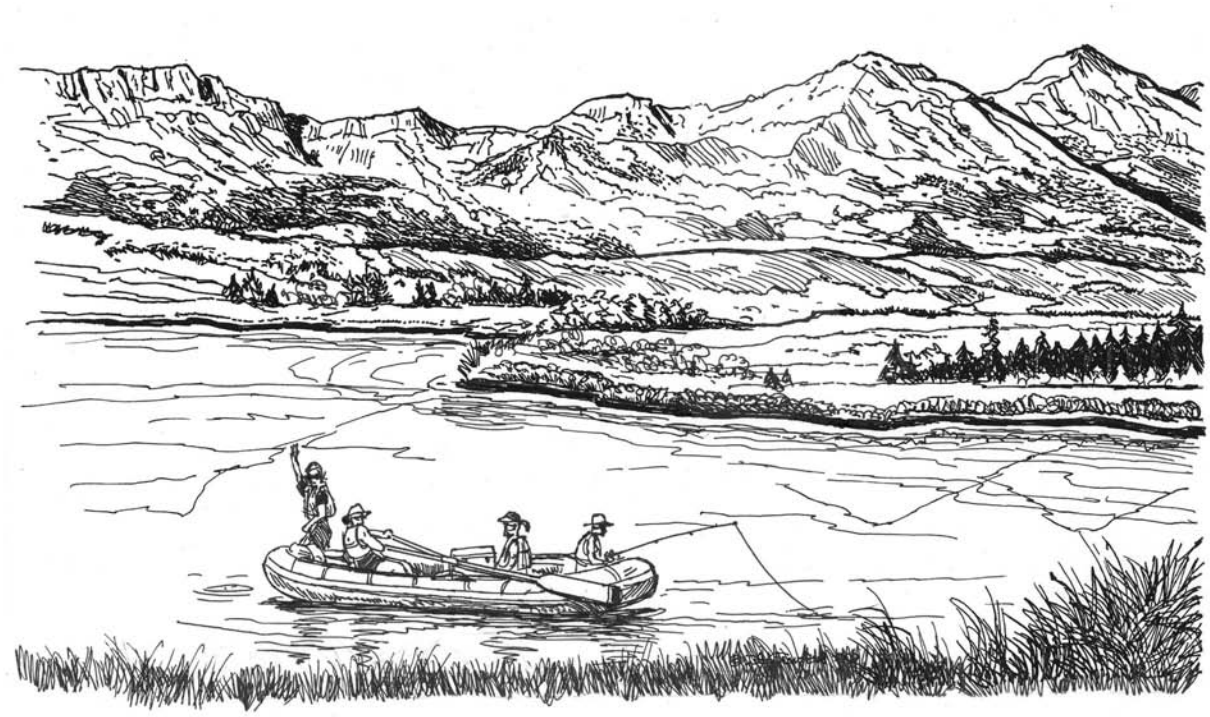
The Economic Value of Recreational Fishing & Boating to Visitors & Communities along the Upper Snake River

May 2005

Dr. John Loomis, Dept. of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO 80523

In cooperation with Dr. Don Reading of Ben Johnson Associates, Boise, ID and Dr. Lynne Koontz, Fort Collins, CO.



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Final Report May 1st 2005

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Acknowledgements

This study was truly a collaborative effort that would not have been possible without the assistance of more than a dozen people. First and foremost, the initiation of the study and critical guidance in study design and data collection came from Steve Trafton, Executive Director, Henry's Fork Foundation and Scott Yates of Trout Unlimited. Funding for the data collection was provided by the Hewlett Foundation grant to the Henry's Fork Foundation. Vicki Kellerman and Chris Jansen Lute of the Bureau of Reclamation provided important direction, detailed comments, and financial support for the economic analysis portion of this project. Valuable study design and survey input was provided Jim Fredricks and Bill Schrader of Idaho Fish and Game (IDFG) and Monica Zimmerman of BLM in the Idaho Falls Field Office. Recruitment of interviewers was facilitated by Dr. Tesa Stegner of the Dept. of Economics, Idaho State University; the data collection was ably conducted by five Idaho State University students Jared Alley, Brice Boland, Dan Donahue, Penny Gneiting and Eric Miller. Interviewer assistance and angler counts was provided by Connor Black, TU summer intern and Ann-Marie Emery, summer intern with the Henry's Fork Foundation. Special thanks to Lynne Koontz who ran her input-output model of Teton County to allow for estimation of the local regional economic effects in Wyoming. Any errors or omissions are the responsibility of the lead author.

