on the four lower Snake River reservoirs is an authorized project purpose. Existing recreation and tourism will be affected in the event a decision is made to breach the four lower Snake River dams. A recreation survey was developed as one tool to gather information for use in recreation analysis. Results of the survey are incorporated into a draft Recreation and Tourism Analysis for review by the DREW and the Independent Economic Analysis Board (IEAB). The final draft report will become the Recreation and Tourism Analysis chapter of the Economic Appendix of the EIS.

In addition, this analysis is only one part of the overall Economic Appendix of the EIS. Other critical components of the economic analysis include power, transportation, water supply, tribal, regional, and social analysis. For a true economic analysis of the implications of any of the study alternatives, economic costs and benefits of all the components of the analysis must be considered, but without any individual component taken out of context.

It is important to note this draft analysis is still preliminary data, and is subject to review and revision. The conclusions of the draft report are subject to change.

This draft document is being released for **information purposes only**. The Corps will not be responding to comments at this time. The formal comment period will coincide with the release of the Draft FR/EIS, expected in October 1999.

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PURPOSE

This chapter summarizes results of four recreation use surveys conducted to estimate the visitation and benefits associated with current reservoir recreation, major system improvements and potential river recreation with natural river drawdown. References to the detailed reports are provided for interested readers. This chapter also applies the results of those surveys to the EIS alternatives and accounts for the timing of when recreational fisheries benefits would be obtained. Finally, the chapter summarizes the passive use values for wild salmon and river recovery.

METHODS

The Principles and Guidelines (U.S. Water Resources Council, 1983) which governs the conduct of benefit-cost analyses by federal agencies such as the U.S. Army Corps of Engineers (COE), requires that benefits to the visitor be measured as the additional amount the visitor would pay for the recreation experience over and above their current costs. This benefit measure is referred to as net willingness to pay (WTP) and is the measure the COE uses when measuring National Economic Development (NED) benefits. The economics profession also recommends net WTP as the conceptually correct measure of benefits for benefit-cost analysis (Sassone and Schaeffer, 1978; Loomis and Walsh, 1997).

The actual expenditures of visitors are costs to visitors (not benefits) but contribute to regional economic development (RED). The local income and employment generated from recreation visitor spending is reported in a separate chapter entitled Regional Economic Development.

Techniques Used to Measure Visitor Benefits

The Principles and Guidelines (U.S. Water Resources Council, 1983) recommends that either the Travel Cost Method (TCM) or Contingent Valuation Method (CVM) be used to quantify visitors net WTP. Both of these methods are used by other Federal agencies and frequently used by economists (Loomis and Walsh, 1997). In this study TCM is applied to estimate net WTP for the current reservoir recreation, river recreation above Lewiston, Idaho and in the Snake River basin in central Idaho. TCM uses the actual number of trips taken by an individual as the quantity variable and the visitor's travel cost as the price variable to statistically trace out a demand curve for recreation using multiple regression. From this demand curve the net WTP is calculated. See McKean (1998a,b) for more details on the TCM demand models used.

Since natural river conditions do not exist in the Lower Snake River, one cannot survey existing users and directly apply a standard TCM to estimate the value of river recreation with dam removal. Therefore a hybrid TCM approach known as "contingent behavior" (CB) is used to estimate the value of river recreation under the Natural River Drawdown Alternative. This hybrid approach involves: (a) describing the new recreation conditions--

e.g., natural river scenario; (b) asking whether the person would visit and if so, how many times per year; (c) asking the distance, travel cost and travel time to their most likely spot on the river they would visit. Thus, the variables are similar to what is used in the TCM for current reservoir recreation. In addition, the same statistical regression models are applied to the data for all alternatives. Thus, the same general recreation valuation approaches are used to value the different types of recreation across alternatives. The contingent behavior approach is becoming widely used in economics, previously applied in the Columbia River System Operation Review (Callaway, et al., 1995) and has been shown to be reliable (Loomis, 1993). See Loomis, 1999 for discussion of the contingent behavior TCM.

Surveys

Surveys were designed to allow estimation of both types of Travel Cost Method demand models. Questions included travel expenditures, travel time, time on site, discretionary time available for recreation and questions regarding visitor demographics.

Reservoir Recreation Surveys: Two separate travel cost method mail survey instruments were developed, an angler survey and a general recreation survey. These two surveys were relatively short, being three pages in length. Visitors names and addresses to allow mailing of these surveys were collected by University of Idaho students stationed at recreation access points along the lower Snake River. Visitors were sampled at the reservoirs from May to October of 1997. A total of 408 completed surveys were mailed back from non-angler river visitors, representing a response rate of 65%. A total of 537 completed surveys were mailed back by anglers, representing a response rate of 59%. Copies of the survey instrument are in McKean (1998a,b).

Snake River Above Lewiston, Idaho Survey: This was a survey of anglers, generally fishing for steelhead in the 30 mile stretch of the Snake River, above the town of Lewiston, Idaho. The names and addresses were collected from September 1997 to March 1998. A total of 247 completed surveys were returned, yielding a response rate of 72%. A copy of the survey instrument is in McKean (1998c).

