US Army Corps of Engineers
Walla Walla District

Recreation and Passive Use Values From Removing the Dams On the Lower Snake River to Increase Salmon

Prepared For:

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EXECUTIVE SUMMARY

Recreation Use and Benefits

Using a survey of households in the Pacific Northwest and California (n=4,780 completed surveys and a response rate of 54% overall), the potential participation of anglers and other visitors that would occur if the four Lower Snake River dams were removed and the river is restored are estimated. Travel cost demand models were also estimated for anglers and non-anglers using intended trips to a free-flowing Lower Snake River to calculate benefits. For both user groups we estimated benefits based on reported trip cost and based on travel cost only, using a cost per mile consistent with the estimate for the existing recreation use of the reservoirs. A policy simulation of the relationship between number of angler trips and salmon catch rates is provided to identify the biological linkages between chinook salmon population estimates and catch rates that will be needed to apply our results in the Environmental Impact Statement.

Five estimates of angler 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.

The low estimate of angler demand is 1.3 million angler days that would increase to 2.7 million angler days over time when chinook salmon populations would increase to the point that salmon fishing would be allowed and fishing quality would be one salmon caught per 35 hours of fishing. With the salmon population increases sufficient to allow fishing, the Travel Cost Method demand model indicated angler benefits (at $76 per day) would increase from $98.3 million to $206 million. Small increases in angler days would occur with subsequent increases in salmon populations and salmon fishing quality to 20 hours per salmon caught (new total angler days would be 2.81 million angler days) and 10 hours per salmon caught (2.87 million angler days).

A low middle range estimate of angler demand uses only those that would definitely visit, but assumes some proportion (around 20%) of the survey non-respondents would visit. This is based on the observation that if we would have used a financial incentive some of the households that were non-respondents, would have been survey respondents reporting some positive number of trips. This low middle estimate yields 1.8 million angler days increasing to 3.85 angler days demanded if salmon recovery would allow for salmon fishing.

A middle range estimate of angler demand uses only those that would definitely visit, but assumes that all households would visit at the same rate as households that responded to the survey. Using this assumption estimated angler demand would increase from 2.78 million angler days to 5.95 million angler days over time when salmon fishing would be allowed. Corresponding fishing benefits would increase from $210 million to $452 million. Of course, the full amount of these use and benefit estimates will not occur for several years into the future, after sufficient salmon recovery to allow delisting and re-establishment of a recreational fishery. Even then, there would be a stair-step increase as salmon recovery of recreational fishing over time to the numbers estimated here. An approach for scaling the angler demand to salmon population levels, eventually to be provided by PATH, is discussed in the main body of the report.

The middle high and upper bound demand estimates are provided in the summary table below and the calculations provided in the main body of the report. The upper bound demand estimate is so large, that biologists should review it to determine if even a recovered chinook salmon fish stock could biologically support such a high level of fishing pressure.

Executive Summary Table of Potential Annual Recreation Demand and Benefits After Dam Removal, River Restoration, and Salmon Recovery
(Units are all in millions of days or dollars)

	Non-Anglers		Anglers					
			Steelhead Fishing Only		Steelhead and Salmon at 35 Hours/Salmon		Steelhead and Salmon at 20 Hours/Salmon	
	Days	Benefits	Days	Benefits	Days	Benefits	Days	Benefits
Low Est	1.68	$190.8	1.29	$98.3	2.72	$206.6	2.81	$213.6
Low Middle	2.85	$322.1	1.81	$137.4	3.85	$293.0	3.98	$303.0
Middle Est*	4.85	$548.5	2.77	$210.6	5.95	$452.2	6.15	$467.7
Middle High*	9.08	$1,026.4	4.74	$360.5	10.37	$788.2	10.70	$815.4
High Est*	28.0	$3,171.7	11.35	$862.8	25.50	$1,938.8	26.40	$2,007.4

Low estimate uses only the visitation rate of households or anglers that would definitely visit *and* assumes that households not returning the survey would *not* visit. This is also called the full response rate adjustment since it *reduces* the Middle Est of demand by 44% for local counties, 49% for Pacific Northwest, and 72% for California (*i.e.*, by one minus the area's response rate).

Low-Middle uses only the visitation rate of households or anglers that would definitely visit and assumes a small proportion of the non-responding households would visit the lower Snake River. This proportion was calculated using a higher response rate (68% of Pacific Northwest and 55% of California households) based on previous survey response rates.

Middle Est uses the visitation rate of households or anglers that would definitely visit *and* assumes that households not returning the survey *would* visit at the same rate as households returning the survey.

Middle High estimate uses the sum of visitation rate of households or anglers that would definitely visit *plus* those that would probably visit, and assumes the households not returning the survey *would* visit at the same rate as households returning the survey.

The High estimate uses the sum of visitation rates of households or anglers that would definitely visit *plus* those that would probably visit, and assumes the households not returning the survey *would* visit at the same rate as households returning the survey.
***Caution:** These are demand estimates and such use levels may not be able to be accommodated given available recreation facilities or fisheries productivity. Recreation planners must compare these estimates to the recreational carrying capacity and facilities to determine if all the demand can be met under the different scenarios. Fisheries biologists would need to determine the level of angler use that is biologically sustainable and limit actual use to that level via fishing season regulations. An example calculation is provided in the report of the procedure that can be used once biologists estimate salmon populations. It may be a decade or more before these full demand estimates can be realized.

The low, low-middle and middle estimate of angler use seems plausible, given there were about 40 million angler days of freshwater fishing reported by anglers from California, Idaho, Oregon, and Washington in the 1991 U.S. Fish and Wildlife Service's National Survey of Hunting, Fishing and Wildlife Associated Recreation.

The salmon fishing demand and benefits relationships estimated in this report could likely be applied to increases in salmon estimated by biologists to occur from improved transport and other dam improvements. However, our demand estimates may overestimate the number of salmon fishing trips and benefits associated *with dam improvements*, if anglers strongly prefer fishing for salmon in a free-flowing river (as described in the survey) as compared to reservoirs. Of course, the non-angling river recreation benefits would not occur without dam removal. However, the existing reservoir recreation estimated by McKean (1998b) would likely remain and could be used to estimate the non-fishing benefits of dam improvements.

These angler demand and benefit estimates can be compared to the current reservoir angler use and benefits estimated by McKean (1998a). In McKean's report he uses the Normandeau Associates fishing use estimates collected by David Bennett's group at the University of Idaho. This yields about 3,305 anglers, fishing 87,050 days. This yields annual reservoir angling benefits of $1.956 million. Thus current angler use and benefits are less than 10% of what is projected to occur if the dams are removed and the anadromous fishing improved.

Using the same ranges of assumptions about survey responses (assume or not assume non-respondents would visit at the same rate as respondents) and respondent certainty (definitely yes vs sum of definitely yes and probably yes) the same four range of river visitor demand and benefit estimates were calculated for non-fishing river visitors.

The low estimate for non-angler river demand is estimated at 1.688 million visitor days *once the Lower Snake River is restored to conditions described in the survey*. The travel cost method demand model estimates these river recreation benefits at $190 million annually once the river is restored. The low-middle estimate assuming some of the non-respondents would visit yields an estimated demand of 2.85 million days. The middle demand estimate (definitely yes visitors assuming non-respondents would visit at same rate as respondents) is 4.85 million visitor days with an economic value of $548 million annually. This visitor demand estimate and the high-middle and high estimate provided in this report need to be reviewed by recreation planners to determine if sufficient carrying capacity exists at the campgrounds and parking lots to accommodate these high estimates of visitor demand. If not, either demand estimates would need to be capped at facility carrying capacity or costs for expanding facilities included if the middle and higher visitor demand estimates are relied upon in the EIS.

Current non-angler use is estimated by using COE reported visitor hours of 9.2 million hours and average length of stay per day. Estimated visitor days consistent with McKean's (1998b) estimate of total non-angler recreation benefits of $31.578 million is 890,000 visitor days. Thus current non-angler use is about one-half to one-fifth of the projected visitation if the dams are removed, depending on the scenario.

The table above summarizes the recreation demand analysis. Detailed tables documenting angler and non-angler river demand calculations and disaggregated by the counties nearby the Lower Snake River, rest of Pacific Northwest and California are provided in tables 6-8. The reader is encouraged to read the detailed explanation of the procedures used in the report before jumping to conclusions about the results. In particular, these demand estimates and benefits will not be immediately realized following dam removal but will occurring gradually over several years.

Passive Use Values

Using a benefits-transfer approach the passive use value of various increases in salmon population are estimated. A passive use value function is provided that allows analysts to calculate the change in annual total passive use values with different levels of salmon recovery. Application of this function for an increase in chinook salmon populations from their current levels (around 10,000 returning adults) to levels necessary for removal from the Endangered Species list (around 32,500 returning adults) has a minimum estimated annual value of $56 million if the gain in Snake River chinook and sockeye salmon is considered equivalent to other wild salmon and the increment is calculated from estimated numbers of returning adult salmon in the Pacific Northwest. If Snake River chinook and sockeye are treated as they under the Endangered Species Act as distinct species, and the increment is calculated starting from current populations of these two species, then the incremental passive use value is $2.9 billion annually to households in the Pacific Northwest and California.

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.

NEED FOR THE STUDY

Four dams were built on the Lower Snake River between the Tri-Cities area at the mouth of the Columbia and Snake Rivers and Lewiston, Idaho from a period of 1960 to 1974. These dams provide hydroelectricity and allow Lewiston to essentially be an inland port for grain and lumber.

Despite fish ladders for ascending adult salmon and barge transport of smolts, populations of chinook and sockeye salmon have plummeted over the three decades since the first dam, Ice Harbor was completed in 1962. Populations of returning adult chinook salmon have fallen from around 100,000 fish during the early 1960's to around 9,000 today. In some years the number of sockeye salmon returning to Redfish Lake in Idaho have been in the single digits. Snake River sockeye salmon are listed as an Endangered species, while chinook salmon are listed as a Threatened Species under the Endangered Species Act.

National Marine Fisheries Service (NMFS) has requested that the U.S. Army Corps of Engineers (COE) evaluate removal of the four lower Snake River dams as part of NMFS recovery planning effort. Dam removal has both direct costs to remove the dams as well as large opportunity costs in terms of foregone hydropower and barging. Several groups of fisheries biologists have evaluated the likely gains from dam removal allowing for quicker migration of smolts downstream to the ocean. While there is some debate regarding the net effect of dam removal versus improved barging, dam removal is considered by federal and state agency biologists to have nearly twice the probability of recovering chinook salmon as dam improvements (Marmorek *et al.*, 1998).

Being biologically effective, is not the same as being economically effective. If dam removal would result in quicker recovery of the chinook salmon runs in the Snake River, one question may be whether the added direct and opportunity cost of dam removal would warrant the greater eventual recovery. Further, a powerful political obstacle to dam removal in the region could request a "God Squad" exemption from the Endangered Species Act under the guise that recovery of the Lower Snake River stock of chinook salmon, is prohibitively costly. In addition, the COE is required under the National Environmental Policy Act of 1969 to prepare an Environmental Impact Statement that must address the social and economic consequences of such a significant Federal action.

ANALYTICAL APPROACHES

Recreation Use Value

Since natural river conditions do not exist in the Lower Snake River, one cannot survey existing users and directly apply standard methods such as the Travel Cost Model (TCM) to estimate the value of river recreation with dam removal. Since this is becoming a common problem, a hybrid approach known as "contingent behavior" (CB) has been developed. This approach involves: 1) describing the new recreation conditions (*e.g.*, natural river scenario); 2) asking whether the person would visit and if so, how many times per year; and 3) asking the distance and travel time to their most likely spot on the river they would visit.

From this information, a travel cost model using expected trips as the dependent variable and round trip distance and time as independent variables is estimated. From this model, use and benefits can be calculated. To incorporate the sensitivity of expected trips to anadromous fish catch, we would also vary catch of salmon and steelhead in our contingent behavior scenario.

This approach has been used successfully for river rafting (Ward, 1988) and fishing (Layman, Boyce, and Criddle, 1996). Loomis (1993) has shown the method to be reliable in a test-rest study as well as valid. The validity test compared individual's actual visitation rates to contingent visitation rates for the same lake level.

Passive-Use Values

Resources that are unique and irreplaceable have long been known to provide existence and bequest values to citizens (Krutilla, 1967). 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 planned to visit, raft, or fish these rivers may still pay something to have a free flowing nature. Avoiding extinction of endangered species was quickly recognized as another source of existence and bequest values (Meyer, 1974; Randall and Stoll, 1983; Stoll and Johnson, 1984). 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." Non-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).

At present the only method generally recognized as being capable of measuring existence values is the Contingent Valuation Method (CVM). This method involves describing the resource to be valued, including the consequences of paying or not paying. The individual is then asked to indicate how they would vote if it cost their household a particular dollar amount. Since different groups of households are asked to pay different dollar amounts, the analyst can estimate a demand like relationship and calculate mean WTP. This referendum approach is recommended by NOAA's Blue Ribbon Panel on CVM (Arrow *et al.*). Using CVM to measure passive use value has been controversial (Arrow *et al.*). CVM has proven to be reliable in measuring passive use values in several test-retest studies (Loomis, 1990; Carson *et al.*). The criterion validity of CVM to elicit passive use values is less encouraging, with stated WTP exceeding cash WTP, except when stated WTP is rescaled by respondent certainty (Champ *et al.*, 1997). However, it is difficult to develop a cash instrument for a public good that does not encourage free-riding, making comparisons with cash and stated WTP problematic (Randall, 1998).

Incorporating non-use values has become fairly routine in many Federal benefit-cost analyses for critical habitat designations of endangered species. Examples include benefit-cost analyses for the Northern Spotted Owl, Mexican Spotted Owl, and Wolf Recovery program. 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).

While the possibility exists that constructed objects such as dams or development may have existence value, economic theory and empirical evidence to date suggests this is likely to be small. As noted above, scarcity and uniqueness are major determinants of the size of non-use values. Dams and reservoirs are not scarce on rivers in the Pacific Northwest. Most of the value of development such as dams or barge transport comes from the market outputs created or the non-market recreation use values. Most public support for the dams can likely be traced to commodities produced or the recreation benefits provided by reservoir. These are being measured as part of the overall economic analysis and therefore are already reflected in the opportunity cost estimates. The other source of public support for projects is due to the local economic activity supported by the projects. While very important at the local level, the economic activity will be relocated elsewhere in the U.S. if the dams are removed. Thus from a benefit-cost standpoint, we cannot count jobs and local incomes that would be lost in the region as these will be gained in other regions of the U.S.

At the request of the COE, non-use values will be approximated based on existing non-use value estimates (*e.g.*, using a benefit-transfer approach) rather than an original study.