STUDY HIGHLIGHTS

The natural beauty and outstanding recreation opportunities of the Snake River corridor from Southwestern Wyoming to Southeastern Idaho draws thousands of visitors a year. This report quantifies the economic benefits, local employment, and income effects stemming from the maintenance of Snake River ecological conditions and associated fisheries, including all its dimensions - water flows, water quality, riparian vegetation as well as public access. Improving ecological conditions and fisheries has the potential to further increase economic benefits and income and employment in this area. Through careful management, the Snake River can support traditional economies related to irrigated agriculture and hydropower generation, along with a robust recreation economy.

Current and Potential Jobs and Income Related to Fishing on the Snake River in Southeast Idaho and Southwest Wyoming based on May –September sampling.
Table 1 presents the current jobs and income associated with the three river segments studied. The remaining columns represent jobs and income if anglers were to catch twice as many fish or fish that were 25% larger in size.

River	Current Jobs	Current Income	Twice Catch Jobs	Twice Catch Income	25% Larger Fish-Jobs	25% Larger Fish-Income
Henry's Fork	851	$29 million	1435	$49 million	1438	$49 million
South Fork	341	$12. million	544	$19 million	540	$19 million
SW Wyoming	268	$ 5.5 million	463	$9.5 million	474	$9.7 million
Totals	**1460**	**$46 million**	**2442**	**$77.5 million**	**2452**	**$78 million**

We can represent these jobs supported in terms of:

- 5.0 jobs per 1000 angler days on the Henry's Fork
- 1.7 jobs per 1000 angler days on the South Fork
- 2.8 jobs per 1000 angler days on the Snake River in southwest Wyoming.

Current Jobs and Income Related to Boating and General Recreation on the Snake River in Southeast Idaho and Southwest Wyoming.

River	Current Jobs	Current Income
Henry's Fork/ So. Fork	22	$796,208
SW Wyoming	538	$10.9 million
Totals	**560**	**$11.7 million**

Net Economic Value of Fishing to Anglers is:

- Henry's Fork: $90 per angler day for an annual total of $15 million
- South Fork: $75 per angler day for an annual total of $14.7 million
- SW Wyoming: $100 per day for an annual total of $9.5 million

Net Economic Value of Boating to Visitors is:

- Henry's Fork: $64 per day for an annual total of $.5 million
- South Fork: $135 per day for an annual total of $1.5 million
- SW Wyoming: $129 per day for an annual total of $16 million

EXECUTIVE SUMMARY

Objectives and Purpose of Study: To estimate the contribution to local income and employment to Southeast Idaho and Southwest Wyoming of 11 river segments of the Snake River from Jackson Hole to the confluence of the Henry's Fork, including the Henry's Fork. We also estimated the net economic value, or net willingness to pay, of anglers, boaters and other visitors to these same 11 river segments. See Map 1 and 2.