Central Idaho Surveys for Angling and Rafting: Due to the variety of access points, these surveys were distributed to anglers and rafters using several methods including on-site contacts and via guides. A total of 257 useable responses was obtained from anglers, while 190 useable surveys were returned by other river recreation users such as rafters. Copies of the survey instrument are in McKean (1999a,b).

Natural River Conditions Recreation Survey: Because the free-flowing lower Snake River does not exist, a stratified sample of households was mailed an eight page survey. The sample was determined by evaluating the origin of current visitors to the Snake River and from guidance from the Drawdown Review Economics Workgroup (DREW). The sample included residents of Idaho, Oregon, Washington, western Montana and California. A local sample strata of counties surrounding the lower Snake River was included to insure adequate representation of these households. The overall response rate was 54% representing 4,780 completed surveys. Only a portion of the 4,780 households returning

surveys indicated they would visit the lower Snake River under the Natural River Drawdown condition, however. A copy of the survey instrument is in Loomis (1999).

SURVEY FINDINGS

Lower Snake River Reservoir

The average net WTP per trip of reservoir fishing was $29.23 (many of these are very short trips of a day or less). When multiplied by an estimated 57,338 angler trips yields annual benefits of $1.676 million.

The average net WTP or net benefit per day of non-angling reservoir recreation such as boating and waterskiing was $71.31 per trip. When multiplied by an estimated 442,834 trips yields an annual recreation benefit of $31.578 million. Details of the per trip and annual benefits methodology for reservoir recreation analyses can be found in McKean (1998a,b).

Upriver of Lewiston, Idaho

The average net WTP for anglers fishing in the 30 mile stretch of the Snake River above Lewiston, Idaho is $35.71 per trip. Multiplying this be an estimated 11,437 angler trips yields an annual value of $408,408. Details of the per trip and annual benefits of this upriver angler analysis can be found in McKean (1998c).

Central Idaho

Anglers in Central Idaho (Snake River Basin) had an average net WTP per trip of $37.68. When multiplied by an estimated 607,183 trips yields an annual benefit of $22,878,664. The average net WTP for non-angling upriver recreation such as rafting is $87.24. Estimated use is 497,480 trips. This yields an annual value of $43,400,000.

Table R-1 lists existing reservoir recreation use and benefits (Alternative A1), which total about 500,172 trips worth $33.254 million annually.

Table R-1
Summary of Existing Recreation Use and Benefits (1998 Dollars)

Recreation Activity	Trips	Annual Benefits
Lower Snake River Reservoirs		
Fishing	57,338	$1,676,000
General Reservoir Recreation	442,834	$31,578,000
Subtotal	**500,172**	**$33,254,000**
Upriver of Lewiston, Idaho		
Fishing	11,437	$408,408
Central Idaho Rivers		
Fishing	607,183	$22,878,664

Natural River Drawdown Recreation

Using the contingent behavior TCM, the value per trip of salmon and steelhead fishing in what would be the free flowing lower Snake River if the dams are breached (Alternative A3) has an estimated value of $256 per trip of 3.36 days. The value for river recreation activities such as rafting, canoeing, kayaking and swimming as well as river related recreation is estimated at $71.36 per trip of 2.6 days using a definition of the price variable in the TCM demand function consistent with McKean (1998b). The resulting value per day is consistent with the literature on the value of floatboating and other types of river related recreation activities respondents indicated in the survey.

Five estimates of river recreation demand and benefits are provided that range from a low estimate (using just households that indicated they would definitely visit with dam removal and assuming zero visitation from survey non-respondents) to an upper bound based on households that indicated they definitely or probably would visit and assuming that survey non-respondents would visit at the same rate as survey respondents. Middle demand estimates are provided by assuming that households that did not respond to the survey would visit at the same rate as households that did

respond to the survey but applying this assumption only to the fraction of the population that were definitely sure they would visit. Lastly, an middle-high demand estimate is provided which uses the households that indicated they definitely or probably would visit but assuming that survey non-respondents would not visit.

These demand estimates are compared to campground and boat ramp capacity to determine how much of the demand can be accommodated given the recreation facilities after Natural River Drawdown. These demand estimates are also phased in over time as the natural river system recovers from dam removal. Table R-2 presents the expected suitability of the area for river recreation with dam removal. This table was initially developed by recreation planners at the COE and then refined and applied to the Natural River Drawdown survey data. As can be seen in this table, suitability for some activities recover more slowly than others. For example, river and shorebased recreation takes two to three decades to become completely suitable for recreation activities.

Table R-2
Recreation Suitability Recovery After Dam Removal

Activity	Year 1	Year 5	Year 10	Year 20	Year 30
Jet Boating, Jet Skiing	0.15	0.4	0.7	0.75	1
Raft/Kayak/Canoe	0.1	0.3	0.6	0.9	1
Swimming	0.2	0.4	0.8	1	1
Picnic/Primitive Camping	0.8	1	1	1	1
Developed Camping	0.5	0.5	0.8	1	1
Hike and Mountain Bike	0.8	1	1	1	1
Hunting	0.4	0.75	0.9	1	1