SAMPLING STRATEGY

The sampling strategy is driven by the primary objective of this study, to estimate recreation use and benefits with natural river conditions. Efficient sampling requires concentrating sampling effort in the geographic region where a majority of the potential visitors may come from. This is a challenge here, since natural river conditions do not exist. In addition, there are no established lists of rafters, hikers, *etc.*, like there are for anglers. Since recreation use is driven largely by distance to the recreation site and site attributes, it is difficult to use data on other rivers. Thus, to determine how broad a geographic area to concentrate on we relied upon two surveys of current users of the Lower Snake River projects. The first was conducted in 1985 by the Walla Walla District of the U.S. Army Corps of Engineers. Those surveys found that between 80% and 89% of use came from within 100 miles of the sites. The second survey was conducted during the summer of 1998 by AEI/Normandeau Associates. Using just the zip codes of visitors contacted at boat ramps, we found that half the water dependent recreation came from seven cities in the area (Tri-Cities of Kennewick, Richland and Pasco along with Clarkston, Lewiston, Pullman and Walla Walla). Spokane and Yakima were the next largest contributors of visitation. Therefore the main strata for contingent behavior surveying is designated "local counties" made up of:

Idaho Counties (Benewah, Latah, Lewis, Nez Perce, and Idaho County);

Oregon Counties (Morrow, Umatilla, and Wallowa); and

Washington Counties (Adams, Asotin, Benton, Columbia, Garfield, Franklin, Spokane, Walla Walla, Whitman, and Yakima).

At the direction of the review team this was supplemented by surveys of households in the rest of Idaho, Oregon, Washington and all of California and Montana. This second strata was sampled more lightly. Nonetheless, this strata is important since the upriver fishing survey by McKean (1998c) indicated that fishing for steelhead on free-flowing sections of the Snake River attracted anglers from great distances.

The sample size was based on standard statistical criteria such as the variance of the population, allowable error and desired confidence level. We obtained estimates of the variance and the prevalence of river recreation activities such as rafting and canoeing in the population from the existing literature. To provide 90% confidence that our sample estimated trips per person would be within 10% of the population mean for river-based activities would require a sample size of 8,600 surveys assuming a 50% response rate of deliverable surveys. Given higher than average non-deliverables associated with rural addresses, we recommended this sample size be increased to 9,000. The 9,000 surveys are allocated as follows: 1) 6,000 to the 18 counties within 150 miles of the Lower Snake River based on population; and 2) 3,000 to the rest of Idaho, Oregon and Washington, and all of California and Montana.

DESCRIPTION OF LIKELY EFFECTS WITH NATURAL RIVER

Based on discussions with COE staff as well as information in a wide variety of documents, we sketched a description of the likely effects of natural river conditions. Figure 1 below presents what the key contingent behavior information presented to the respondents was in the final mail survey.

Figure 1
Key Contingent Behavior

WHAT ARE THE RECREATION OPPORTUNITIES OF NATURAL RIVER CONDITIONS?

Before we ask you whether you would visit the Lower Snake River if the dams were removed, we want to describe what the resulting free-flowing river would be like. Also see the map insert.

What Would the River Look Like?

Dam Sites: The earthen part of the four dams would be removed and the river would flow around the remaining concrete dam structure.
River Canyon: The 140-mile river canyon would be unchanged and is over 1,000 feet deep in places.
River Depths: Minimum river depths would be 4-6 feet during spring, summer and fall.
Islands: Prior to the dams, there were about 70 small islands. These islands will reappear with natural river levels. The islands would provide wildlife habitat as well as potential camping and lunch spots.
Vegetation: Would be re-established along the river and on re-emerging islands over a 5-10 year transition period.

What Would Recreation Access be Like?

Land Ownership: Federal, State and County ownership and management would continue. Generally there are no fees for most activities, except camping at developed campgrounds.
Roads to the river: 30 river segments would be accessible by car. There are several sections of paved road that parallel the river and provide access. (See map insert). Several 10-20 mile segments of the river would remain unroaded and accessible only by boating or hiking.
Bridges across the river: Two existing paved roads across the middle of the river and existing road access at either end of the river would remain. (See map insert).
Trails: Old road beds and railroad beds in the canyon would re-emerge. Large portions of these would be suitable for hiking, mountain biking, and horseback riding along the shoreline.
Boat ramps: 14 of the existing 27 boat ramps would be extended down to the river.

What Recreation Activities Would be Possible?
River Based:
River fishing, rafting, canoeing, kayaking, tubing, drift boats and jet boating would be possible.
Flows: During the high flow months of April to June, the entire 140 miles of river could be floated in boats such as rafts or canoes in about 7 days. During July and August, portions of the river could be floated on a typical weekend.
Rapids: Prior to the dams, the river had 63 named rapids. These were relatively small rapids. Most of these rapids would return with dam removal.
Land Based:
Currently there are seven campgrounds, offering over 400 individual campsites located in the river canyon. The majority of these campgrounds have running water, flush toilets, tables, shade trees, and electrical hook-ups for RV's. These campgrounds and facilities would remain in place, however, they would be a few hundred feet further to the new river level. There are also hotels and lodging available in nearby towns of Pasco and Lewiston. (See map insert)

What Would the Fishing be Like After Dam Removal and River Restoration?

Resident Fish: Due to loss of reservoirs, catch rates for species such as smallmouth bass would be slightly lower than today, while fishing for species such as yellow perch, bullheads, catfish, and bluegill would be largely eliminated. Sturgeon fishing would improve with natural river conditions.
Steelhead Fishing: It is expected that fishing for steelhead would improve from current catch rates averaging 1 steelhead for every 24 hours of fishing (3-4 angler days) to 1 steelhead per XX hours of fishing.
Salmon Fishing: It is expected that chinook salmon populations will increase to the point where they would no longer be endangered and fishing for chinook salmon in the Lower Snake River would occur each year. Catch rates of 1 chinook salmon per HH hours of fishing are expected over a DD day season. [Where XX, HH and DD were varied over the biologically likely range (as determined by harvest rates at similar rivers and historic data) and varied in a way to minimize the colinearity between salmon and steelhead catch rates.]

Using A Range of Salmon and Steelhead Figures to Deal With Uncertainty Regarding Anadromous Fish Response

Since we were unable to obtain specific information from the Federal agency biologists on likely changes in salmon populations or salmon/steelhead fish catch rates with dam removal or improved dams, the XX, HH, and DD on the previous page represents different catch rates and season lengths in the different survey versions. These changes in fish catch are used as variables in the travel cost method demand equation. Using information on existing catch data from University of Idaho, current catch rates of steelhead at the reservoir were set as the baseline catch rate (one fish every 24 hours of fishing). Steelhead catch rates in the free-flowing section were used as guidance for dam removal catch rates. Information on catch rates from Idaho Fish and Game's 1997 special season hatchery salmon fishery and information provided by Bert Bowler of Idaho Fish and Game based on the chinook salmon fishery in the Hanford Reach of the Columbia River were used to set the range of catch rates for chinook salmon. Catch rates were expressed as 1 fish per X hours of fishing, where X varied with salmon population levels used in that survey version. While not a perfect measure, discussions with Idaho Fish and Game as well as University of Idaho biologists studying steelhead fishing, suggested this is the way fishing success rate data is frequently reported in the local newspapers. Therefore, anglers were used to judging the quality of fishing in terms of the hours it takes to harvest one steelhead. We used the same measure for salmon fishing and supplemented it with an associated season length to further define the relative scarcity or abundance of salmon. The range includes a low end which involves small increases in steelhead fishing but no salmon fishing to an upper end of fully fishable estimate. To reduce multicolinearity between steelhead and salmon catch rates in order to estimate separate coefficients, the 16 different versions were mixed in an off-setting pattern.

CONTINGENT RECREATION BEHAVIOR MODEL FOR RIVER RECREATION

For any one indicating that salmon or steelhead fishing would be an activity, we statistically estimated the probability of visiting and the number of visits as a function of travel cost to the site, expected hours to catch a salmon and steelhead as well as respondent demographics. We initially estimated a two-stage model of the form:

1. Probability of visitation = f(Milesi, HoursSteelhead, HoursSalmon, Demographicsi); and
2. Number of tripsi = f(TCi, TTi, HoursSteelhead, HoursSalmon, Income, Recreation Days, SubstituteCost, Demographicsi)

   Where:

   Miles - mileage from respondents place of residence to the area on the Lower Snake River they would most likely visit.

   TCi - is round trip cost of respondent. This was measured as reported trip cost of respondents or for consistency with McKean's (1998a,b) of reservoir recreation, as travel costs.

   TTi - is travel time from respondent's home to the area on the Lower Snake River they would most likely visit.

   HoursSteelhead and HoursSalmon - are the average number of hours it takes to catch steelhead and salmon. This number varied from respondent to respondent in the survey to allow estimation of a coefficient on fish catch. There were eight different levels of hours to catch a steelhead and six different levels for salmon (essentially two salmon versions with zero catch). These variables are key policy variables that can be changed by feasibility study alternative.

   Income: The household income is tested to see if the income constraint or money budget influences the number of trips.

   Recreation Days: The number of days available for recreation is tested to see if the time constraint or time budget influences the number of trips (see Bockstael *et al.*; McKean *et al.*, 1995, for the theoretical consistency with disequilibrium labor markets).

   Substitute River Recreation Cost: For those respondents that currently visit other rivers, the travel costs to those rivers.

   Demographics: This would include boat ownership, number of recreation activities they would participate in, boat ownership, age, *etc.*

This model formulation allows for river restoration to:

1. induce non-visiting anglers to the area to begin to visit for anadromous fishing or other river recreation. This is modeled in equation (1), using a Probit model since the dependent variable is zero (no visit) or one (visit); and

2. anglers to increase the number of trips in response to better anadromous fishing quality or riverine conditions. This is the Travel Cost Method demand equation specified in (2).

For those respondents who indicate they would not fish, the same basic two step Travel Cost Model will be tested without including the Steelhead and Salmon variables.

Since the number of trips taken is a non-negative integer, a count data model is an appropriate statistical model to estimate the Travel Cost Method (TCM) demand equation (Creel and Loomis, 1990; McKean, 1998). If the mean of the dependent variable is not equal to the variance, then overdispersion is present. This condition requires use of a negative binomial count data formulation rather than the more standard Poisson model (Creel and Loomis, 1990). The negative binomial count data TCM is the same approach used by McKean (1998) to estimate the economic value of reservoir recreation at the existing Lower Snake River dams. Thus there is consistency in valuation methodology between non-market benefits being lost and gained.

FOCUS GROUPS

To check for understandability and internal validity of the survey, portions of the survey were made into one page worksheets that were distributed at the focus groups. The individual was then asked to review the description of what the river would be like with dam removal. They were asked to point out any words that were not clear. They were asked to identify any additional information that they felt was needed before they could make an informed decision about whether to visit the restored Lower Snake River. The responses on the written worksheets were supplemented by discussions with the focus group. These were recorded on flip charts. After each focus group, changes were made to materials for the following focus group. Focus groups were conducted during the month of January 1998, in the cities of Seattle, Kennewick, Boise, Spokane, Lewiston, and San Jose, California. There were 9 to 11 people at each focus group.

SURVEY PRETESTING

The revised survey was printed as a booklet with color cover and color recreation map insert. The pretest involved mailing five versions of this booklet. The household was then phoned and their answers read back to interviewers. In addition, a set of check questions were included to probe for lack of clarity on any informational materials or specific survey questions. Individuals were then asked to mail their booklets back. A total of 45 surveys were completed over the months of February and March. Individuals interviews conducted over the phone gave us several useful insights for revising the survey. The results of the pretest also aided in refining the design of the bid amounts to be used in the survey.

Numerous revisions to the survey were made during the months of April and May. At the end of July a decision was made to go forward with a survey that would only address recreation use with and without the dams. Other than omission of the non-use values, the revised recreation portions were only slightly different than the previous version that was pretested. Nonetheless, to insure that the changed context and wording changes made during the intervening four months had not altered the internal validity of the survey questions, the survey was again pretested. This time, 11 pretests were conducted in-person in Spokane, Washington, on August 28. In addition, 100 surveys were priority mailed to Snake River recreation users to solicit their feedback. A total of 36 the 100 surveys were returned completed by the cut-off date for survey printing, with an additional five being returned undeliverable. A complete copy of the 8-page survey instrument and map is found in the appendix. We were often restricted from using questions that current economic theory suggested would be important, because such questions had not been included in the previously approved set of questions from OMB.

MAILING PROCEDURES

The 10,000 surveys were not sent out until October 9, 1998. The survey package was sent first class and included a personalized cover letter, stamped return envelope and the survey with recreation map insert. A reminder postcard was sent to all households. The second mailing was sent out four weeks later with a new more emphatic cover letter that attempted to address any concerns individuals might have for not returning the survey and stressing the importance of completing the survey. A replacement survey was included. A third mailing was sent by U.S. Post Office Priority Mail with a cover letter stressing the importance of the survey and urging them to complete it. This survey was sent out December 10th. This is not an ideal time to survey due to the holidays.

SURVEY RESPONSE RATE

The three mailings of the survey resulted in 4,780 surveys being returned by respondents and another 1073 being undeliverable surveys sent back by the Post Office. There were also 83 survey packages returned by spouses or relatives indicating the addressee was deceased. There were 108 people who returned the survey package, refusing to answer it and six people moved out of the sampling area. Thus there were a net deliverable surveys of 8838 (10,000 minus 1162) yielding a response rate of 54% This is fairly good given the requirement not to use any financial incentive such as a $1 bill and the timing of the third mailing around the holidays. Many general household surveys without financial incentives are often in the mid to low 40% range. Household surveys with financial incentives can attain responses rates of local populations in the range of 68% to 77% and 55% for U.S. households (Loomis, 1996). Our response rate in this survey varied from a low of 28% in California to 56% for areas around the Lower Snake River such as Spokane, Lewiston and the Tri-Cities. To calculate the low-middle estimate we assumed this higher response rate of 68% response rate would have resulted in some Pacific Northwest non-respondents to our survey, having been respondents, and therefore reported some positive number of trips. For California, we used the 55% response rate in the same way to estimate the low-middle estimate of recreation demand.

DESCRIPTIVE STATISTICS

Table 1 summarizes respondents basic attitudes toward the relative importance of different recreational uses of the Lower Snake River and whether they current visit the Lower Snake River.

Table 1
What Are Your Views on Managing the Lower Snake River?

Uses of the Lower Snake River	Local Counties	Rest of ID, OR, and WA	MT	CA
Reservoir recreation such as waterskiing and motorboating	2.19	1.78	1.82	1.67
Reservoir fishing for small mouth bass, catfish, and bluegill	2.29	2.03	2.04	2.07
Recreational salmon fishing in the river	2.37	2.34	2.38	2.39
River recreation such as rafting, canoeing, and kayaking	2.04	2.09	2.04	2.12
(Where: 1 = Not Important; 2 = Slightly Important; 3 = Important; 4 = Very Important)				
Did You Visit the Lower Snake River in 1998?				
Percent Yes	38%	11%	4%	3%

Table 2 summarizes the probability that individuals from each of the sampling areas would visit the Lower Snake River if the dams were removed.