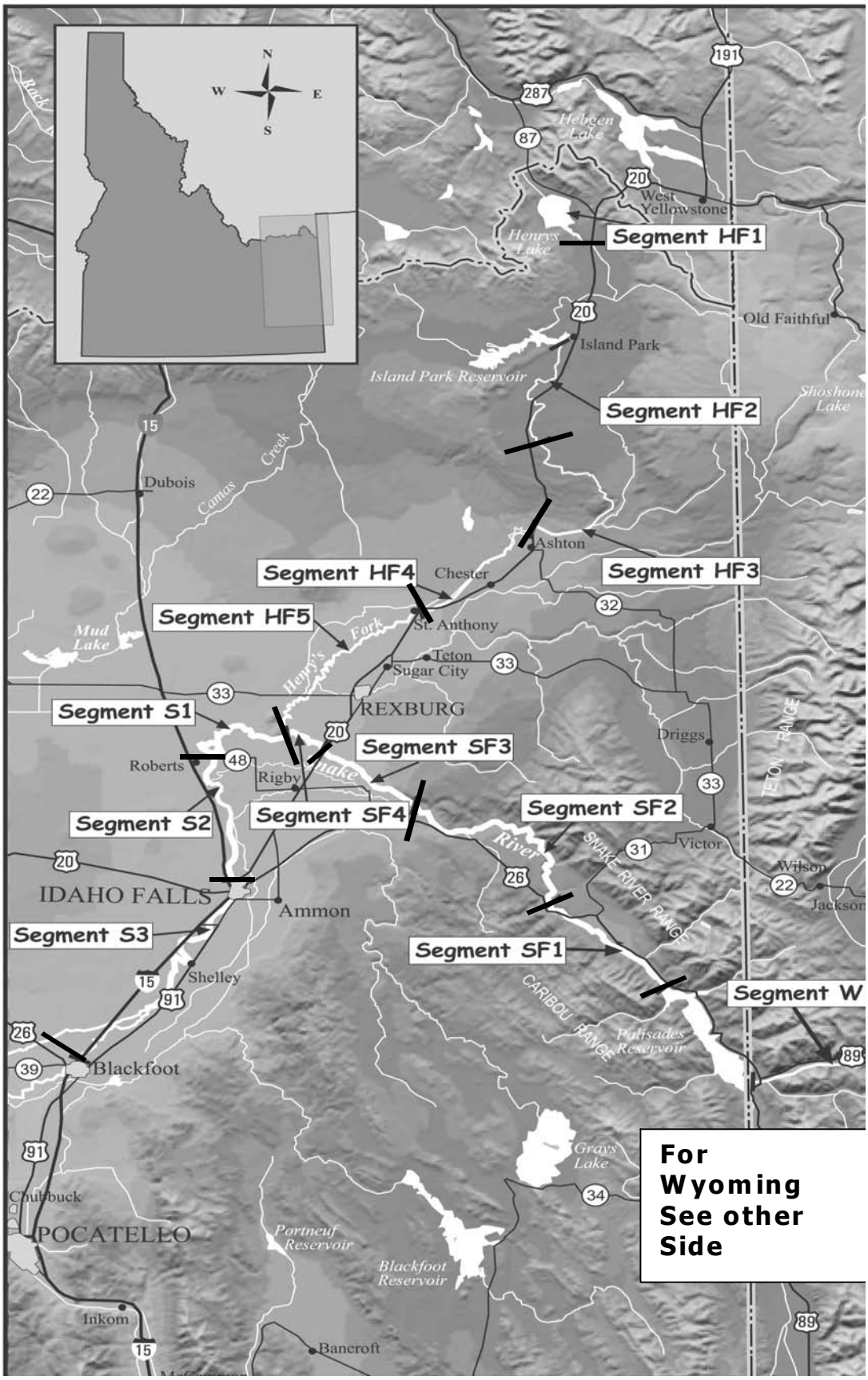
Survey Procedures and Response Rate: Visitors were given a mail back survey booklet during the 99 sampling days at the 11 river segments. Sampling took place from mid-May until mid-September 2004. Out of 1272 surveys handed out, 787 were returned by mid-October, yielding a 63% response rate. With over 700 surveys returned the margin of error on most responses is plus or minus 3.5% to 3.8%.

Table E-1 presents our estimate of angler and other visitor use at the four Henry's Forks sections (Henry's Lake and the three downstream portions), sections of the South Fork (from the outlet of Palisades Reservoir to the confluence with the Henry's Fork), and three sections of the Snake River in Wyoming (from the southern section of Grand Teton National Park to the inlet of Palisades Reservoir). We estimate more than a half million visitor days are spent on these stretches of the Snake River, with about 75% of that use being primarily anglers and 25% being boaters and other visitors.

Table E-1. Estimated Angler and Other Visitor Use of the Snake River in Southeastern Idaho and Southwest Wyoming from May through September 2004.