The visitation estimates for General River Recreation given in Table R-3, reflect the application of these suitability factors to the respective demand estimates. Further, the amount of existing facilities may also limit visitor use. Three key capacities were examined: boat ramps, developed campsites and areas available for primitive camping. COE recreation planners provided information on the number of boat ramps, developed campsites and suitable areas for primitive camping. To calculate visitor day capacities, we took the recreation season as April through October. This time period coincides with spring break through the steelhead fishing season as well as summer vacations. This area is attractive in spring and fall, due to the early warm temperatures. While rather hot during the summer, the area receives high use during the vacation months of July and August. Given the average party size of three persons, the maximum number of visitor days that could be accommodated during this April through October time period was calculated. This figure limited the amount of camping demand that could be accommodated in all scenarios, including the low visitor use scenario (starting in year 10 for that scenario, but starting in year 1 for all other scenarios). This assumes no new camping facilities are constructed by federal, state or county agencies to accommodate increased camping demand over time. Primitive camping was limited during the first few years until the receding beaches became suitable for camping. Boat ramp capacity was sufficient for all but the highest use scenario, although they would be used at close to capacity in the middle-high use estimate.

Unlike current conditions, with the Natural River Drawdown our surveys predict that a large percentage of total river recreation use would come from distant states like California. Specifically, 30-45% of the total trips are from California depending on the sample expansion assumptions. This percentage of trips is not out of line with the fact California represents 60%-70% of the population of our sampling area. While the percent visiting is quite low and only one trip is taken per year, these are long trips being more than a week in duration. As such, they contribute large number of visitor days. Because only 20% of the California respondents indicating they would visit the Snake River if the dams were removed had visited in the previous year (they may have visited at some time in the past, however), there was concern by COE regarding the accuracy of California household responses. To test the sensitivity of the overall economic analysis to inclusion of California visitors, the Recreation Risk and Uncertainty Section provides a more detailed analysis of the California visitors and then calculates the Natural River Drawdown estimates without California visitors.

However, this change in distribution of the origin of visitors is consistent with the pattern found in McKean's travel cost analyses of actual visitation. Specifically, the current reservoirs are primarily local use areas with a majority of visitors coming from within 100-120 miles (McKean, 1998a,b). However, in the free-flowing river sections of Central Idaho 21% of the river visitors come from 1,000 miles or more away, with 12% coming from 1,500 miles or further (McKean, 1999). This pattern is consistent with the lack of availability of substitute rivers of the size and magnitude of what the Lower Snake River will be with the dams removed. Thus people are willing to travel

greater distances to visit free flowing rivers. Besides the limited number of major rivers in the western U.S., many existing rivers such as the Rogue, Salmon or the Colorado have use limits and permits are rationed by lottery. By contrast, reservoir visitors do not have to travel great distances as there are numerous reservoirs in the local area, including Lake Wallula downstream from Ice Harbor dam very near the Tri-Cities area, Dworshak Reservoir near Lewiston, ID and three large lakes near Spokane, Washington.

As explained in more detail below, salmon and steelhead fishing demand with natural river condition is constrained by availability of salmon and steelhead. The availability of salmon for harvest was estimated by the interagency PATH biologists as extended by Shannon Davis (see Radtke, Davis and Johnson, 1999). The limited availability of salmon for recreational fishing constrains the desired angler days to an annual average of 32,255 angler days or 9,600 angler trips over the period of analysis. This is about 2% of the low estimate of salmon angler demand.

The same pattern is evident for steelhead, where numbers of fish limit angler days to an annual average of 338,242 or 100,667 trips over the period of analysis. This represents 26% of the lowest estimated demand. As explained in more detail in the next section, a portion of the resident fishing angler demand is also supplied with the Natural River Drawdown Alternative (A3).

Table R-3
Summary of Natural River Recreation Use and Benefits (1998 Dollars)

Recreation Activity	Trips	Annual Benefits
Fishing (resident, steelhead, and salmon in Year 10)	142,512	$30,275,570
General River Recreation (In Year 10)		
Low	570,464	$40,700,000
Low Middle	813,654	$58,000,000
Middle	1,177,088	$84,000,000
Middle High	1,944,154	$138,700,000
High	4,970,854	$354,600,000

Natural River Drawdown (A3) is expected to have at least 721,000 trips worth an estimated $70 million annually, ten years after dam breaching and river restoration.

APPLICATION OF SURVEY RESULTS TO EIS ALTERNATIVES

There are eight different alternatives evaluated in the EIS. However, from the standpoint of general/non-fishing recreation, these alternatives can be grouped into two main categories: (1) alternatives in which the dams remain; and (2) Natural River Drawdown (A3). Group (1) includes Existing System (A1), Existing System with Maximize salmon transport (A-2) and Major System Improvements for salmon such as surface bypass collectors (A-2').

River Recreation

For the Natural River Drawdown Alternative, the estimated time path of river recovery following dam removal and its influence on recreation suitability and facility availability was estimated by COE recreation staff. In Table R-2 these recreation carrying capacity estimates by time interval were refined and used to estimate the percentage of the different recreation activities that could be accommodated in each time period. These percentages were applied to the five different estimates of non-angling river recreation demand calculated from the survey. These resulting visitation figures were reduced by the carrying capacity of the developed campgrounds in the all estimates and boat ramps in the high use estimate. The resulting visitor days are valued using the benefits calculated from the TCM.