Table 2
Would You Visit the Free-Flowing Lower Snake River?

	Local Counties	Rest of ID, OR, and WA	MT	CA
Definitely Yes	14%	10%	5%	3%
Probably Yes	28%	24%	15%	21%
Probably No	43%	50%	60%	51%
Definitely No	16%	17%	20%	25%

Comparing the responses in Table 1 and 2 with regard to actual versus intended visitation is reassuring. With exception of those in the Local Counties, about the same percentage of people that currently visit from each area, would definitely visit if the dams were removed. Thus the definitely visit percentages appear to be grounded in reality. If the dams are removed, another 15%-28% would likely visit the Lower Snake River. Adding together the Definitely and Probably Yes responses yields a percentage visitation from Local Counties about equal to their current visitation. Again, this is reassuring regarding the realism of the intended visitation percentages.

Table 3 presents information on average recreation expenditures of people that would visit the Lower Snake River if the dams were removed.

Table 3
Expenditures for Visiting the Free-Flowing Lower Snake River
(Round trip transportation, rental fees, boat gas, camping fees, lodging, food, bait, supplies)

	Local Counties	Rest of ID, OR, and WA	MT	CA
Average of All Users				
Costs Per Group Trip	$103.52	$351.45	$366.57	$871.35
Avg # of days per trip	2.28	6.29	3.94	10.69
Avg # of people	2.87	2.83	2.41	3.14
Costs Per Person/Day	$15.82	$19.74	$38.61	$25.96
Anadromous Fishing				
Costs Per Group Trip	$177.76	$401.59	$312.38	$913.68
Avg # of days per trip	2.42	8.14	4.45	7.11
Avg # of people	2.67	3.03	2.48	3.11
Costs Per Person/Day	$18.22	$16.28	$28.31	$41.31
Non-Anglers				
Costs Per Group Trip	$96.71	$314.72	$404.50	$846.97
Avg # of days per trip	2.21	5.00	3.58	12.53
Avg # of people	2.97	2.70	2.37	3.16
Costs Per Person/Day	$14.73	$23.31	$47.67	$21.40

The pattern of expenditures appear reasonable, as more distant users have higher expenses per trip and stay longer per trip, than nearby users, who can make more frequent weekend trips. Anglers from the Pacific Northwest tend to stay longer than other river users. The cost per day per person is also quite reasonable given that it includes travel costs and any boat gas, camping fees or lodging.

The cost per angler trip averaged over all four areas of residence is $197.30, averaging $21.43 per angler per day of the trip. The cost per non-angler river visitor averaged over all four areas of residence is $148.60 which yields $18.40 per day.

The overall average household income reported in the survey was $55,400. This compares the 1990 Census estimate (updated to 1996 dollars) of $52,526. Thus, the survey incomes are within 10%, and part of the difference may be due to the survey being in 1998 dollars.

CONTINGENT BEHAVIOR MODELLING RESULTS

Anglers

Probability of Visiting the Free-Flowing Lower Snake River

Respondents were asked in the survey whether they would visit the Lower Snake River if the dams were removed and the river restored to conditions described in their version of the survey (*e.g.*, number of hours to catch a steelhead and salmon). Individuals could respond with definitely yes, probably yes, probably no and definitely no.

We estimated a probit model on the definitely yes responses and the sum of the definitely yes plus probably yes responses as a function of their driving distance to the Lower Snake River, whether they owned a boat, number of river based recreation activities they would participate in beside fishing at the Lower Snake River and the importance of river based recreation (from Section I of the survey). These variables were statistically significant and had a sign consistent with economic theory. However, hours to catch a salmon and hours to catch a steelhead had little systematic influence on the probability of visiting the Lower Snake River in either the definitely yes probit model or the summed definitely yes/probably yes probit model. Therefore it appears that steelhead or salmon fishing quality is not a strong predictor of the probability a household would visit the Lower Snake River if the dams were removed. Therefore, we do not present the probit equations, as we simply use the point estimate *for that region and user group* of the probability of visiting the Lower Snake River in the analysis below. By using separate visitation rates for the three main geographic regions, we have utilized a spatially varying visitation rate, similar to what would have occurred had the probit models been applied, but with much less complications.

To facilitate sensitivity analysis, we calculate five different estimates of the number of anglers that would visit. These range from a low estimate, a low-middle, two middle estimates and one high estimate. The low estimate uses only the definitely yes responses to calculate the probability (or percentage of that region's respective population) visiting the Lower Snake River and then adjusts downward for the survey response rate from that region. The use of definitely yes responses is consistent with a criterion validity study of Champ *et al.* (1996), which showed a close match between actual behavior and intended behavior of the persons that were definitely sure of their answers. By itself the visitation rate associated with the definitely yes will be one of our middle estimates. However, to make this the low estimate in the table below, we adjusted downward by the mailing survey response rate. In effect, we are assuming those with insufficient interest to return the survey, would not visit the Lower Snake River if the dams were removed. The low-middle estimates incorporates two insights: 1) some of the non-respondents to the survey might actually visit the river if the dams were removed; and 2) with a higher response rate that would have occurred with the use of financial incentives, some non-respondents would have become respondents and reported some positive visitation. For the low-middle estimate we continue to use the definitely yes responses, but allow for some of the non-respondents to visit, but using a higher survey response rate adjustment of 68% for the Pacific Northwest and 55% for California. The other middle estimate uses the combined proportion definitely and probably yes responses adjusted for the sample response rate from that region. The inclusion of probably yes responses recognizes that some of those anglers will likely visit the Lower Snake River each year. The high estimate uses the combined definitely and probably yes and does not adjust for the survey response rate. Again, we allow for the possibility that some people not returning the survey, would still visit the Lower Snake River if the dams were removed.

Angler Travel Cost Method Demand Model

Given the probit model did not find a systematic effect between probability of participation and anadromous fishing quality, there was not much advantage in linking the probit model to the travel cost model. Avoiding the link greatly simplifies the application of the Travel Cost Model to evaluating EIS alternatives. As explained in more detail in McKean's analysis of reservoir recreation (McKean, 1998a, 1998b) and in Loomis and Creel (1990) if the mean of the dependent variable does not equal the variance, a negative binomial count data model rather than a Poisson count data model is appropriate. The negative binomial count data model is more general and includes the Poisson count data model as a special case.

Two negative binomial count data models are reported in Table 4. The first model uses the reported trip cost per person (RTRCPP) from our survey. To allow greater comparability of benefit estimates with McKean's (1998a) estimate of reservoir angling we estimated a second model using the same cost per mile as McKean (1998a, 19 cents).

Table 4
Angler Travel Cost Method Demand Equation for Free-Flowing Lower Snake River

Dependent Variable: Angler River Trips

Variable	Reported Trip Cost			Std Cost @19 cents per mile		
	Coefficient	Standard Error	Probability	Coefficient	Standard Error	Probability
C	1.6830	0.3090	0.000	1.7340	.3100	.00
RTRCPP	-0.0039	0.0007	0.000			
RIVTRTIME	-0.0800	0.0187	0.000	-0.0220	.0260	.41
ESTLOWTCPP				-.0075	.0016	.00
RECDAYS	0.0022	0.0006	0.000	0.0020	.0006	.00
INC	0.0009	0.0015	0.523	0.0007	.0015	.61
AGE	-0.0117	0.0044	0.008	-.0104	.0044	.01
SALIMP	0.2045	0.0610	0.001	.1587	.0615	.01
HRSAL	-0.0021	0.0008	0.011	-.0020	.0008	.02
Mixture (Overdispersion) Parameter						
SHAPE:C(9)	-0.2699	0.0812	0.000	-.268	.0814	.00
S.E. of regression		15.2324		.1427		
Log likelihood		-913.2864		-1098.8380		
Restr. log likelihood		-2182.8240		-2605.8970		
LR statistic (8df)		2539.0750		3014.1180		
Probability (LR stat)		0.0000		0.0000		
LR Index (Pseudo-R²)		0.5816		0.5783		
Sample Size		423.0000		427.0000		

RTRCPP: Trip cost using reported round trip travel costs per person
RIVTRTIME: travel time
ESTLOWTCPP: Travel cost using 19 cents per mile based on McKean, 1998a
RECDAYS: respondent's number of days available for recreation each year
INC: household income
AGE: age of respondent
SALMIMP: importance of salmon fishing as a use of the lower Snake River
HRSAL: survey version's stated hours to catch one salmon

In both angler TCM models, the crucial cost coefficient is negative and highly significant (p >.01 for 1% level). Travel time (RIVTRTIME) is negative in both models but statistically significant only in the survey based trip cost model. The lack of significance of travel time in the second model is likely due to multicolinearity caused by scaling driving distance by a single cost per mile. The total days available for recreation (RECDAYS) is positive and statistically significant at the .01 level indicating those with more days available for recreation would take more trips to the Lower Snake River. Age has a negative and statistically significant influence on the number of trips to the free-flowing river. Income was insignificant in both models, suggesting income is not a determining factor in the number of visits an angler would make to the Lower Snake River.

In terms of the key policy variable, salmon fishing quality, hours to catch a salmon (HRSAL) has the correct sign, negative and is significant at the 5% level (p=.0118 and p=.02 in models 1 and 2). Negative is the correct sign since the longer it takes to catch a salmon, the fewer trips anglers will take. Thus, if salmon populations rise with dam removal, this will reduce the number of hours it takes to catch a salmon and will increase the number of trips taken by anglers. For example, with only steelhead fishing and no salmon fishing, the model predicts a typical anadromous fishing angler would take 2.05 trips each year. Once sufficient salmon recovery occurs that salmon fishing could begin with an estimated 35 hours to catch one salmon, then fishing trips per angler would double to 4.13 trips per year. Once salmon fishing is introduced, additional improvements in salmon catch rates have smaller effects on trips (as would be expected with diminishing marginal utility). Increasing the salmon populations sufficiently to reduce hours to catch a salmon from 35 hours to 20 hours per fish, would increase trips by .13 per angler. An increase in salmon populations in the future to reduce hours to 10 hours per salmon caught yields an increase of .3 trips per angler more. These incremental effects will be used to illustrate increases in angler trips associated with a range of anadromous fish increases ranging from small near-term effects to larger long-term effects.

These salmon fishing responses could likely be applied to increases in salmon from improved transport and other dam improvements. Our demand estimates may over-estimate the number of salmon fishing trips and benefits associated with dam improvements, if anglers strongly prefer fishing for salmon in a free-flowing river (as described in the survey) as compared to reservoirs, however.

The TCM model based on respondent's reported cost is robust with respect to checks for potential multi-destination trips, potential outliers and inclusion of a substitute variable. In particular, including the price of (cost of travelling to) substitute river recreation had little effect on the demand function and benefit estimate. This is part was due to cost of travelling to other river sites having a negative sign, indicating other rivers have a complementary relationship with the Lower Snake River, rather than a positive sign indicating a substitute relationship. A dummy variable for whether the angler visited other rivers was insignificant and made no change in trip benefits. We also screened trips for one-way travel distances in excess of 1,000 miles as these long trips could end up being multidestination. Dropping those nine observations had no effect on average consumer surplus.

Angler Benefit Estimates

The net willingness to pay (WTP) or consumer surplus for a salmon/steelhead fishing trip to the free-flowing Lower Snake River is calculated from the count data regression equations in Table 4 based on the trip cost coefficient. Since the trip cost coefficient is per person, the resulting value per trip is $256 per person. These trips average 3.36 days in length, yielding a value of $76 per day. As mentioned above this value per day is quite robust to issues of potential multidestination trips or possible outliers. If one uses just the transportation costs at the cost per mile of reservoir users that was applied by McKean in his reservoir recreation travel cost model (19 cents per mile), the value per person per trip is $131.80 with a per day value of $39. This will be referred to as the Low Recreation Value. Generally speaking, the Low Recreation Value travel cost demand model was not statistically significant on the travel time variable but otherwise was quite similar, particularly with respect to the coefficient on hours to catch a salmon.

These values compare to a value of $88 per trip from McKean's (1998c) estimate for steelhead fishing on the Snake River upriver from Lewiston, Idaho. Dividing McKean's (1998c) reported angler days per year (14.82) by reported annual number of trips per year (12.33) yields 1.2 days per trip as an average. Therefore, the equivalent value per day is $73 per day, nearly identical to our estimate of $76 per day. Our estimate also compares to $110 estimate (updated for inflation) from Olsen *et al.* (1991) for steelhead fishing in the Columbia River. On a per day basis this is about $55 per day. This value is reported as the value for the last trip, so given the downward slope of the demand curve, this would be an estimate less than our average value over the season. Walsh *et al.* (1992), report an average (adjusted for inflation) of $75 per day for values of steelhead/salmon fishing in Idaho, Washington and Oregon from 1967 to 1982. While these older benefit estimates suffer from methodological limitations associated with travel cost models from that time period, the $76 per day estimate based on respondents reported cost is quite similar to these past studies, while the $39 per day estimate based 19 cent per mile is substantially below estimates in the literature.

Non-Angling Visitors

Respondents were asked in the survey whether they would visit the Lower Snake River if the dams were removed and the river restored to conditions described in the survey. To avoid additional complexity (there were already numerous survey versions due to differences in fishing conditions) none of the non-fishing, river-based attributes were varied. Given the description of the restored river, individuals could indicate whether they would definitely visit, probably visit, probably not visit or definitely not visit.

To facilitate sensitivity analysis, we calculate five different estimates of the number of non-fishing river recreationists that would visit. These range from a low estimate, two middle estimates and one high estimate. The low estimate uses only the definitely yes responses to calculate the probability (or percentage of that region's respective population) visiting the Lower Snake River and then adjusts downward for the survey response rate from that region. The use of definitely yes responses is consistent with a criterion validity study of Champ *et al.* (1996), which showed a close match between actual behavior and intended behavior of the persons that were definitely sure of their answers. By itself the visitation rate associated with the definitely yes will be one of our middle estimates. However, to make this a lower bound in the table below, we adjusted downward by the mailing survey response rate. In effect, we are assuming those with insufficient interest to return the survey, would not visit the Lower Snake River if the dams were removed. As with anglers, the low-middle estimates incorporates the observation that some of the non-respondents to the survey might actually visit the river if the dams were removed and a higher response rate that would have occurred with the use of financial incentives, some non-respondents would have become respondents and reported some positive visitation. For the low-middle estimate we continue to use the definitely yes responses, but allow for some of the non-respondents to visit, but using a higher survey response rate adjustment. The other middle estimate uses the combined proportion definitely and probably yes responses adjusted for the sample response rate from that region. The inclusion of probably yes responses recognizes that some of those households will likely visit the Lower Snake River each year. The high estimate uses the combined definitely and probably yes and does not adjust for the survey response rate. Again, we allow for the possibility that some people not returning the survey, would still visit the Lower Snake River if the dams were removed. This is the same procedure used for anglers.