	Total Visitors	% Anglers	Total Angler Days	% Other Visitors	Total Other Visitor Days	Total Annual Visitor Days
Henry's Fork	16,990	87.2%	168,656	12.8%	9,693	178,349
South Fork	13,645	82.1%	196,199	17.9%	10,976	207,175
Wyoming	61,173	50.6%	95,563	49.4%	125,774	221,337
Total for Sampled Sites			460,418		146,443	606,861

These estimates are somewhat lower than Idaho Fish and Game (IDFG) for 2003 for the Henry's Fork. Using IDFG estimates of trips and our estimate of days per trip, IDFG estimate would be 255,423 angler days for Henry's Lake and the Henry's Fork versus ours of 168,656 angler days. Most of the difference with our estimate relates to Henry's Lake, where our estimate is 40,922 angler days but IDFG is more than double this at 106,449. Some of the difference in visitation estimates is likely to due to IDFG having performed an annual survey of anglers. That is, they have total annual trips. Although we also asked anglers about annual trips, our survey was just conducted from May through September, and missed some early spring and late fall fishing trips. However, with regard to the South Fork, our estimate of 196,199 angler days is substantially higher than the equivalent estimated angler days from IDFG of 123,278. Summing our estimate of the Henry's Fork and South Fork yields 364,855 angler days while IDFG is estimated at 378,701, quite similar overall.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Island Park Reservoir
Henrys Lake
Island Park
Old Faithful
West Yellowstone
Ashton
Chester
St. Anthony
Teton
Sugar City
REXBURG
Driggs
Victor
Wilson
Jackson
Roberts
Rigby
IDAHO FALLS
Ammon
Shelley
Blackfoot
Dubois
Mud Lake
Camas Creek
Henry's Fork
Snake River
SNAKE RIVER RANGE
CARIBOU RANGE
TETON RANGE
Palisades Reservoir
Grays Lake
Portneuf Reservoir
Blackfoot Reservoir
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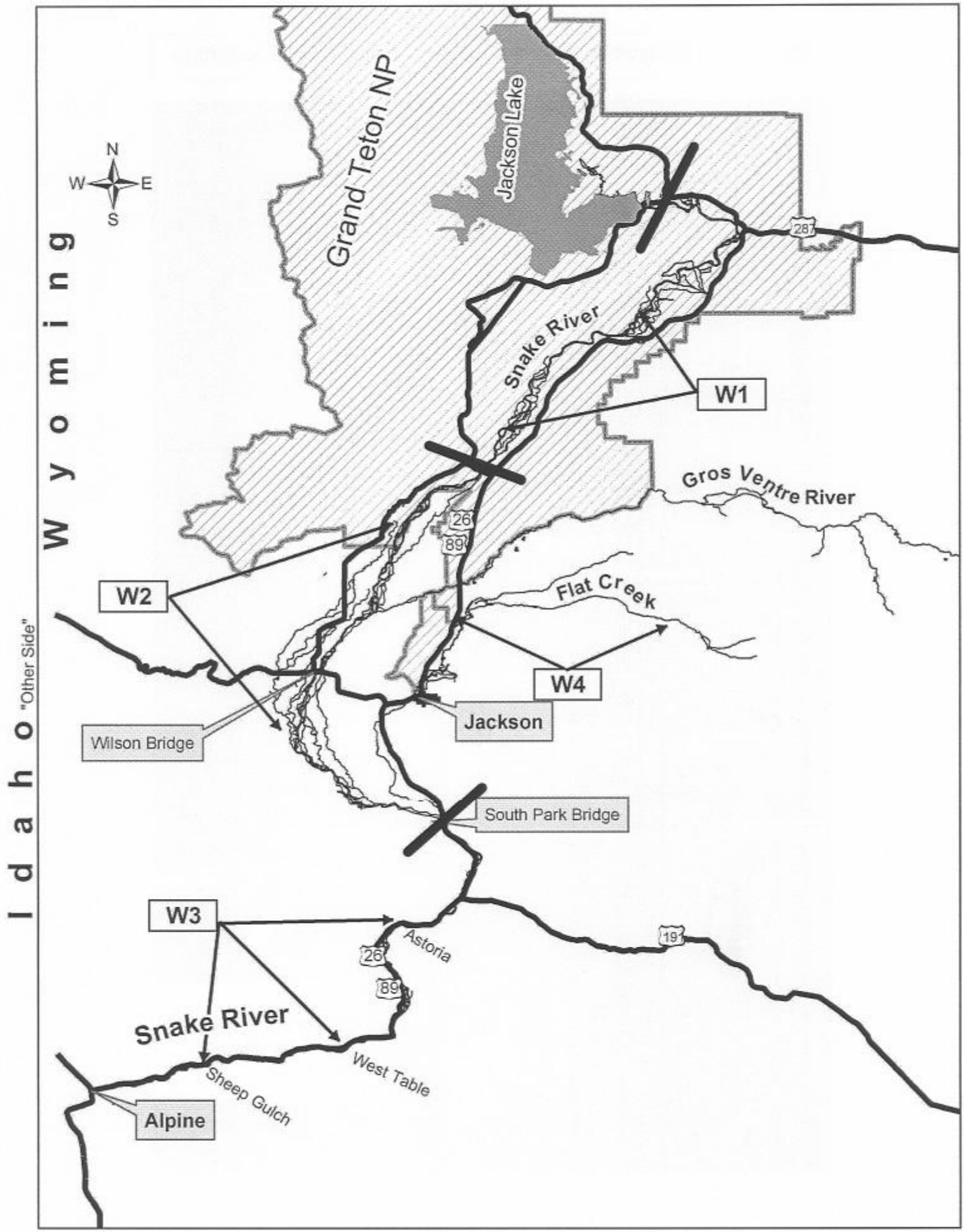
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W2
Flat Creek
W4
Jackson
Wilson Bridge
South Park Bridge
W3
Astoria
26
89
19
Snake River
Sheep Gulch
West Table
Alpine
28