Recreational Fishing

The estimated salmon and steelhead that can be recreationally harvested with each alternative was provided by Shannon Davis (see Radtke, Davis and Johnson, 1999 for details). Davis based his estimates on PATH analysis and made additional assumptions to generalize the seven PATH index stocks to all Snake River stocks. He also used information from various international and national fishery treaties to allocate the total stocks to commercial, tribal and recreational catch. The biological availability of salmon and steelhead for recreational harvest was used to constrain the river angler demand calculated from the household survey data. Specifically, only the proportion of river angler demand compatible with salmon and steelhead available for recreational harvest was counted in any given year. This results in only a small fraction of the angler demand indicated in the survey being met.

Using Davis' generalization of PATH's estimates of salmon and steelhead with existing reservoirs (A1, A2, A2') we calculated the time path of anadromous fishing benefits with these three alternatives. These changes in salmon and steelhead available for recreational harvest reflect fisheries improvements recently put in place (Alternative A1) or proposed improvements with alternatives A2 or A2'. Mainstem recreational harvest is used with the

household survey data from Loomis (1999). The tributary harvests of spring-summer chinook and steelhead are used with McKean's upriver of Lewiston and Central Idaho analysis. As is evident from Tables R-4A to R-4C, recreational salmon fishing is a small part of the overall benefits. In part this is due to the small allocation of available fish to recreational fishing as compared to commercial fishing.

Normandeau and Bennett (1999) analysis of resident fish biology impacts by alternative was applied to McKean's baseline resident fish benefits to estimate changes in fishing by alternative. Generally Normandeau and Bennett conclude there will be minor effects on resident fish for the non-drawdown alternatives (e.g., A1, A2, A2'). To estimate the effect of natural river drawdown (A3), information from Normandeau and Bennett's Table 4-3 on acres of habitat quantity and Table 4-4 on productivity per hectare was used. With natural river drawdown, surface area of habitat falls from 33,890 to 13,162. However, estimated biomass will increase from 50.9 to 84.7 kg/ha with natural river conditions. If we combine the two effects, there appears to be a net loss, as the loss in habitat area is greater than the gain productivity. Based on these two factors it appears that the loss is about a one-third reduction in resident fish carrying capacity with natural river drawdown. Thus the estimated resident fishing benefits with A3 is two-thirds of estimated current resident angler trips and $1.13 million in resident angler benefits.

Calculation of Present Value of Recreation Benefits

When using a positive discount rate, the timing of when the different recreation benefits are received influences the present worth or present value of recreation under each alternative. The time profile of benefits is quite different among the alternatives. Obviously, Existing System alternatives currently provide their annual level of benefits and these would be expected to continue each year into the future. Alternatives involving Major System Improvements and Natural River Drawdown take several years into the future to deliver some of their benefits and several decades for the salmon fishing benefits to be fully realized. To put all dollars of benefits on an equal footing with respect to their worth today, the present worth or present value is calculated using two positive discount rates. These are 4.75% which is the rate used by BPA and the discount rate is the rate used by the COE for Fiscal Year 1999 which is equal to 6.875%. This discount rate weights benefits (and costs) in the near future more heavily than those received in the distant future. For purposes of comparison, the tribal discount rate of zero is presented in Table R4-C. This weights all benefits and costs equally overtime. The present value of recreation benefits is shown in the last line of Table R-4.The present values are also converted into average annual equivalent values (AAEV). This is an annualized present value.

SUMMARY OF RECREATION RESULTS

Tables R-4A-C displays the present value of the recreation benefits of each of the EIS alternatives at the three different discount rates. All four alternatives have increasing fishing benefits over time, although PATH estimates for Alternative A3 have the largest salmon and steelhead gains. While much of the gain of A3 is driven by projected increases in steelhead and salmon populations with Natural River conditions, some is also be due to survey respondents reported desirability of fishing for anadromous fish in a free-flowing river environment as compared to a reservoir. With all three discount rates and all ranges of river visitor survey response assumptions, the present value of recreation benefits over the 100 year period are higher with Natural River conditions (A3) than with other alternatives. The lower the discount rate, the greater the gain in recreation benefits with Natural River Conditions, in part due to recovery of river recreation requiring 10 years or more. To assess the sensitivity of these results to removal of California river visitors see Uncertainty and Risk section.

Table R-5 illustrates the net effect of alternatives A2, A2' and A3 as compared to alternative A1. That is, Table R-5 shows the gain or loss in recreation benefits of each alternative compared to the current baseline (A1) which is used as the future without. Based on the PATH fish estimates as extended from the PATH stocks to all stocks by Shannon Davis, there are small losses to salmon and steelhead fishing with A2 and A2' as compared to A1. There are large net gains in recreation with alternative A3, ranging from $28 million to $306 million annually with a best estimate of $66 million annually.