Non-Angler Travel Cost Method Demand Model

Table 5 presents the negative binomial count data models for non-fishing visits to the free-flowing Lower Snake River. The reported trip cost per person (RTRCPP) is negative and significant at the .01 level. Travel time (RIVTRTIME) is also negative and statistically significant at .01 level. The total days available for recreation (RECDAYS) is positive and statistically significant at the .01 level. Income is negative and significant at the 5% level. The number of recreation activities the respondent would participate in has a positive and statistically significant effect on the number of trips the individual would take. Those that own a boat also would take more trips. We attempted to use a cost per mile consistent with McKean's (1998b) estimate for general recreation at the Lower Snake River reservoirs (20.2 cents per mile). However, transformation of round trip distance into travel costs using this mileage figure resulted in the travel cost coefficient being insignificant at conventional levels (p=.2). Since the benefit estimate depends directly on this coefficient, this was unacceptable. An alternative approach to calculate travel cost consistent with McKean's (1998b) model was used. In this alternative approach, we relied upon his estimate of the percentage of total trip cost that was spent just on car transportation (*e.g.*, spending at service stations). This percentage was multiplied by our reported total trip cost. This estimated coefficient was statistically significant at the .05 level, and the remaining variables had the same sign and similar significance as in the reported cost model.

Table 5 Non-Angler Travel Cost Method Demand Equation for Free-Flowing Lower Snake River						
Dependent Variable: Non-Angler River Trips						
Variable	**Reported Trip Cost**			**Std Cost @19 cents per mile**		
	Coefficient	**Standard Error**	**Probability**	**Coefficient**	**Standard Error**	**Probability**
C	0.90343	0.1348	0.000	.6870	.1430	.00
RTRCPP	-0.00336	0.0011	0.003			
RTANCPP				-.0140	.0060	.02
RIVTRTIME	-0.18394	0.0321	0.000	-.2139	.0340	.00
RECDAYS	0.00144	0.0004	0.000	.0017	.0004	.00
INC	-0.00232	0.0012	0.057	-.0021	.0013	.10
RIVNUMACT	0.10872	0.0205	0.000	.1673	.0209	.00
OWNBOAT	0.19359	0.0801	0.015	.2875	.0865	.00
Mixture (Overdispersion) Parameter						
SHAPE:C(9)	-1.0131	0.1175	0.000			
S.E. of regression		3.15		7.885		
Log likelihood		-1019.337		-1062.279		
Restr. log likelihood		-1340.227		-1902.618		
LR statistic (8df)		641.78		1680.678		
Probability (LR stat)		0.000		0.000		
LR Index (Pseudo-R²)		0.239		0.441		
Sample Size		525.000		528.000		

RTRCPP: reported round trip travel costs per person
RTRANCPP: reported round trip costs prorated by percentage spent on transportation to and from site, based on McKean (1998a)
RIVTRTIME: travel time
RIVSTAY: length of stay at the Lower Snake River
RECDAYS: respondent's number of days available for recreation each year
INC: household income
RIVNUMACT: The number of river-based recreation activities the respondent woul dparticipate in while visiting the lower Snake River
OWNBOAT: Whether the respondent owned a boat (=1) or not (=0).

Non-Angler Benefit Estimates

Using the TCM demand equation estimated from respondent reported cost in Table 5, the net WTP or average consumer surplus is $297 per individual trip. Given the 2.62 day duration of trips, the average value per day would be $113. The travel cost method estimate based on McKean's estimate transportation cost spending is $71.36 per trip or $27.23 per day. These estimates compare to McKean's (1998a) travel cost method estimate of $71.31 per trip or $29-35 per day for general reservoir recreation on the Lower Snake River reservoirs. There does not appear to be similar river-based recreation studies to what the Lower Snake River will be like. Thus comparing our values is difficult.

Application of Models to Estimate Total Visitation To and Benefits From a Free-Flowing Lower Snake River

Since the rural counties surrounding the Lower Snake River were sampled at a higher rate than the remainder of the states in the Pacific Northwest and they are located closer to the Snake River, it is appropriate to apply their probability of visiting to their respective populations. Further, since anglers are likely to have a different propensity to visit a free-flowing Lower Snake River than non-anglers, it is appropriate to keep these groups separate. Further, California's population is so large and its response rate was much lower than for the Pacific Northwest, it was decided to split this geographic area out separately. Thus, to calculate the number of potential visitors we essentially have a six components that go into any estimate of overall recreation use and benefits. To estimate angler and non-angler recreation use, households in a region were split into these two mutually exclusive groups based on the USFWS National Survey of Fishing, Hunting and Wildlife Associated Recreation. This is a conservative approach, which assumes that angler households do not make non-angling recreation trips. We repeat all calculations five times, using a different assumption about probability of visitation (*i.e.*, using only households definitely certain they would visit or using households that are definitely and probably certain they would visit) and whether those not returning the survey would visit or not. Further, we compute recreation benefits using the TCM demand model based on reported costs as well as the travel cost only estimate for consistency with McKean (1998a,b). Nonetheless, these variety of estimates provides a broad basis for a sensitivity analysis as part of the NED or benefit-cost analysis in the EIS.

River Recreation Use Estimates

The upper portion of Table 6 estimates river recreation use relying upon only those households that indicated they would definitely visit the Lower Snake River if the dams were removed. About 7% of residents of the Idaho, Oregon and Washington counties adjacent to or nearby the Lower Snake River would definitely visit the free-flowing Lower Snake River for river recreation. About 4% of those living in the more distant urban areas of the Pacific Northwest would definitely visit the free-flowing Lower Snake River. Only about 2% of California residents would definitely visit the free-flowing Lower Snake River. Visitors from the counties surrounding the river would take an average of four visits per year while those living in the remainder of the Pacific Northwest would take an average of 1.46 trips per year. Those in California would take about one trip per year. Multiplying the percentage of the population that would definitely visit, times the number of households in the region times the number of trips per household and days per trip, yields the column labeled Total Days, for the Middle Estimate or 4.8 million visitor days annually. This assumes that households that did not return the survey would visit at the same rate as those that did return the survey. (Recreation planners should verify that there is or would be sufficient recreation carrying capacity and facilities to accommodate 4.8 million visitor days annually). Two different NED benefit estimates are reported. The column labeled NED benefits uses the value per day from the Travel Cost Method (TCM) demand model estimated using survey respondents reported trip costs as the price variable ($113 per day), while the Low NED Benefits ($27.23 per day) uses the TCM demand model reflecting just the proportion of trip costs attributable to travel to be consistent with McKean's (1998b) TCM of reservoir recreation use. Using the two estimates the annual non-angling river recreation use benefits range from $132 million to $548.4 million.

Table 6
Non-Angler Detailed Visitor Use and Benefit Estimates

		Definitely Yes	Number of Households	Estimated Number of Visitors	Number Trips Per Visitor	Est Total Trips	Days Per Trip	Total Days	NED Benefits	Low NED Benefits
Rural Idaho, Oregon, and Washington										
Middle Est	Sample Estimate	0.0676	327,614	22,147	4	88,587	2.21	195,777	$22,122,788	$5,331,005
Low Mid Est	Part Adj Resp Rate	0.0676	222,778	15,060	4	60,239	2.21	133,128	$15,043,496	$3,625,083
Low Est	Full Adj Resp Rate	0.0676	183,464	12,402	4	49,609	2.21	109,635	$12,388,761	$2,985,363
Rest of Pacific Northwest										
Middle Est	Sample Estimate	0.0476	3,597,604	171,246	1.46	250,019	4.78	1,195,091	$135,045,310	$32,542,334
Low Mid Est	Part Adj Resp Rate	0.0476	2,446,371	116,447	1.46	170,013	4.78	812,662	$91,830,811	$22,128,787
Low Est	Full Adj Resp Rate	0.0476	1,834,778	87,335	1.46	127,510	4.78	609,497	$68,873,108	$16,596,591
California										
Middle Est	Sample Estimate	0.0246	9,768,880	240,314	1.15	276,362	12.53	3,462,811	$391,297,647	$94,292,345
Low Mid Est	Part Adj Resp Rate	0.0246	5,372,884	132,173	1.15	151,999	12.53	1,904,546	$215,213,706	$51,860,790
Low Est	Full Adj Resp Rate	0.0246	2,735,286	67,288	1.15	77,381	12.53	969,587	$109,563,341	$26,401,856
Total										
Middle Est	Sample Estimate			433,707		614,968		4,853,679	$548,465,745	$132,165,684
Low Mid Est	Part Adj Resp Rate			263,680		382,251		2,850,336	$322,088,013	$77,614,660
Low Est	Full Adj Resp Rate			167,026		254,500		1,688,719	$190,825,211	$45,983,810

		Definitely and Probably Yes	Number of Households	Estimated Number of Visitors	Number Trips Per Visitor	Est Total Trips	Days Per Trip	Total Days	NED Benefits	Low NED Benefits
Rural Idaho, Oregon, and Washington										
High Est	Sample Estimate	0.2705	327,614	88,620	4	354,478	2.21	783,397	$88,523,878	$21,331,904
Middle-High	Full Adj Resp Rate	0.2705	183,464	49,627	4	198,506	2.21	438,702	$49,573,372	$11,945,866
Rest of Pacific Northwest										
High Est	Sample Estimate	0.1740	3,597,604	625,983	1.46	913,935	4.78	4,368,611	$493,653,024	$118,957,273
Middle-High	Full Adj Resp Rate	0.1740	1,834,778	319,251	1.46	466,107	4.78	2,227,992	$251,763,042	$60,668,209
California										
High Est	Sample Estimate	0.1628	9,768,880	1,590,374	1.15	1,828,930	12.53	22,916,489	$2,589,563,292	$624,016,004
Middle-High	Full Adj Resp Rate	0.1628	2,735,286	445,305	1.15	512,100	12.53	6,416,617	$725,077,722	$174,724,481
Total										
High Est	Sample Estimate			2,304,976		3,097,343		28,068,497	$3,171,740,194	$764,305,181
Middle-High	Full Adj Resp Rate			814,183		1,176,715		9,083,311	$1,026,414,136	$247,338,557

To calculate the row labeled Low Estimate, we assume that those not returning the survey would not visit and hence take zero trips. Thus, we multiple the number of households in the row labeled Sample Est by the response rate for Rural ID ,OR, WA (56%), the Pacific Northwest (51%) and for California (28%) to yield the low estimate of number of households. All other calculations in this row are otherwise similar. Using the row labeled Low Estimate , there would be about 1.688 million visitor days. This has an economic value of $190.8 million using the higher consumer surplus estimate per day and $45.9 million for the lower consumer surplus estimate, respectively, **each year after the Lower Snake River is restored to the free-flowing condition described in the survey**. We calculate the Low-Middle Estimate in Table 6 assuming that some proportion of the non-responding households would visit the lower Snake River if the dams were removed. We calculated this proportion using a higher response rate which would have made some of the current non-respondents into respondents that would have reported some positive visitation. Thus the Middle Estimate in the Pacific Northwest and California are multiplied by 68% and 55%, respectively, to arrive at the Low-Middle estimate.

The lower portion of Table 6 reflects our Middle-high and High estimates that use visitors that would definitely and probably visit the Lower Snake River if the dams were removed. The High estimate assumes the proportion of households that did not respond to the survey would visit at the same rate as households that did respond to the survey. The Middle-high assumes that households that did not respond to the survey would not visit. The Middle-high estimate of visitor days is 9 million, while the High estimate is 28 million visitor days. Clearly, recreation planners should verify that there is or would be sufficient recreation carrying capacity and facilities to accommodate 9 or 28 million visitor days annually before such estimates should be used in the benefit-cost or EIS sensitivity analysis. It may be that the High estimate needs to be capped or limited to recreation area carrying capacity or the cost of building additional facilities included as a cost in the benefit-cost analysis.

Estimated visitor days consistent with McKean (1998b) annual benefits of $31.6 million is 890,000 visitor days. Thus current non-angler use is about one-third of the projected visitation if the dams are removed.

Angler Recreation Use Estimates

Table 7 provides Low, Low-Middle and Middle estimates of angler use and benefits, while Table 8 provides Middle-High and High estimates of angler use and benefits. Since salmon fishing is a significant variable in the Travel Cost Method demand equation, we calculate how angler trips changes when salmon populations increase sufficiently to allow salmon fishing, and then with an improvement in salmon fishing catch rates (*i.e.*, less time to harvest one salmon).