Table E-2 reports how anglers indicated they would change the number of trips and hence angler days if catch were to double or fish size were to increase by 25%. While doubling fish catch may not be biologically possible or desirable, the ***rate of change in angler use*** or the elasticity can be calculated for smaller changes in fish catch. Specifically, over all three main stretches of the Snake River, a 1% change in catch would result in a .645% change in angler use. Of course, these relationships can also be used to assess how angler use would decrease if the fishery deteriorates. That is, if angler catch were to drop by 1% angler use drop by .645%.

Table E-2. Change in Angler Days with Twice Current Catch Rate and 25% Larger Fish Catch.

	Current Angler Days	Angler Days With Twice Catch Rate	% change in Anglers Day Twice Catch	Angler Days 25% Larger Fish	% change in Angler Days 25% Larger Fish
Henry's Fork	168,656	284,470	68.7%	284,991	69.0%
South Fork	196,199	312,866	59.5%	310,479	58.2%
Wyoming	95,563	159,889	67.3%	170,168	78.1%
Total for Sampled Sites	**460,418**	**757,224**	**64.5%**	**765,638**	**66.3%**

Yellowstone Cutthroat Trout Fishing: About half of the current angler days on the South Fork were by anglers targeting Yellowstone Cutthroat trout. This rose to nearly 100% of anglers on the Flat Creek tributary to the Snake River in Jackson Hole.

Perception of Crowding and Lack of Support for Permits: Generally speaking most anglers and other visitors rated most stretches of the Henry's Fork, South Fork and Wyoming stretches as only moderately crowded. Many visitors would reduce their trips to these stretches of the Snake River if they had to apply for a permit ahead of time.

Income and Employment Supported by Snake River Recreation
Using data on visitor expenditures in southeast Idaho and southwest Wyoming with two input-output models to capture multiplier effects, the total (direct, indirect and induced) jobs and income (wages, profits, rents) to the southeast Idaho and southwest Wyoming economies were calculated. Southeast Idaho includes the six counties of Bingham, Bonneville, Fremont, Jefferson, Madison and Teton Counties. Southwest Wyoming is primarily Teton County. The results are reported for anglers in Table E-3 and for non-fishing visitors in Table E-4. Both types of recreation activities provide a substantial amount of employment and income to the two economies. Currently we estimate 1460 total jobs and $46.43 million in income are generated.

Breaking this down by river segment and to jobs per 1000 anglers, results in 5.4 jobs per 1000 anglers on the Henry's Fork, 5.0 jobs per 1,000 anglers on the South Fork and 3.6 jobs per 1000 anglers in southwest Wyoming.