Table R-4A
Present Value (PV) & Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ 6.875% (COE rate)

	A1 PV	A1 AAEV	A2 PV	A2 AAEV	A2' PV	A2' AAEV	A3 PV	A3 AAEV
Reservoir Recreation	$459.64	$31.60	$459.64	$31.60	$459.64	$31.60		
River Recreation								
Low							$492.80	33.90
Low Middle							$714.40	49.10
Middle							$1,049.30	72.1
Middle High							$1,756.50	120.80
High							$4,537.40	311.90

Recreation Fishing								
Resident and Steelhead								
	$26.11	1.79	$26.02	1.78	$26.06	1.79	$351.22	24.14
Mainstem Salmon								
	$13.71	.94	$13.70	.94	$13.17	.94	$18.18	1.25
Upstream Steelhead								
	$401.54	27.60	$393.82	27.07	$397.25	27.3	$452.50	31.11
Upstream Salmon								
	$4.39	.30	$4.95	.34	$4.38	.30	$3.69	.25
Total Middle	**$905.39**	**62.23**	**$898.13**	**61.73**	**$900.50**	**61.93**	**$1,874.90**	**128.85**
Total Low							**$1,318.40**	**90.04**
Total High							**$5,362.90**	**368.65**

Table R-4B
Present Value (PV) & Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ 4.75% (BPA rate)

	A1 PV	A1 AAEV	A2 PV	A2 AAEV	A2' PV	A2' AAEV	A3 PV	A3 AAEV
Reservoir Recreation	$664.80	$31.60	$664.80	$31.60	$664.80	$31.60		
River Recreation								
Low							$757.20	36.00
Low Middle							$1,096.30	72.10
Middle							$1,610.40	76.50
Middle High							$2,695.90	128.10
High							$6,821.40	324.00
Recreation Fishing								
Resident and Steelhead	$37.90	1.79	$37.70	1.79	$37.80	1.79	$517.10	24.60
Mainstem Salmon	$21.60	1.03	$20.90	.99	$20.40	.97	$31.70	1.50
Upstream Steelhead	$579.46	27.52	$565.90	26.88	$569.90	27.07	$665.50	31.60
Upstream Salmon	$6.44	.30	$6.95	.33	$6.30	.30	$5.90	.28

Total Middle	**$1,310.20**	**62.20**	**$1,296.00**	**61.61**	**$1,299.00**	**61.73**	**$2,830.60**	**134.50**
Total Low							**$1,977.00**	**93.90**
Total High							**$8,041.00**	**381.90**

Table R-4C
Present Value (PV) & Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ Zero% (Tribal rate)

	A1 PV	A1 AAEV	A2 PV	A2 AAEV	A2' PV	A2' AAEV	A3 PV	A3 AAEV
Reservoir Recreation	$3,157.00	$31.60	$3,157.00	$31.60	$3,157	$31.60		
River Recreation								
Low							$4,240.00	42.40
Low Middle							$6,141.00	61.40
Middle							$9,037.00	90.30
Middle High							$15,151	151.50
High							$36,306	363.00
Recreation Fishing								
Resident and Steelhead	$184.00	1.84	$182.80	1.83	$182.90	1.83	$2,672.00	26.72
Mainstem Salmon	$132.20	1.32	$116.40	1.16	$117.40	1.17	$243.50	2.43
Upstream Steelhead	$2,877.70	28.77.33	$2,769.20	27.69.31	$2,776.90	27.7.31	$3,424.40	34.24.42
Upstream Salmon	$33.40		$31.10		$30.60		$.42	

Total Middle	**$6,384.30**	**63.86**	**$6,256.50**	**62.593**	**$6,264.80**	**62.60**	**$15,419.30**	**154.16**
Total Low							**$10,622.30**	**106.20**
Total High							**$42,688.30**	**426.80**

Table R-5
Difference in PV & Annualized (AAEV) Value of Recreation Benefits from Alternative A1
Millions of 1998 dollars @ 6.875% (COE rate)

	A2 PV	A2 AAEV	A2' PV	A2' AAEV	A3 PV	A3 AAEV
Reservoir Recreation	$0	$0	$0	$0	$-459.64	-31.60
River Recreation						
Low					+$492.80	+33.90
Low Middle					+$714.40	+49.10
Middle					+$1,049.30	+72.10
Middle High					+$1,756.50	+120.80
High					+$4,537.40	+311.90
Recreation Fishing						
Resident and Steelhead	-$.09	-.01	-$.09	-.01	+$325.11	+22.35
Mainstem Salmon	-$.01	.00	-$.54	-.04	+$4.47	+.31
Upstream Steelhead	-$7.72	-.53	-$4.29	-.30	+$50.96	+3.51
Upstream Salmon	$.56	.04	-$.01	.00	+$.70	-.05

Total Middle	**-$7.26**	**-.50**	**-$4.93**	**-.35**	**+$970.90**	**66.62**
Total Low					**+$413.00**	**28.42**
Total High					**+$4,458.23**	**306.42**

RISK AND UNCERTAINTY

As in any survey and statistical analysis, there is a degree of uncertainty regarding the exact magnitude of the estimates of the visitor use estimates and recreation benefits. This section expands upon the potential range of river visitor use estimates, and provides a range of benefit per trip associated with the various recreation uses.

Reservoir recreation benefits represent nearly all the benefits of alternatives A1, A2 and A2'. The average value per trip from McKean (1998b) is $71.31. The 95% confidence interval around the mean is $47 to $148 per trip. Using the 95% confidence interval, the annual value of recreation changes from the mean estimate of $31.6 million to a low of $20.8 million to a high of $65.5 million annually.

River recreation benefits also reflect a large part of the benefits for alternative A3. The mean benefits per trip using the low NED value is $71.36 per trip, with a 95% confidence interval of $39 to $446 per trip. If we use visitors entire reported trip costs as the price variable in the demand function, then river recreation benefits could have a mean value of $297 per trip, with a 95% confidence interval of $181 to $831 per trip.