Table 7
Expected Angler Demand and Benefits with Dam Removal and/or Salmon Increases

		Rural ID, OR, WA		**Rest of Pacific NW**		**California**	
		Mid Est Samp Est	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**
Anglers	Definitely Yes	0.2041	0.2041	0.1304	0.1304	0.0441	0.0441
	# Households	101,488	56,833	1,079,038	550,309	1,332,120	372,993.6
	Est # of Anglers	20,714	11,600	140,707	71,780	58,746	18,449
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est # of Anglers	220,167		99,809		142,076	
		Rural ID, OR, WA		**Rest of Pacific NW**		**California**	
		Mid Est Samp Est	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**
Baseline Steelhead Catch Rate, No Salmon Fishing	# Trips per Angler	6.12	6.12	1.78	1.78	1.41	1.41
	Est Total Trips	126,768	70,990	250,458	127,733	82,833	23,193
	Days/Trip	2.42	2.42	7.49	7.49	7.11	7.11
	Est Total Days	306,778	171,796	1,875,928	956,723	588,939	164,903
	NED Benefits	$23,315,143	$13,056,480	$142,570,523	$72,710,986	$44,759,399	$12,532,632
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est Total Trips	460,058		221,917		302,071	
	Est Total Days	2,771,646		1,293,422		1,808,157	
	NED Benefits	$210,845,065		$98,300,078		$137,419,922	
		Rural ID, OR, WA		**Rest of Pacific NW**		**California**	
		Mid Est Samp Est	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**
Baseline Steelhead Allow Salmon Fishing with 35 hours Fish	# Trips per Angler	8.21	8.21	3.87	3.87	3.50	3.50
	Est Total Trips	170,032	95,218	544,351	277,619	205,536	57,550
	Days/Trip	2.42	2.42	7.49	7.49	7.11	7.11
	Est Total Days	411,479	230,428	4,077,189	2,079,367	1,461,362	409,181
	NED Benefits	$31,272,377	$17,512,531	$309,866,390	$158,031,859	$111,063,532	$31,097,789
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est Total Trips	919,920		430,387		598,826	
	Est Total Days	5,950,030		2,718,976		3,56,043	
	NED Benefits	$452,202,298		$206,642,179		$293,059,304	
Gain in Days w/Scenario		104,700	58,632	2,201,261	1,122,643	872,423	244,278
Gain in NED Benefits w/Scenario		$7,957,234	$4,456,051	$167,295,867	$85,320,892	$66,304,133	$18,565,157
Req'd # Adult Salmon		19,644	11,000	412,995	210,627	163,682	45,831
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est Total Trips	3,178,385		1,425,554		2,047,887	
	Est Total Days	$241,557,234		$108,342,100		$155,639,382	
	NED Benefits	596,320		467,459		384,219	

		Rural ID, OR, WA		Rest of Pacific NW		California	
		Mid Est Samp Est	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**
Baseline Steelhead Salmon Fishing w/20 hours fish	# Trips per Angler	8.34	8.34	4.00	4.00	3.63	3.63
	Est Total Trips	172,815	96.776	563,251	287,258	213,427	59,760
	Days/Trip	2.42	2.42	7.49	7.49	7.11	7.11
	Est Total Days	418,212	234,199	4,218,747	2,151,561	1,517,466	424,890
	NED Benefits	$31,784,088	$17,799,089	$320,624,790	$163,518,643	$115,327,393	$32,291,670
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est Total Trips	949,492		443,794		617,909	
	Est Total Days	6,154,425		2,810,650		3,987,738	
	NED Benefits	$467,736,271		$213,609,402		$303,068,103	
Incremental Gain in Days w/20 hrs		6,733	3,771	141,558	72,195	56,103	15,709
Incremental Gain in NED Ben w/20 hrs compared to 35 hrs/salmon caught		$511,711	$286,558	$10,758,401	$5,486,784	$4,263,862	$1,193,881
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
Incremental Gain in Days w/20 hrs		204,394		91,674		131,695	
Incremental Gain in NED Ben w/20 hrs compared to 35 hrs/salmon caught		$15,533,973		$6,967,224		$10,008,800	

		Rural ID, OR, WA		Rest of Pacific NW		California	
		Mid Est Samp Est	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**	**Mid Est Samp Est**	**Low Est Full Adj Resp Rate**
Baseline Steelhead Salmon Fishing w/10 hours fish	# Trips per Angler	8.43	8.43	4.09	4.09	3.72	3.72
	Est Total Trips	174,720	97,843	576,190	293,857	218,829	61,272
	Days/Trip	2.42	2.42	7.49	7.49	7.11	7.11
	Est Total Days	422,821	236,780	4,315,663	2,200,988	1,555,876	435,645
	NED Benefits	$32,134,425	$17,995,278	$327,990,410	$167,275,109	$118,246,599	$33,109,048
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
	Est Total Trips	969,739		452,972		630,975	
	Est Total Days	6,294,361		2,873,414		4,077,902	
	NED Benefits	$478,371,433		$218,379,434		$309,920,517	
Incremental Gain in Days w/20 hrs		4,610	2,581	96,916	49,427	38,411	10,755
Incremental Gain in NED Ben w/10 hrs compared to 20 hrs/salmon caught		$350,337	$196,189	$7,365,619	$3,756,466	$2,919,206	$817,378
		Total Middle Est Survey Sample Estimate		**Total Low Estimate Full Adj Resp Rate**		**Total Low Middle Est Part Adj Resp Rate**	
Incremental Gain in Days w/20 hrs		139,936		62,764		90,163	
Incremental Gain in NED Ben w/10 hrs compared to 20 hrs/salmon caught		$10,635,162		$4,770,032		$6,852,414	

Middle Est or Sample Est: assumes non-respondents to the survey will visit at the same rate as respondents.
Low Estimate: assumes none of the survey non-respondents would visit (44% for local, 49% for PAC NW, 72% for California would not visit)
Low Middle Estimate: assumes a portion of the survey non-respondents would visit with the proportion calculated using a higher survey response rate (17% higher for PAC NW and 27% higher for California)

Table 8
High Estimate of Expected Angler Use and Benefits
With Dam Removal and/or Salmon Increases

		Rural ID, OR, WA		Rest of Pacific NW		California	
		High Est Samp Est	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**
Anglers	Definitely Yes	0.5026	0.5026	0.4095	0.4095	0.3529	0.3529
	# Households	101,488	56,833	1,079,038	550,309	1,332,120	372,994
	Est # of Anglers	51,008	28,564	441,866	225,352	470,105	131,629
		Total High Use Est Survey Sample Estimate			**Total Mid-High Est Adj Resp Rate**		
	Est # of Anglers	962,979			385,546		
		Rural ID, OR, WA		**Rest of Pacific NW**		**California**	
		High Est Samp Est	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**
Baseline Steelhead Catch Rate, No Salmon Fishing	# Trips per Angler	6.12	6.12	1.78	1.78	1.41	1.41
	Est Total Trips	312,168	174,814	786,522	401,126	662,848	185,598
	Days/Trip	2.4	2.4	7.49	7.49	7.11	7.11
	Est Total Days	749,204	419,554	5,891,047	3,004,434	4,712,851	1,319,598
	NED Benefits	$56,939,472	$31,886,104	$447,719,549	$228,336,970	$358,176,685	$100,289,472
		Total High Use Est Survey Sample Estimate			**Total Mid-High Est Adj Resp Rate**		
	Est Total Trips	1,761,538			761,538		
	Est Total Days	11,353,101			4,743,586		
	NED Benefits	$862,835,706			$360,512,546		
		Rural ID, OR, WA		**Rest of Pacific NW**		**California**	
		High Est Samp Est	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**	**High Est Samp Est**	**Mid-High Est Adj Resp Rate**
Baseline Steelhead Allow Salmon Fishing with 35 hours Fish	# Trips per Angler	8.21	8.21	3.87	3.87	3.50	3.50
	Est Total Trips	418,708	234,477	1,709,446	871,817	1,644,756	460,532
	Days/Trip	2.42	2.42	7.49	7.49	7.11	7.11
	Est Total Days	1,013,274	567,433	12,803,750	6,529,913	11,694,212	3,274,379
	NED Benefits	$77,008,802	$43,124,929	$973,085,020	$496,273,360	$888,760,099	$248,852,828
		Total High Use Est Survey Sample Estimate			**Total Mid-High Est Adj Resp Rate**		
	Est Total Trips	3,722,910			1,566,826		
	Est Total Days	25,511,236			10,371,725		
	NED Benefits	$1,938,853,921			$788,251,117		
Gain in Days w/Scenario		264,070	147,879	6,912,704	3,525,479	6,981,361	1,954,781
Gain in NED Benefits w/Scenario		$20,069,330	$11,238,825	$525,365,470	$267,936,390	$530,583,414	$148,563,356
Req'd # Adult Salmon		49,544	27,745	1,296,943	661,441	1,309,824	366,751
		Total High Use Est Survey Sample Estimate			**Total Mid-High Est Adj Resp Rate**		
	Est Total Trips	14,158,134			5,628,139		
	Est Total Days	$1,076,018,215			$427,738,571		
	NED Benefits	2,656,310			1,055,936		

		Rural ID, OR, WA		Rest of Pacific NW		California	
		High Est Samp Est	Mid-High Est Adj Resp Rate	High Est Samp Est	Mid-High Est Adj Resp Rate	High Est Samp Est	Mid-High Est Adj Resp Rate
Baseline Steelhead Salmon Fishing w/20 hours fish	# Trips per Angler	8.34	8.34	4.00	4.00	3.63	3.63
	Est Total Trips	425,559	238,313	1,768,797	902,086	1,707,900	478.212
	Days/Trip	2.4	2.4	7.49	7.49	7.11	7.11
	Est Total Days	1,021,343	571,952	13,248,290	6,756,628	12,143,167	3,400,087
	NED Benefits	$77,622,049	$43,468,348	$1,006,870,027	$513,503,714	$922,880,661	$258,406,585
		Total High Use Est Survey Sample Estimate			Total Mid-High Est Adj Resp Rate		
	Est Total Trips			3,902,256			1,618,612
	Est Total Days			26,412,799			10,728,66
	NED Benefits			$2,007,372,738			$815,378,647
Incremental Gain in Days w/20 hrs		8,069	4,519	444,540	226,715	448,955	125,707
Incremental Gain in NED Ben w/20 hrs compared to 35 hrs/salmon caught		$613,247	$343,418	$33,785,008	$17,230,354	$34,120,561	$9,553,757
		Total High Use Est Survey Sample Estimate			Total Mid-High Est Adj Resp Rate		
Incremental Gain in Days w/20 hrs				901,563			356,941
Incremental Gain in NED Ben w/20 hrs compared to 35 hrs/salmon caught				$68,518,816			$27,127,530

		Rural ID, OR, WA		Rest of Pacific NW		California	
		High Est Samp Est	Mid-High Est Adj Resp Rate	High Est Samp Est	Mid-High Est Adj Resp Rate	High Est Samp Est	Mid-High Est Adj Resp Rate
Baseline Steelhead Salmon Fishing w/10 hours fish	# Trips per Angler	8.43	8.43	4.09	4.09	3.72	3.72
	Est Total Trips	430,250	240,940	1,809,431	922,810	1,751,131	490,317
	Days/Trip	2.4	2.4	7.49	7.49	7.11	7.11
	Est Total Days	1,032,600	578,256	13,552,639	6,911,846	12,450,538	3,486,151
	NED Benefits	$78,477,631	$43,947,473	$1,030,000,558	$525,300,285	$946,240,924	$264,947,459
		Total High Use Est Survey Sample Estimate			Total Mid-High Est Adj Resp Rate		
	Est Total Trips			3,990,812			1,654,067
	Est Total Days			27,035,778			10,976,253
	NED Benefits			$2,054,719,113			$834,195,217
Incremental Gain in Days w/10 hrs		11,258	6,304	304,349	155,218	307,372	86,064
Incremental Gain in NED Ben w/10 hrs compared to 20 hrs/salmon caught		$855,582	$479,126	$23,130,531	$11,796,571	$23,360,264	$6,540,874
		Total High Use Est Survey Sample Estimate			Total Mid-High Est Adj Resp Rate		
Incremental Gain in Days w/20 hrs				622,979			247,586
Incremental Gain in NED Ben w/10 hrs compared to 20 hrs/salmon caught				$47,346,376			$18,816,570

As shown in Table 7, about 20% of angler households living in counties surrounding the Lower Snake River would definitely fish at the free-flowing Lower Snake River. About 13% of anglers living in the remainder of the Pacific Northwest would definitely visit while 4% of California anglers would visit the Lower Snake River to fish if the dams were removed. Assuming households not responding to the survey would not visit, yields the full adjustment for response rate estimate of the number of anglers for each of the geographic areas. The next to last right hand column totals this up across the three geographic areas and yields a low estimate of 99,809 anglers would visit the Lower Snake River if the dams were removed. The survey data indicates that residents of the surrounding counties would take 6.12 trips per year, while rest of Pacific Northwest residents would take 1.41 trips per year with a free-flowing Lower Snake River and steelhead fishing but no salmon fishing. Combining the number of anglers, number of trips times the average length of stay, yields about 1.29 million angler days if the low response rate adjustment is used. Using the estimate of average consumer surplus per day from the angler Travel Cost Method demand equation ($76 per day) yields an annual economic value of $98.3 million with the low estimate of angler use for just steelhead fishing.

Since hours to catch a salmon had the correct sign and was statistically significant, the remainder of the table simulates how the addition of salmon fishing and increased salmon fishing catch rates can be used with biologists' estimates of changes in salmon populations to estimate the incremental benefits over time as the fisheries increase with habitat restoration. The first scenario involves the benefits occurring when chinook salmon populations consistently surpass the level where the Snake River chinook salmon would be delisted (estimated at 32,500 returning adult chinook salmon by National Marine Fisheries Service) and a limited chinook salmon recreational fishery could be allowed involving an average of 35 hours to catch one salmon. While the exact mapping of chinook salmon populations to alternative catch rates is not known with certainty, discussions with Idaho Fish and Game suggests this might occur at 150% of delisting levels or roughly 50,000 returning adults. Thus, setting HRSAL to 35, the Travel Cost Method demand equation estimates angler trips would increase by 2.088 per angler. Applying this new level of trips to estimated number of anglers, yields an additional 1.425 million angler days using the low approach. The additional NED benefits of these increases in angler days is $108 million annually. Of course the present value of this benefit will depend upon how far into the future chinook salmon fishing will be initiated on the Lower Snake River. The angler response to opening of salmon fishing on the Lower Snake River has the biggest effect, and as shown in the next simulations, increases in catch rates have a much smaller incremental effect on angler trips. This is sensible given diminishing marginal utility of additional units of a good. If we assume that anglers that did not respond to the survey would still visit the Lower Snake River if chinook salmon populations increased to allow salmon fishing, total angler days would be 5.9 million angler days with the increment due to opening up of salmon fishing being 3.178 million angler days. The low-middle estimate assumes that some proportion of anglers that were non-respondents to our survey, would visit. This proportion is by adjusting the for the survey response rate using a higher survey response rate that would have resulted in some of the non-responding anglers, responding and therefore reporting positive trips. This procedure yields an estimate of 1.8 million angler days prior to salmon fishing being allowed, and 2.7 million angler days once habitat recovery is sufficient to allow salmon fishing.

Before any of these demand estimates should be used in the sensitivity analysis in the benefit-cost or EIS it must be determined by biologists whether such a recently recovered fishery could withstand the estimated level of angler pressure. It may be that this demand exceeds what a recently recovered salmon fishery could support and angler use would have to rationed using drawings to the amount of angler use biologically sustainable. The determination of the biologically sustainable use level at 35 hours per salmon harvested should be made to determine what proportion of the 5.9 million angler days could be supported once the chinook salmon populations recover to allow limited recreational fishing.

In Table 7 (and 8), we provide line below our angler estimates to suggest what the adult salmon catch would have to be to accommodate the predicted level of demand. If the PATH prediction of adult salmon numbers are less than this, then the increase in salmon angler days can be scaled back proportionately. In addition, the time line of salmon population increases can be applied to the demand estimates to develop the time profile of increases in angler demand that can be accommodated as salmon populations increase over time. However, at time we are finalizing this report, the estimated adult salmon catch figures are not available to us.

Besides the biological capacity, other simple tests of reasonableness can be performed to evaluate which of the five different estimates are most plausible. The low and low-middle estimates of 2.7 to 3.85 million angler days seem plausible, given there were about 40 million angler days of freshwater fishing reported by anglers from California, Idaho, Oregon and Washington in the 1991 U.S. Fish and Wildlife Service's National Survey of Hunting, Fishing and Wildlife Associated Recreation. Thus less than 10% of freshwater angler days in the region would be involved, and the 140 miles of river is a significant addition of free-flowing salmon fishing opportunities in the region. Further, our survey does not account for any angler days that might be taken by people living outside the survey region (*e.g.*, in nearby states of Wyoming, Utah, Nevada and Colorado) which have substantial populations of anglers and no anadromous fishing opportunities. The low and middle estimate of angler days also yield estimates of about 100 angler days per mile of river over a 180 day season. While this is a season average, photographs of peak steelhead and salmon fishing days on other rivers appear to be substantially higher than this.

These angler demand and benefit estimates can be compared to the current reservoir angler use and benefits estimated by McKean (1998a). In McKean's report, he uses the Normandeau Associates fishing use estimates collected by David Bennett's group at the University of Idaho. This yields about 3,305 anglers, fishing 87,050 days. This yields annual reservoir angling benefits of $1.956 million. Thus current angler use and benefits are less than 10% of what is projected to occur in the future if the dams are removed and the anadromous fishing improved. Of course, there will be several years between dam removal and salmon recovery where there will be reduced recreational fishery, even below current levels. Given the interest rate, each dollar of these near term losses weigh more heavily than a dollar of future gain.

The lower portion of Table 7 analyzes a further improvement in chinook salmon fishing quality to one salmon caught 20 hours of fishing. Changing HRSAL in the TCM demand equation we estimate angler trips would increase by an additional .1343 trips per angler per year. Applying this increase yields an estimated additional 91,674 angler days, in total, from all groups of anglers (*e.g.*, local and rest of Pacific Northwest and California). This has an incremental value of $6.9 million annually. Once again, the present value of this would need to be calculated accounting for the likelihood that it may take several decades before salmon populations would increase to these levels (possibly around 140,000 returning adult chinook salmon). Clearly, the biologists will need to map from returning adult chinook salmon into hours to catch a salmon to apply our approach for calculating the angler benefits over time and alternatives. The last policy simulation in Table 7 calculates future angler use and benefits if salmon fishing quality improved to 10 hours per salmon caught. The low estimate is an additional 62,764 trips worth an additional $4.77 million annually.

The salmon fishing benefits could likely be applied to increases in salmon from improved transport and other dam improvements. Our demand estimates may over-estimate the number of salmon fishing trips and benefits associated with dam improvements, if anglers strongly prefer fishing for salmon in a free-flowing river (as described in the survey) as compared to reservoirs, however. Of course, the non-angling river recreation benefits would not occur without dam removal. However, the existing reservoir recreation estimated by McKean (1998b) would likely remain and could be used to estimate the non-fishing benefits of dam improvements.

Table 8 repeats the analysis and policy simulations at the Middle-high and High estimates of angler visitation rates. The Middle-high and High estimates use the sum of anglers that definitely and probably would visit if the dams were removed. The Middle-high estimate assumes anglers that did not respond to the survey would not visit the Lower Snake River if salmon fishing were made available. The resulting demand estimates of 11-27 million angler days need to be evaluated by fisheries biologists to determine what portion of this angler demand could be accommodated by a newly recovered chinook salmon fishery. It may be that once full recovery occurs in 3-4 decades, that this level of angler demand might be accommodated on the Lower Snake River.

PASSIVE-USE VALUE BENEFIT TRANSFER ANALYSIS

Salmon Passive Use Value Literature

Before reviewing the specific studies on the economic value of salmon and free-flowing rivers, we wish to define benefit transfer. There are several closely related definitions of benefit transfer (Brookshire and Neill, 1992). A commonly referred to definition is provided by Boyle and Bergstrom (1992:657) "...benefit transfer is defined as the transfer of existing estimates of nonmarket values to a new study [site] which is different from the study for which the values were originally estimated." Desvousges *et al.*, characterize benefit transfer as application of economic values from a previously studied site to a new policy site under evaluation.

A review of two large computerized economic databases (American Economic Association's EconLit and Environment Canada's recently developed Environmental Values Reference Inventory or EVRI) yielded four published studies, but only three which presented original passive use values for salmon. These three are: 1) Olsen, Richards and Scott's article published in Rivers on existence values for doubling the size of Columbia River Basin salmon and steelhead runs; 2) Loomis article in Water Resources Research on the economic benefits of increased salmon from removing the dams on the Elwha River; and 3) Hanemann, Loomis and Kanninen's article published in American Journal of Agricultural Economics on benefits of increasing chinook salmon populations in the San Joaquin River.

The key characteristics of these three studies are described in Table 9. The Olsen *et al.*, study involved a telephone interview of Pacific Northwest households, using an open-ended WTP question format. Their means of payment (*i.e.*, payment vehicle) was an increase in household electric bill. The change in salmon was a doubling from 2.5 million to 5 million salmon, for a net change of 2.5 million salmon. The response rate on the phone interviews was quite good at 72%. The original study existence value is $26.52 per household amounting to $32.52 in 1996 dollars.

Table 9 Passive Use Value Studies Used in the Benefit-Transfer			
Category	**Olsen *et al.***	**Loomis-Elwha**	**Hanneman *et al.***
Sample Frame	ID,MT,OR,WA	WA	CA,OR,WA
Response Rate	72%	68%	51%
Survey Mode	Phone	Mail	Phone/Mail
CVM Question Format	Open-ended	Dichotomous choice	Dichotomous choice
River	Columbia	Elwha	San Joaquin
Payment Vehicle	Elec Bill	Taxes	Taxes
Protests In (%)	No-16%	No-6%	No-4.4%
Change in Salmon Pop	2,500,000	300,000	14,900
Wild/Hatchery	Wild and Hatchery	Wild	Wild and Hatchery
Orig WTP/Household	$26,52	$73.00	$181.00
Year of Value	1989	1994	1989
WTP in $ 1996	$32.52	$76.48	$221.96
Pac NW and CA Non-Use Households	12,541,700	12,541,700	12,541,707
Total Passive Use WTP w/chg # Salmon	$407,877,896	$959,141,438	$2,783,782,018
Passive Use per Salmon to Non-User Households	$163	$3,197	$186,831
All Pac NW and CA Households	12,653,525	12,653,525	12,653,525
Passive Use Per Salmon to All Pac NW and CA Households	$165	$3,262	$188,497

The Loomis (1996a) Elwha study used a mail questionnaire and a dichotomous choice willingness to pay question format. An increase in federal taxes was the payment vehicle. The mail survey had a response rate of 68% for Washington residents and 55% for rest of U.S. residents. Respondents were shown a bar chart in the survey indicating the increase in salmon population due to dam removal was approximately 300,000 fish. The Washington residents value was $73 in 1994 dollars or $76.46 in 1996 dollars. The value to the rest of U.S. residents was quite similar at $68 in 1994 dollars or $71.24 in 1996 dollars.

The Hanemann *et al.* (1990), study involved a combination telephone contact, mail survey booklet and then phone interview of respondents using the survey booklet. A dichotomous choice willingness to pay question was used, with taxes as the means of payment. The resource was an increase from 100 chinook salmon to 15,000 chinook salmon for a net increase of 14,900 in the San Joaquin River. The combination phone-mail-phone survey had a 51% response rate. The value per household was $181 in 1989 dollars or $222 in 1996 dollars. Using Pate and Loomis' reanalysis of this data to relate it to distance from the resource, we are able to approximate the value a household in the mid-western U.S. and east coast of the U.S. would have for protecting salmon. This value is about 75% of the value per household on the west coast.

Key characteristics of each study for the benefit transfer are shown in Table 9. More details on each study can be found in the respective journal article.

Criteria for Benefit Transfer

Boyle and Bergstrom (1992:659) "...propose the following idealistic technical criteria:

> 1) the nonmarket commodity valued at the study site must be identical to the nonmarket commodity to be valued at the policy site;
>
> 2) the populations affected by the nonmarket commodity at the study site and the policy site have identical characteristics;
>
> 3) assignment of property rights at both sites must lead to the same theoretically appropriate welfare measures (*e.g.*, willingness to pay versus willingness to accept compensation)."

In reviewing existing empirical studies on the non-use value of salmon, criteria 1) and 3) are met quite well. With respect to criteria 3), we have obtained estimates of willingness to pay (WTP) from all of the studies and this is value measure of value required under the Principles and Guidelines (U.S. Water Resources Council, 1983). The studies we have measure the value of salmon or salmon and steelhead. These are the general category of fish species we are concerned with in the Lower Snake River study so criteria #1 is satisfied, with two minor exceptions. Our policy involves increasing populations of officially listed Threatened and Endangered salmon, while the existing studies value increases in salmon that are not threatened with extinction. The second subtle issue has to do with valuation of wild stocks versus hatchery stocks. One study below, deals primarily with wild stocks, whereas the other two studies deal with a mix of wild and hatchery stocks. The species of greatest policy relevance in the Lower Snake River are the recovery of wild salmon and steelhead populations. On both these issues, the values in the existing literature will tend to understate the values the public would likely place on increasing officially listed wild stocks at stake in the Lower Snake River. Some evidence for the fact that existing scarcity influences WTP may be found in comparing the WTP estimates from three studies in relation to baseline populations and target populations. The Olsen *et al.*, study has the highest baseline population (2.5 million fish) and highest increase (another 2.5 million fish for a total of 5 million). Loomis (1996) presents the baseline at about 50,000 fish with an increase to 350,000, indicating a net gain of over 300,000 fish. Finally, the San Joaquin Valley study has a baseline of 100 salmon versus the program target of 15,000. The marginal values per fish in Table 9 follow the relative scarcity.

Criteria 2) is met very well for the Olsen *et al.* study, as their sampling frame is nearly identical to our study (*e.g.*, the Pacific Northwest states of Idaho, Montana, Oregon, and Washington). The Loomis (1996a) study on the Elwha matches fairly well, as the State of Washington is by far the most populous of the Pacific Northwest states affected by the removal of the Lower Snake River dams. Only the study on the economic value of salmon in the San Joaquin River in California, is weak on criteria 2) (since the majority of the sample is California residents, with only a portion of the sample being Oregon and Washington residents). Although the species match is good, the San Joaquin transfer is weaker than the rest in that the river is located in central California, rather than the Pacific Northwest.

Nonetheless, compared to many benefit transfers illustrated in the special section of Water Resources Research and attempted by others, our benefit transfer adheres fairly closely to the technical criteria for an ideal benefit transfer.

A further factor suggesting the merit of the benefit transfer relates to the quality of the studies used in the analysis. All of the studies had large samples and reasonably high response rates. More importantly, the studies of Olsen *et al.*, Loomis (1996a) and Hanemann *et al.*, and Pate-Loomis (1997) were all published in peer reviewed scientific journals.

Generalizing the Value per Household to the Region

As noted by Gardner Brown and Jason Shogren (1998) the benefits of threatened, endangered or rare species extend far beyond the local area where the critical habitat is located. Since non-use values are public goods which can be received by all households in the U.S. simultaneously, the potential market area over which to vertically sum the individual values could be nationwide. Statistical analysis using the San Joaquin Valley data (Pate and Loomis, 1997) indicates that the non-use values for salmon did not fall off rapidly with distance from the river where the salmon were being protected. Statistical analysis of using the Elwha data (Loomis, 1996b) found only a very slight decline in WTP with distance, falling from $78 to $68 per household as distance went from 100 miles to 2,500 miles from the river. Residents of both the east and west coasts in the United States valued protection of California and Northern Spotted Owl habitat (Loomis and Caban, 1996).

Besides statistical criteria is the fact that this salmon species being recovered in the Lower Snake River are federally listed species. The recommendation on dam removal are being made by Federal agencies. It is likely some Federal tax dollars would be used to pay for any dam removal and river restoration. Finally, the U.S. Water Resources Council Principles and Guidelines requires a national accounting stance when performing benefit cost analysis. Thus, one end of the non-use value spectrum will be to include distance adjusted values per household to households in the rest of the U.S.

At the other end of the spectrum is to use just households in the Pacific Northwest region of Idaho, Montana, Oregon and Washington. This would be a lower bound estimate of the non-use values, as it presumes no other households in the rest of the U.S. receives any benefits. As noted above, empirical evidence from two different studies suggests this is would result in a substantial underestimate of the non-use values.

In designing the original survey which was to include passive-use values, it was decided by the interagency team to use Pacific Northwest households plus California as the relevant population. California was added as that state is tied into the electricity market for power from the hydropower system. Northern California is sometimes considered part of the Pacific Northwest. Consistent with Olsen *et al.* (1990), we calculated a lower bound estimate using only households that did not include an angler as a non-user or existence value household. This is a low approach as anglers can also hold non-use value (Loomis, 1988), but it definitely eliminates any possible concern with double counting of recreation and non-use values. Information from the U.S. Fish and Wildlife Service's National Survey of Fishing, Hunting and Wildlife Associated Recreation was used to calculate the number of angler households in the states of California, Idaho, Montana, Oregon and Washington. As noted above, since users can still hold existence values, a less conservative approach expands the existence values per household to all households in the Pacific Northwest and California. This results in a small increase in non-use values per salmon and total non-use values in this region.

Estimating Benefit Transfer Functions

While the range of value per household and value per salmon in Table 9 may appear large, the pattern of values actually correspond with economic principles of diminishing marginal value. Specifically, the Olsen *et al.*, study offers a gain of 2.5 million salmon from a base of 2.5 million salmon, and thus the value per additional salmon is lower than in the Hanemann *et al.*, where they were offered an increase of 14,900 salmon on a base of 100 salmon. When you have very little of something and are offered a small increase, each additional unit is very valuable.

To incorporate the value estimates for all three studies and *provide a WTP function that could be applied to the change in number of salmon for a wide range of policy alternatives*, the non-use value per salmon was regressed on the number of salmon offered in the program. The regression equation for non-angler Pacific Northwest households is:

Natural Log($NUV per Salmon)= 25.353 -1.37358(Natural Log of Number of Salmon)

T-Statistic (-102.32)

R² = .99

The regression equation for all Pacific Northwest households is:

Natural Log($NUV per Salmon)= 25.357 -1.37315(Natural Log of Number of Salmon)

T-Statistic (-104.73)

R² = .99

As is evident from the regression equation it is nearly a perfect fit and number of salmon is highly significant, even adjusted for the number of observations. This equation attempts to approximate a marginal benefits function, estimating the marginal non-use value of another salmon in the Lower Snake River. From this marginal function, the total non-use value is constructed. A summary of the annual values are presented in Table 10. From this table simple calculation of the net difference due to dam removal or alternative transport policies can be measured.