Evaluation of Alternatives Without California River Visitors

A concern was expressed by the COE that a large portion of the total river recreation benefits resulted from survey respondents living in California. A review of the detailed visitation figures does reveal an interesting pattern. While California households make up about 70% of the population of the study region (*e.g.*, California, Idaho, western Montana, Oregon and Washington) the survey indicated they would make only 30% to 45% of the total trips depending on whether we assume non-respondents would visit or not. Further, California households would visit at a rate about one-third of locals and about one-half of Pacific Northwest residents. Those that would visit would take only 1 trip per year.

However, given the long distance of these trips, it is not surprising these trips had a very long length of stay, of over a week. As a result of their much longer average length of stay, California residents do make up half or more of the visitor days and thus benefits. Currently, the average length of stay of survey respondents visiting the Lower Snake River reservoirs is about 3 days in length.

Of course the benefit-cost accounting stance the COE is required to use under the U.S. Water Resources Council is a national one (hence the name National Economic Development). Therefore, exclusion of benefits arising from one geographic region of the country is not permissible unless there is a serious concern regarding its validity. The specific concern was that California residents currently do not frequently visit the area and therefore have lower knowledge of the Lower Snake River than local residents and therefore these California responses may be less reliable. A review of the California survey responses does indicate that only 20% of those California households indicating they would definitely visit if the dams were removed, had visited the Lower Snake River in 1998. We do not know if the other 80% indicating they would definitely visit had visited in previous years, since this question was not asked. However, the concern remains that the survey responses for more distant California visitors implies an unusually large percentage of total visitation being made up by these distant users. The estimated visitation rates are based on 190 returned surveys, so there is not a serious small sample problem. However, California did have the lowest response rate at 28%. This response rate is accounted for in the Low Estimate of visitation this response rate by assuming that the 72% of non-respondents would not visit at all. But the concern regarding the lower California response rate becomes more relevant in the Middle Estimate, which makes no adjustment for this lower response rate.

The Low, Low-middle and Middle estimates in all of the tables presented in this chapter uses just those indicating they would definitely visit. Based on the research by Champ, *et al.* (1997) respondents that are definitely sure of their responses had criterion validity with actual cash payments. Since it is likely that at least some of the respondents indicating they would Probably Visit the Lower Snake River if the dams were removed may visit, the Low, Low-Middle and Middle estimates are conservative due to the omission of the Probably Visit respondents. Further, the Low estimate reduces the Definitely Yes visitation estimate by the survey non-response rate. That is, the Low estimate assumes that none of the non-respondents to the survey would visit the Lower Snake River if the dams were removed. Thus, the Low estimate is doubly conservative.

However, as part of a sensitivity analysis to determine whether the overall NED analysis is sensitive to various sources of uncertainty, Table R-6 presents the recreation analysis with California visitation benefits removed. As can be seen the benefits of Alternative A3 are reduced, although the recreation benefits of A3 still exceed the foregone reservoir recreation. Nonetheless, the gain is much smaller and this may likely affect the overall benefit-cost analysis evaluation of the alternatives.

Table R6
Present Value (PV) & Annualized (AAEV) Value of Recreation Benefits over 100 years
Millions of 1998 dollars @ 6.875% (COE rate)
California Visitors Removed From River Recreation Scenario

	A1 PV	A1A AEV	A2 PV	A2A AEV	A2 Net		A2' PV	A2'A AEV	A2' Net		A3 PV	A3 AAEV (Without CA)	A3 Net	
					PV	AAEV			PV	AAEV			PV	AAEV
Reservoir Recreation	$459.64	$31.60	459.64	31.60	0	0	459.64	31.60	0	0	-$459.64	-$31.60		
River Recreation														
Low											208.80	14.40	+209.80	+14.40
Low Middle											235.70	16.20	+235.70	+16.20
Middle											300.70	20.70	+2300.70	+20.70
Middle High											515.70	35.50	+515.70	+35.50
High											832.80	57.30	+832.80	+57.30

Recreational Fishing													
Resident & Steelhead	$26.11	1.79	$26.02	1.78	-.09	-.01	$26.06	1.79	-.05	.00	$351.22	24.14	+325.11	+22.35
Mainstem Salmon	$13.71	.94	$13.70	.94	-.01	.00	$13.17	.90	-.54	.04	$18.18	1.25	+4.47	+0.31
Upstream Steelhead	$401.54	27.60	$393.80	27.07	-7.72	-.53	$397.25	27.30	-4.29	-.30	$452.50	31.11	+50.96	+3.51
Upstream Salmon	$4.39	.30	$4.95	.34	.56	.04	$4.38	.30	-.01	.00	$3.69	.25	-.70	-.05
Without California Visitor Benefits Estimates													
Total Middle	$905.39	62.23	$898.13	61.73	-7.26	.50	$900.50	61.90	-4.93	-.35	$1,126.30	77.45	+220.90	+15.22
Total Low											$1,035.39	71.15	+130.00	+8.92
Total High											$1,658.39	114.05	+753.00	+51.80

Avoided Cost Analysis

Removal of the dams in alternative A3 will not result in any significant recreation management costs avoided to the COE. Most of the COE recreation maintenance cost is related to the developed campground areas and other developed facilities which will remain under all alternatives. The labor costs associated with rangers will continue as well.