Table 10
Annual Passive-Use Value of Pacific Northwest and California Households

Salmon Population	Non-Users Marginal NUV Per Fish	Non-Users Aggregate NUV	Non-Users and Anglers Marginal NUV Per Fish	Non-Users and Anglers Aggregate NUV
4000	$1,156,315	$4,625,260,966	$1,165,510	$4,662,041,701
5000	$851,064	$5,476,324,646	$857,915	$5,519,956,578
10000	$328,452	$7,829,249,230	$331,196	$7,892,245,068
15000	$188,189	$8,997,235,911	$189,795	$9,070,112,988
20000	$126,760	$9,631,034,341	$127,857	$9,709,399,666
30000	$72,628	$10,460,659,123	$73,270	$10,546,318,893
35000	$58,769	$10,754,503,651	$59,292	$10,842,780,194
40000	$48,920	$10,999,106,047	$49,359	$11,089,575,207
50000	$36,006	$11,387,201,394	$36,332	$11,481,177,881
60000	$28,029	$11,667,495,713	$28,286	$11,764,034,731
70000	$22,681	$11,894,303,077	$22,890	$11,992,931,010
80000	$18,880	$12,083,102,322	$19,055	$12,183,480,197
90000	$16,060	$12,243,699,492	$16,209	$12,345,574,230
100000	$13,896	$12,382,658,293	$14,026	$12,485,834,651
120000	$10,817	$12,612,739,817	$10,920	$12,718,085,122
140000	$8,753	$12,797,183,243	$8,836	$12,904,280,358
150000	$7,962	$12,876,800,947	$8,038	$12,984,658,038
175000	$6,442	$13,037,862,735	$6,504	$13,147,268,132
200000	$5,363	$13,171,933,972	$5,415	$13,282,636,089
225000	$4,562	$13,285,978,185	$4,606	$13,397,789,232
250000	$3,947	$13,384,656,431	$3,986	$13,497,431,570
275000	$3,463	$13,471,225,955	$3,497	$13,584,850,513
300000	$3,073	$13,548,043,285	$3,103	$13,662,424,515
325000	$2,753	$13,616,862,621	$2,780	$13,731,924,165
350000	$2,486	$13,679,021,342	$2,511	$13,794,699,383
375000	$2,262	$13,735,559,937	$2,284	$13,851,800,451
400000	$2,070	$13,787,302,170	$2,090	$13,904,058,910
450000	$1,761	$13,878,923,375	$1,778	$13,996,597,761
500000	$1,523	$13,957,869,289	$1,539	$14,076,338,140

This calculation can be performed from two different perspectives, that yield different starting and ending points on the total benefits curve. If one applies the benefit function just to the Lower Snake River, then the starting point is the current number of returning adult chinook salmon has averaged between 8,000 and 10,000 over the last decade. If 10,000 is expected to continue, baseline passive-use value would be roughly $7.8 billion annually. If dam removal would boost returning adult salmon populations in 20 years by 50,000 salmon to 60,000 salmon, total passive-use value would rise to $11.6 billion annually for a gain of $3.8 billion each year (this incremental passive use value represents less than one-half of one percent of regional income, so is quite reasonable). However, as suggested by one reviewer, this benefit function could be interpreted as a Columbia River basin or even an entire Pacific Northwest salmon benefit function. In this case the starting point would be around 260,000 returning adult salmon in the Columbia River plus the number of returning adults in other coastal streams in the Pacific Northwest. *To illustrate this other perspective, if there are 350,000 returning adults this would be the baseline for the Lower Snake River analysis.* To continue the example, the value of the same 50,000 adult salmon increment would now be $103 million annually ($13.723 billion minus $13.620 billion). Which of these perspectives the DREW and the COE wishes to adopt is in part a policy question and in part a question of what is the baseline for the future without. To a certain extent the EIS is addressing solely changes in the operation of the Lower Snake River dams, not the entire Columbia River system, so one might argue the Lower Snake River starting point of 10,000 adult salmon is appropriate. This view is reinforced by the fact the chinook and sockeye salmon being evaluated in the Lower Snake River are listed as separate species under ESA. Alternatively, to if all wild salmon are treated equally and to ensure this analysis is a marginal analysis reflecting current amounts of salmon in the Pacific Northwest would be used as the baseline. The COE and DREW will need to decide whether to use the Lower Snake River, Columbia River Basin, or the entire Pacific Northwest as the baseline to use.

By using the values in Table 10, the analyst can calculate the annual change in passive use values to Pacific Northwest household for changes in salmon (linear interpolation would be needed for changes intermediate between our increments or the analyst could use the regression equation to estimate changes in passive use value for finer increments). Note that even using a total passive use value interpretation of Table 10, the existence value of 400,000 salmon represents about 1% of regional income. This seems quite reasonable given the high profile nature of endangered salmon in the region.

To calculate the passive use value for rest of U.S. households, we only had two data points: 1) the rest of U.S. benefit estimate from Loomis (1996) Elwha study; and 2) Pate-Loomis (1997) estimated willingness to pay for San Joaquin River salmon as a function of distance. Using these two data points a rest of the U.S. WTP equation was calculated. Because there are two points, the equation is a straight line of the form:

($NUV per Salmon)= 948.024 -1.60232*(Number of Salmon)

Using this equation, the marginal and total passive use value to rest of U.S. households was calculated. The annual values are displayed in Table 11. Given the large number of households in the mid-west and east coast, the passive use values are quite large, nearly ten times that of the Pacific Northwest and California. As before the analyst can use the table or the equation to calculate the change in passive use values with changes in salmon populations in each year of recovery.

Table 11
Total Passive-Use Value of Rest of U.S. Households
As a Function of Salmon Population

Salmon Population	NUV Per Fish	Aggregate NUV
4000	$941,614	$3,766,456,880
6000	$938,410	$5,644,878,360
8000	$935,205	$7,516,890,560
10000	$932,000	$9,382,493,480
12000	$928,796	$11,241,687,120
14000	$925,591	$13,094,471,480
15000	$923,989	$14,018,460,180
20000	$915,977	$18,598,348,680
25000	$907,966	$23,138,173,180
30000	$899,954	$27,637,942,680
35000	$891,942	$32,097,654,180
40000	$883,931	$36,517,307,680
45000	$875,919	$40,896,903,180
50000	$867,908	$45,236,440,680
60000	$851,884	$53,755,283,680
70000	$835,861	$62,113,894,680
80000	$819,838	$70,312,273,680
90000	$803,815	$78,350,420,680
100000	$787,792	$86,228,335,680
110000	$771,768	$93,946,018,680
120000	$755,745	$101,503,469,680
130000	$739,722	$108,900,688,680
140000	$723,699	$116,137,675,680
150000	$707,676	$123,214,430,680
200000	$627,560	$154,592,405,680
250000	$547,444	$181,964,580,680
300000	$467,328	$205,330,955,680
350000	$387,212	$224,691,530,680
400000	$307,096	$240,046,305,680
450000	$226,980	$251,395,280,680
500000	$146,864	$258,738,455,680

Passive Use Value of Free-Flowing Rivers

Besides the existence and bequest values of the salmon themselves, is the existence value of having the Lower Snake River as a free-flowing river once again. This is the value of restoring the canyon back to its natural, pre-dam condition. Like the estimating the non-use value of salmon, we were asked by the Corps of Engineers to make a rough estimate of this value using existing studies.

A mail survey of WTP to preserve free-flowing rivers was performed by Sanders, Walsh, and Loomis (1990) of Colorado households statewide. The mail survey had a 51% response rate of deliverable surveys. The annual WTP per household for option, existence and bequest value was $77 in 1983 dollars or $116 in 1996 dollars. Dividing this by the 555 miles being valued yields a value of 21 cents per mile. Multiplying this by the 140 miles of the Lower Snake River yields a value per household of $29.40 per year per household. The rivers included in this list are all within Colorado and include the Yampa, Dolores and Green River.

Another study was a contingent valuation method estimate of preserving the Black Canyon of the Upper Snake River from development. This study was performed by Scott and Wandschneider (1993). The University of Idaho conducted telephone interviews of residents of the four counties in Southeastern Idaho surrounding this section of the river. The study was conducted for the Bureau of Land Management. The survey had a response rate of 76% and a sample size of nearly 350.

The survey identified that slightly more than half of the sample were non-users (n=196) and they had an annual WTP of $58 for preservation of the Upper Snake River (as compared to users who had a WTP of $92). Dividing this value by the 63 miles protected yields a value of 92 cents per mile per household. This value is naturally higher since only individuals living in counties adjacent to the river were sampled. This value per household per mile is applied to the counties surrounding the Lower Snake River. Thus a value of 92 cents times 140 miles or $129 would be multiplied by non-use households in the counties surrounding the Lower Snake River. To calculate this we use the data in Table 6. We subtract out the number of non-angling households that would visit the Lower Snake River from the total non-angling households. This yields 305,467 non-angling, non-user households. Therefore $129 per household times 305,467 households yields our estimate of $39.4 million in passive-use value for restoring a free-flowing Lower Snake River. We use the Sanders *et al.*, value of $29.40 for the rest of non-user households in Washington, Oregon, Idaho, Montana and California. Using data from Table 7 we estimate 12.95 million non-angling, non-user households. Multiplying by Sanders *et al.*, value of $29.40 per household yields an estimated non-use value for restoring the Lower Snake River of $380.73 million. Thus aggregate passive use value for just the restoration of the free-flowing nature of the Lower Snake River is $420.13 million.

CONCLUSION

The removal of the four dams on the Lower Snake River and restoration of the river to a free-flowing condition appears to have substantial recreation use and passive use values to residents of the Pacific Northwest and California. The importance of the passive use values is evident as they are more than ten times the recreation benefits. Nonetheless, the river recreation benefits of a restored free-flowing river are estimated using the Low NED benefits for river recreation at least $144.2 million a year, increasing to $252 million annually once chinook salmon populations increase to the point where salmon fishing is allowed. Using the river recreation benefits based on river visitors' reported trip cost yield an estimated annual benefits of $288 million annually, increasing to $396 million annually once chinook salmon populations increase to the point where salmon fishing is allowed. These estimates of restored river recreation benefits are at least four times larger than current reservoir recreation benefits ($33.5 million) and may be as much as ten times larger than current reservoir recreation benefits, if all of the free-flowing river recreation users projected to visit the restored river can be accommodated at a restored lower Snake River.

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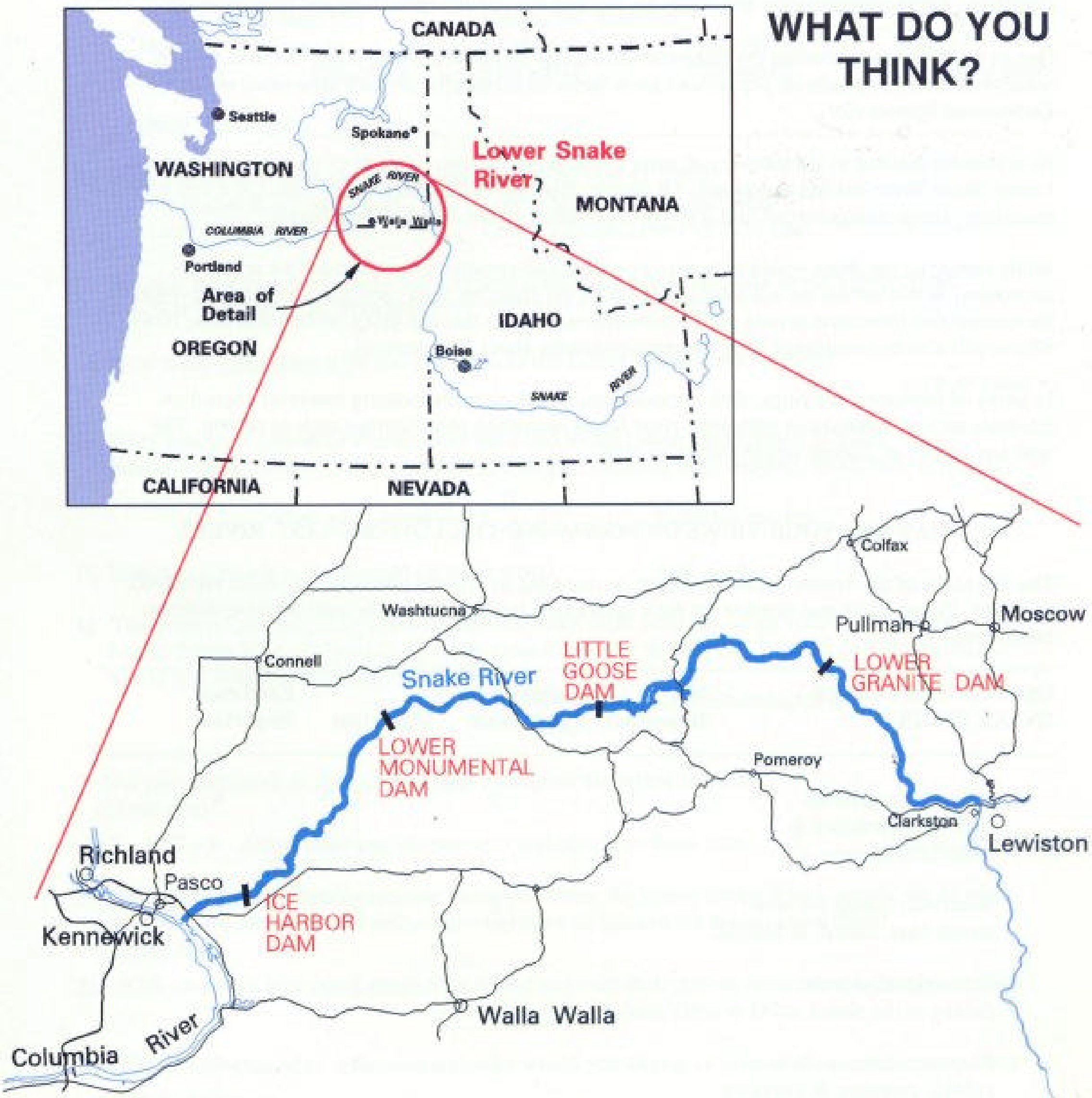
REMOVING DAMS FROM THE LOWER SNAKE RIVER

WHAT DO YOU THINK?



OMB 0710-0001

WHY IS THE SNAKE RIVER IMPORTANT?

The Snake River is one of the largest rivers in the United States. The Snake River is also the largest tributary to the Columbia River.

Historically, these two rivers produced an abundance of salmon and steelhead. The fish were harvested commercially and recreationally. Today, dams on these rivers provide large amounts of electricity, barge transportation and reservoir recreation such as waterskiing and motorboating.

Due to many factors including the dams and destruction of habitat, Snake River chinook salmon, sockeye salmon and steelhead populations have fallen so drastically they are now listed under the Endangered Species Act.

As a possible method to aid recovery of these endangered salmon, removal of the four dams on the Lower Snake River has been proposed. Of course, removal of the dams would result in a loss of electricity, barge transportation and reservoir recreation on the Lower Snake River.

While removing the dams would have many positive and negative effects beyond its impact on recreation, in this survey we are asking only about the effect on your recreation use and activities. Be assured that recreation is only one of the important issues that are being studied and these other effects will also be considered in any recommendations about dam removal.

In terms of recreation activities, dam removal would replace many existing reservoir recreation activities such as waterskiing with new, river based recreation opportunities such as rafting. The type and quality of fishing would change as well.

WHAT ARE YOUR VIEWS ON MANAGING THE LOWER SNAKE RIVER?

The 140 miles of the Lower Snake River can be managed to provide alternative types of recreation activities. Please circle one number for each question to indicate the importance of these different uses to you.

USES OF THE LOWER SNAKE RIVER	Not Important	Slightly Important	Important	Extremely Important
1. Reservoir recreation such as waterskiing & motorboating	1	2	3	4
2. Reservoir fishing for small mouth bass, catfish & bluegill	1	2	3	4
3. Recreational salmon fishing in the river	1	2	3	4
4. River recreation such as rafting, canoeing & kayaking	1	2	3	4

1. DID YOU VISIT THE LOWER SNAKE RIVER FOR RECREATION IN 1998?
(Circle One)
YES **NO (skip to the next page----------->)**

1a. If YES in which of the following activities did you or your household participate?
(please check all that apply during the year)

___Fishing for resident fish		___Fishing for steelhead	___Hunting
___Motorized boating	___Jet skiing	___Waterskiing	___Sailing
___Camping	___Picnicking	___Swimming	___Sightseeing	___Cruise/tour boats

___Other please list ______________________________

1b. Which dams/reservoirs did you or your household visit in 1998?
___ Ice Harbor/Lake Sacajawea ___Lower Monumental/Lake West
___ Little Goose/Lake Bryan ___Lower Granite/Lower Granite Lake

1c. Roughly how long does it take you to travel from your home, one-way to the Lower Snake River site you visit most frequently? ________ Hours

1d. How many **recreation** trips did you make to the Lower Snake River in 1998?
_____ # of Trips

1e. What was your typical or average cost for a trip to the Lower Snake River in 1998?
(Please include transportation, rental fees, boat gas, camping fees, lodging, food, bait, supplies)

Cost of a typical trip $_________ # of days per trip _______

1f. How many people were covered by these costs? # of people __________

1g. The price of gasoline, lodging and other trip costs often increase. If the cost of visiting the Lower Snake River site where you went most frequently in 1998 had been $3 per trip higher, would you have still gone there? (Circle one)
YES---> # of Trips at higher cost _______
NO

2. Did you participate in **reservoir or lake** recreation elsewhere in 1998?
(Circle one)

NO YES--> About what was the cost of a typical trip to those sites $______ (go to Q3).
⇓

3. If dam removal eliminated reservoir recreation along the Lower Snake River, would you or other members of your household visit other reservoirs or lakes in the region more often?
(Circle one)

3a. YES-->About how many **more** trips would you take each year to these other reservoirs or lakes?
_____ # Added Trips to Other Lakes

3b. NO -->In what other recreation activities would you engage in instead of reservoir recreation?
List Activities--> ______________________________

WHAT ARE THE RECREATION OPPORTUNITIES OF NATURAL RIVER CONDITIONS?

Before we ask you whether you would visit the Lower Snake River if the dams were removed, we want to describe what the resulting free-flowing river would be like. Also see the map insert.

What Would the River Look Like?

Dam Sites: The earthen part of the four dams would be removed and the river would flow around the remaining concrete dam structure.
River Canyon: The 140 mile river canyon would be unchanged and is over 1,000 feet deep in places.
River Depths: Minimum river depths would be 4-6 feet during spring, summer and fall.
Islands: Prior to the dams, there were about 70 small islands. These islands will reappear with natural river levels. The islands would provide wildlife habitat as well as potential camping and lunch spots.
Vegetation: Would be re-established along the river and on re-emerging islands over a 5-10 year transition period.

What Would Recreation Access be Like?

Land Ownership: Federal, State and County ownership and management would continue. Generally there are no fees for most activities, except camping at developed campgrounds.

Roads to the river: 30 river segments would be accessible by car. There are several sections of paved road that parallel the river and provide access. (See map insert).
Several 10-20 mile segments of the river would remain unroaded and accessible only by boating or hiking.

Bridges across the river: Two existing paved roads across the middle of the river and existing road access at either end of the river would remain. (See map insert).

Trails: Old road beds and railroad beds in the canyon would re-emerge. Large portions of these would be suitable for hiking, mountain biking and horseback riding along the shoreline.

Boat ramps: 14 of the existing 27 boat ramps would be extended down to the river.

What Recreation Activities Would be Possible?

River Based:

River fishing, rafting, canoeing, kayaking, tubing, drift boats and jet boating would be possible.

Flows: During the high flow months of April to June, the entire 140 miles of river could be floated in boats such as rafts or canoes in about 7 days. During July and August, portions of the river could be floated on a typical weekend.

Rapids: Prior to the dams, the river had 63 named rapids. These were relatively small rapids. Most of these rapids would return with dam removal.

Land Based:

Currently there are seven campgrounds, offering over 400 individual campsites located in the river canyon. The majority of these campgrounds have running water, flush toilets, tables, shade trees, and electrical hook-ups for RV's. These campgrounds and facilities would remain in place, however, they would be a few hundred feet further to the new river level.

There are also hotels and lodging available in nearby towns of Pasco and Lewiston. (See map insert)

What Would the Fishing be Like After Dam Removal and River Restoration?

Resident Fish: Due to loss of reservoirs, catch rates for species such as smallmouth bass would be slightly lower than today, while fishing for species such as yellow perch, bullheads, catfish, and bluegill would be largely eliminated. Sturgeon fishing would improve with natural river conditions.

Steelhead Fishing:
It is expected that fishing for steelhead would improve from current catch rates averaging 1 steelhead for every 24 hours of fishing (3-4 angler days) to 1 steelhead per 14 hours of fishing.

Salmon Fishing:
It is expected that chinook salmon populations will increase to the point where they would no longer be endangered and fishing for chinook salmon in the Lower Snake River would occur each year. Catch rates of 1 chinook salmon per 8 hours of fishing are expected over a 60 day season.

WOULD YOU VISIT THE FREE-FLOWING LOWER SNAKE RIVER?

Please take a moment to think about the material you have just read and look at the map insert of the river, boat ramps, campgrounds and distance to major cities.

1. Given where you live, about how long would it take you to drive to the Lower Snake River?

______ hours.

2. About how far is that? (refer to map) ______ one-way miles.

3. Given the travel time, the description of the Lower Snake River, and the availability of other free-flowing rivers in the region, would you or other members of your household visit the Lower Snake River if the dams were removed, the river conditions were as described above and if fishing, your expected catch rates would be as listed above? (circle one)

a. Definitely YES b. Probably YES *c. Probably NO* *d. Definitely NO*

(If you circled c. or d. skip to the top of page 7------->)

4. If the dams were removed and the free-flowing river restored, about how many recreation trips per year do you estimate you or other members of your household would make to the Lower Snake Rive each year?

______ Expected # of Trips per year

5. What would be the main or primary activities you or other members of your household would participate in while visiting the free-flowing Lower Snake River. (Please check all that apply)

___ Fishing for steelhead
___ Jet Boating
___ Sightseeing
___ Picnicking
___ Hiking
___ Fishing for chinook salmon
___ Jet skiing
___ Camping in Developed sites
___ Swimming
___ Mountain Biking
___ Fishing for resident fish
___ Rafting/Kayaking/Canoeing
___ Primitive camping
___ Hunting

____ Other: ______________________________

6. About how much would you anticipate it would cost you to travel to the place where you would most frequently visit on the Lower Snake River?
(Please include round trip transportation, any rental fees, boat gas, camping fees, lodging, food, bait, supplies).

$________ per trip ----------------------> average # of days per trip ________

7. How many people would be covered by these costs? average # of people ____________

8. The price of gasoline, lodging and other trip costs often increase. If the cost of visiting the free-flowing Lower Snake River site where you would plan to go increased by $3 per trip, would you still go there? (Please circle one)

YES----> Expected # of Trips per year at the higher cost ________

NO

9. Do you currently visit other free-flowing rivers? YES NO (go to top of next page)

9a. If YES---> About what was the cost of a typical trip to those rivers? $______

9b. If the dams were removed on the Lower Snake River, would you take fewer trips to these other rivers?

YES---> About how many <u>fewer</u> trips would you take each year to these other rivers?

_______ # of Fewer Trips to Other Rivers

NO

Section V About You

These last few questions will help us in determining how well the returned surveys reflect people living in the region. **Your answers are strictly confidential and will only be used for the analysis of this study. You will not be identified in any way.**

1. Are you ____Male ____Female

2. What is your age? ____Years

3. Are you retired? (circle one) Yes No

4. What is your zip code? ____________

5. Did you go fishing anywhere in the U.S. in 1998? (circle one) Yes No

6. Do you own a boat or other watercraft?
   a. Yes--> Please circle: powerboat fishing boat cruiser jet-ski canoe kayak sailboat houseboat drift boat jet-boat bass-boat raft float tube
   b. No

7. Highest level of formal schooling? (circle one number)

1 2 3 4 5 6	7 8 9	10 11 12	13 14 15 16	17 18 19 20+
(Elementary)	(Jr.High)	(High School)	(College or Technical School)	(Graduate or Professional School)

8. Do you work outside the home? Yes No

9. When you participate in recreation, do you almost always go on weekends, holidays, vacations or other non-work days? (circle one) Yes No

10. How many days per year do you have available for outdoor recreation? _____ days per year

11. Including yourself, how many members are there in your household? #_____

12. How many contribute to paying the household expenses? #_____

13. Including these people, approximately what was your household income from all sources (before taxes) last year?

____ less than $10,000	____ $40,000 to $49,999	____ $80,000 to $89,999
____ $10,000 to $19,999	____ $50,000 to $59,999	____ $90,000 to $99,999
____ $20,000 to $29,999	____ $60,000 to $69,999	____ $100,000 to $149,999
____ $30,000 to $39,999	____ $70,000 to $79,999	____ over $150,000

Thank you for completing the survey!

When you are finished, please put the survey in our stamped return envelope and mail it back to us.

Thank You for Completing the Survey!

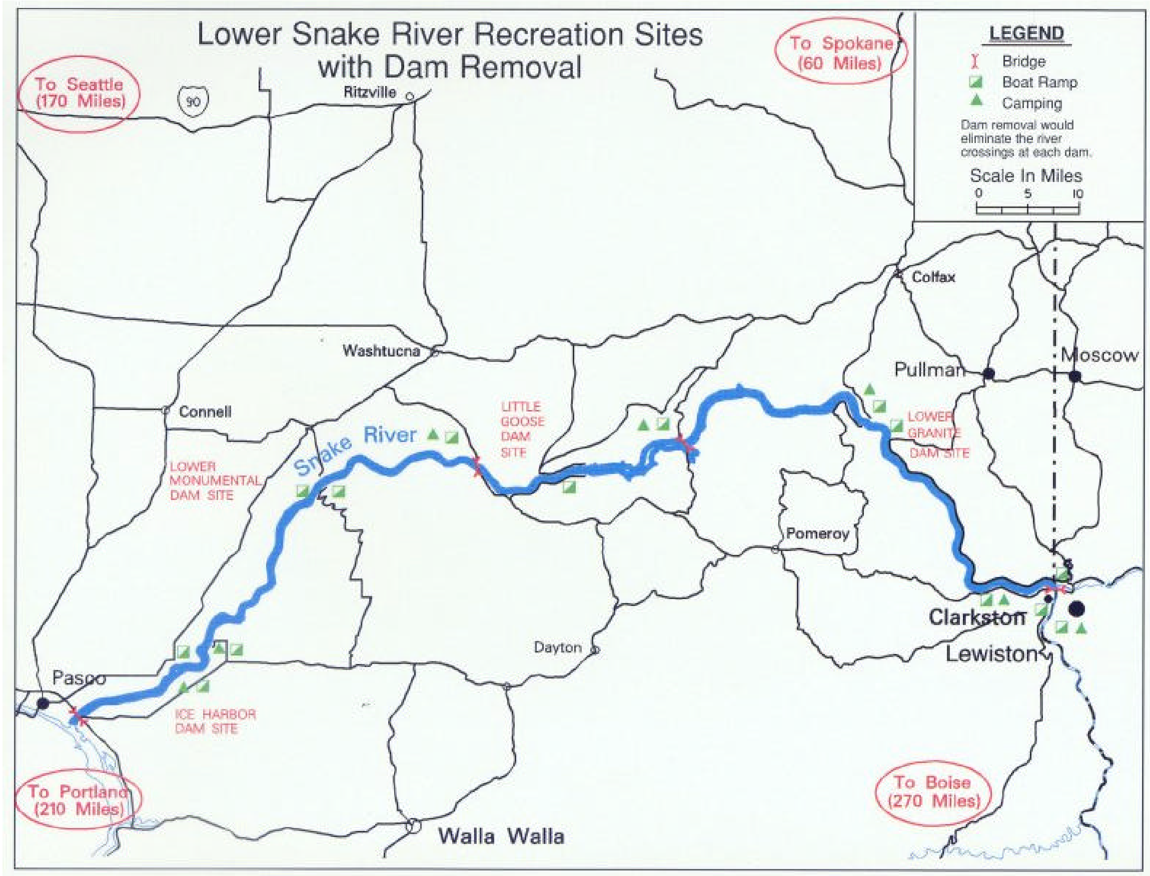
If you have any additional thoughts on any issues related to removing the dams on th Lower Snake River, please feel free to write them down.

Snake River Survey Project
College of Forestry, Wildlife and Range Sciences
University of Idaho
Moscow, ID 83844-1136

Estimated time to complete this survey is 15 minutes per response. Send any comments regarding this estimate or any other aspect of this survey, including suggestions for reducing the time burden to the Department of Defense, Washington Headquarters Services, Directorate of Information Operations, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Please do not return the questionnaire to this address.

OMB 0710-0001, 9-98

CU2- 9772



Lower Snake River Recreation Sites
with Dam Removal
To Seattle
(170 Miles)
To Spokane
(60 Miles)
LEGEND
Bridge
Boat Ramp
Camping
Dam removal would
eliminate the river
crossings at each dam.
Scale In Miles
0
5
10
90
Ritzville
Colfax
Washtucna
Pullman
Moscow
Connell
LITTLE
GOOSE
DAM
SITE
Snake River
LOWER
GRANITE
DAM SITE
LOWER
MONUMENTAL
DAM SITE
Pomeroy
Clarkston
Lewiston
Dayton
Pasco
ICE HARBOR
DAM SITE
To Portland
(210 Miles)
To Boise
(270 Miles)
Walla Walla