Mitigation

The recreation effects from removal of the dams in alternative A3 will not be directly mitigated. Much of the same water based recreation is expected to continue to occur as today, with the major exception being activities such as waterskiing. The availability of existing nearby reservoirs such as Lake Wallula downstream from Ice Harbor dam and near Tri-Cities, Dworshak Reservoir near Lewiston Idaho and three large lakes near Spokane (Rufus Woods Lake, Coeur d'Alene and Lake Pend Oreille) provide opportunities for flat water recreation.

PASSIVE USE VALUES OF WILD SALMON AND FREE-FLOWING RIVERS

Avoiding extinction of endangered species is recognized as a source of existence or passive use values (Meyer, 1974; Randall and Stoll, 1983; Stoll and Johnson, 1984). Existence values are defined as the benefit received from simply knowing the resource exists even if no use is made of it. Free-flowing rivers, were one of the first examples of such resources with existence values (Krutilla and Fisher, 1975). Essentially people who never plan to visit, raft, or fish these rivers may still pay something to have a free flowing river. Wild stocks of Snake River Sockeye and Chinook Salmon clearly fit into this picture. As noted by Olsen, et al. in his existence value of salmon study "Existence values as the value an individual (or society) places on the knowledge that a resource exists in a certain state is theoretically sound and can be measured for assessment within the resource decision making arena." Passive use value are also public goods, in that these benefits can be simultaneously enjoyed by millions of people all across the region and the country (Loomis, 1996a).

Incorporating non-use values has become fairly routine in many Federal benefit-cost analyses for critical habitat designations of endangered species. For example, the USDA Economic Research Service's economic analysis of salmon recovery efforts on the Snake River included estimates of non-use values drawn from the existing literature (Aillery, *et al.* 1996). Nonetheless, passive-use values are not formally part of the COE's National Economic Development analysis. This may be due, in part, to the benefit-cost procedures which must be followed by the COE being originally written about 20 years ago (U.S. Water Resources Council, 1979), before measurement of passive use values had become common. These benefit-cost procedures are silent on measurement of passive use values, although they do allow for measurement of other categories of benefits as long as the procedures are documented and willingness to pay is used. Passive use values are estimated using a method recommended by the U.S. Water Resources Council for valuing recreation, but its use to measure passive use values has been controversial (Diamond and Hausman, 1996; McFadden, 1994) although it has been given a limited endorsement by a Blue-Ribbon panel chaired by two Nobel Laureate economists (Arrow, *et al*).

Although the COE will not formally include the passive use values in their official NED analysis, the Drawdown Economic Workgroup (DREW) asked that passive use values be included in an overall presentation of benefit and cost summary in the Economic Appendix.

Therefore, passive use values were calculated to be included in that part of the overall economic analysis. DREW had originally requested an original passive use value survey as part of the recreation survey and such a survey was pretested. However, due to a variety of factors the COE decided the non-use values would be approximated based on existing passive use value estimates (*e.g.*, using a benefit-transfer approach) rather than a new survey as was originally proposed. The final passive use value survey was not conducted.

A passive use value per salmon function was statistically estimated using marginal existence values per salmon calculated from three previous contingent valuation method studies of West Coast residents' WTP for increasing salmon populations. The original studies are Olsen, *et al.*, Hanemann, *et al.*, and Loomis, 1996b. The procedures for estimating the function are reported in Loomis, 1999. Using the function the change in annual total passive use values with different levels of wild salmon and wild steelhead recovery is calculated for non-user households in the Pacific Northwest and California. Data on run size of wild chinook salmon and wild steelhead was obtained from PATH analyses provided by Shannon Davis. Application of this function to wild salmon and steelhead populations in alternative A1 is treated as the baseline or future without. The change in annual passive use values is then calculated for each of the three alternatives for an increase in wild salmon and steelhead populations.

The natural river drawdown alternative A3, is estimated by PATH to yield a near doubling of the wild salmon and wild steelhead run size and therefore produces a $1,040 million average annual increase in passive use values. Given the small reduction in wild salmon and steelhead run sizes of A2 and A2' from the future without (A1), there is a slight reduction in passive use values for A2 (loss of $87 million annually from baseline-A1) and A2' (loss of $29 million annually from baseline A1). A more conservative approach to calculate the passive use value can be made by matching the change in anadromous fish populations in A3 to the one existing study which valued a similar size change in salmon (Loomis, 1996b) rather than using the statistical function estimated from all three studies. The resulting lower estimate of the gain in passive use value would be about $220 million per year.

However, the $1,040 million for the PATH fisheries biologists estimate of a near doubling of the wild salmon and wild steelhead run size in the Snake River is consistent with recently released results of a survey of Washington residents by Brown, *et al.*, (1999). These authors estimated that Washington residents would pay $307 million annually for a doubling of salmon in eastern Washington and the Columbia River. However, Washington residents reflect only 12% of the households in the Pacific Northwest and California region used in our analysis. Generalizing the Brown, *et al.*, values to the same geographic region as used in our analysis, yields a value of $2,557 million for the doubling of salmon runs in eastern Washington and the Columbia River.

Also based on the existing literature there appears to be a passive use value of $420 million annually for returning the Lower Snake River to a free-flowing condition, independent of any effect on salmon populations. See Loomis, 1999 for literature used and details of calculations.

CONCLUSION

If the dam breaching alternative (A3) is implemented on the Lower Snake River it will result in a loss of some reservoir based recreation activities and replacement with more river based recreation activities. Overall both recreational fishing and general recreation use is expected to increase in ten years once the river is restored and the fisheries respond to natural river conditions. The present value of recreation benefits accounts for the immediate impact of the loss of many reservoir recreation activities and the gradual gain in river recreation activities. The annualized present value of the economic benefits of restored river fisheries and river recreation exceeds the loss in reservoir recreation by at least $28 million per year to as much as $306 million per year with a middle estimate of $66 million per year. The incremental passive use values for the increase in anadromous fish due to the dam breaching is about $1 billion for households in the Pacific Northwest and California.

References

Aillery, *et al.*, Salmon Recovery in the Pacific Northwest: Agricultural and Other Economic Effects. Report #727. USDA Economic Research Service, Washington DC.

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner and H. Schuman. 1993. Report of the NOAA Panel on Contingent Valuation. Federal Register 58(10):4602-4614.

Brown, Gardner, David Layton and Mark Plummer. 1999. Estimated Economic Benefits of Regulations to Improve Washington State Fisheries. Dept. of Economics, University of Washington, Seattle (Feb. 4, 1999).

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

Champ, P., R. Bishop, T. Brown and D. McCollum. 1997. Using Donation Mechanisms to Value Nonuse Benefits from Public Goods. Journal of Environmental Economics and Management 33(2):151-162.

Diamond, P. and J. Hausman. 1994. Contingent Valuation: Is Some Number Better than No Number? Journal of Economic Perspectives 8:45-64.

Krutilla, John and Anthony Fisher. 1975. The Economics of Natural Environments. Resources for the Future, Johns Hopkins University Press. Washington DC.

Hanemann, Michael, John Loomis and Barbara Kanninen. 1991. Statistical Efficiency of Double Bounded Dichotomous Choice Contingent Valuation. *American Journal of Agricultural Economics*, Volume 73(4): 1255-1263.

Loomis, J. 1993. "An Investigation into the Reliability of Intended Visitation Behavior." Environmental and Resource Economics. 3:183-91.

Loomis, John. 1996a. How Large is the Extent of the Market for Public Goods: Evidence from a Nationwide Contingent Valuation Survey. Applied Economics 28:779-782.

Loomis, John. 1996b. Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River: Results of a Contingent Valuation Survey. *Water Resources Research*, 32(2):441-447.

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

Loomis, John and Richard Walsh. 1997. Recreation Economic Decisions: Comparing Benefits and Costs. 2nd. Edition. Venture Publishing, State College, PA.

McFadden, D. 1994. Contingent Valuation and Social Choice. American Journal of Agricultural Economics 76(4): 689-708.

McKean, John. 1998a. Sportfishing Use and Value on the Lower Snake River Reservoirs. Agricultural Enterprises Inc., Masonville, CO.

McKean, John. 1998b. Outdoor Recreation Use and Value on Lower Snake River Reservoirs. Agricultural Enterprises Inc., Masonville, CO.

McKean, John. 1998c. Sportfishing Use and Value on the Free Flowing Snake River Above Lewiston. Agricultural Enterprises Inc., Masonville, CO.

McKean, John. 1999a. The Sportfishing Use and Value in the Snake River Basin in Central Idaho, 1999. Agricultural Enterprises Inc., Masonville, CO.

McKean, John. 1999b. Outdoor Recreation Use and Value in the Snake River Basin in Central Idaho, 1999. Agricultural Enterprises Inc., Masonville, CO.

Meyer, Phillip. 1974. Recreation and Preservation Values Associated With Salmon of the Frasier River. Environment Canada. PAC/IN-74-1, Vancouver, Canada.

Normandeau Associates and David Bennett. 1999. Draft Resident Fish Appendix, Lower Snake River Juvenile Salmon Migration Feasibility Study EIS.

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

Pate, Jennifer and John Loomis. 1997. The Effect of Distance on Willingness to Pay Values: A Case Study of Wetlands and Salmon in California. Ecological Economics 20:199-207.

Radtke, Hans, Shannon Davis and Rebecca Johnson. 1999. Anadromous Fish Economic Analysis. Lower Snake River Juvenile Salmon Migration Feasibility Study EIS.

Randall, Alan and John Stoll. 1983. "Existence and Sport Values in a Total Valuation Framework." in R. Rowe and L. Chestnut, Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Westview Press: Boulder, CO.

Sassone, Peter and William Schaeffer. 1978. Cost-Benefit Analysis: A Handbook. Academic Press, San Diego, CA.

Stoll, John and Lee Ann Johnson. 1984. Concepts of Value, Nonmarket Valuation and the Case of the Whooping Crane. Transactions of the 49th North American Wildlife and Natural Resources Conference, Wildlife Management Institute. Washington DC.

U.S. Water Resources. 1979. Procedures for Evaluation of National Economic Development (NED): Benefits and Costs of Water Resources Planning (Level C) Final Rule. Federal Register 44(242): 72892-977.

U.S. Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. U.S. Government Printing Office, Washington DC. March 10, 1983.