If conditions improved such that anglers could catch twice as many fish or fish that were 25% larger, the increased angler trips and spending would support a total of 2,442 jobs

and provide $77 million in total income. The income and jobs multipliers in Southeast Idaho average 1.6, meaning that each initial dollar of income or each direct job creates another .6 jobs indirectly through spending and re-spending of money in the local economy. Of course these effects work in reverse for deterioration in fishing conditions, which have not only direct reductions in tourism jobs, but also these multiplier reductions throughout the local economy.

Table E-3 Current and Potential Jobs and Income Related to Fishing on the Snake River in Southeast Idaho and Southwest Wyoming based on May –September sampling.

River	Current Jobs	Current Income	Twice Catch Jobs	Twice Catch Income	25% Larger Fish-Jobs	25% Larger Fish-Income
Henry's Fork	851	$29 million	1435	$49 million	1438	$49 million
South Fork	341	$12. million	544	$19 million	540	$19 million
SW Wyoming	268	$ 5.5 million	463	$9.5 million	474	$9.7 million
Totals	**1460**	**$46 million**	**2442**	**$77.5 million**	**2452**	**$78 million**

Using angler day estimates calculated from IDFG's 2003 survey, would substantially increase the jobs and income related to the Henry's Fork and somewhat lower the job and income related to the South Fork.

Of the South Fork anglers, those targeting Yellowstone cutthroat trout supported 273 of the 341 total jobs, and $9.6 of the $12 million in income produced by South Fork anglers. In Wyoming, 240 of the 268 jobs and $4.9 million of the $5.5 million in income is related to anglers targeting Yellowstone cutthroat trout.

Jobs from non-fishing recreation such as boating and general recreation is given in Table E-4

Table E-4. Current Jobs and Income Related to Boating and General Recreation on the Snake River in Southeast Idaho and Southwest Wyoming.

River	Current Jobs	Current Income
Henry's Fork/ So. Fork	22	$796,208
SW Wyoming	538	$10.9 million
Totals	**560**	**$11.7 million**

Net Economic Value of Fishing, Rafting and Other River Recreation

While visitor expenditures become income to outfitters, hotel owners, workers and ultimately the community, these expenditures are costs to the visitor not benefits or value to the visitors. Economists define value as the monetary benefits that remain after the expenses are paid. For example, if a visitor would pay $100 for a day of fishing, and paid $60 in travel costs, the angler would have $40 of benefits remaining. This is called consumer surplus, as it is surplus value received or retained by the visitor. This consumer surplus is also referred to as the visitor's net willingness to pay, or willingness to pay in excess to or in addition to the costs incurred to visit the site. When economists and federal agencies conduct benefit-cost analysis, benefits are measured as consumer surplus or net willingness to pay. Economists use consumer surplus as a measure of the benefits to anglers and other visitors. For example, in this study the consumer surplus could represent the money available to pay for fisheries improvements. Expenditures, on the other hand, is money already spent to pay for costs such as gasoline and hotels which is therefore not available to pay for fisheries improvements.

Table E-5 presents the net economic value of fishing to the anglers themselves. Table E-5 values are derived using the Contingent Valuation Method (CVM) since it applies to all types of angler's trips including single destination, multiple destination and incidental trips where fishing took place. Anglers were asked whether they would pay **higher** trip costs (the amount of the increase varied across the sample of anglers). Analyzing the responses using logistic regression the net willingness to pay over and above their current costs could be calculated. In total, the value of fishing on these three stretches of the Snake River is $39 million, with $15 million attributable to the Henry's Fork, $14.7 million from the South Fork, and $9.5 million from anglers in southwest Wyoming. The average value per day estimated for our rivers is above those in the reported literature. Overall, the typical angler would pay $85 more per trip to fish these rivers rather than not fish them or fish at substitute rivers. The net Willingness to Pay (WTP) as estimated using the Travel Cost Method (TCM) is reported in the main body of the report. Generally, the values from the TCM are lower, but in part this reflects the fact that TCM can only be applied to trips where fishing was the primary or equal purpose of the trip.

Table E-5 Net Willingness to Pay (WTP) for Fishing as Estimated by the Contingent Valuation Method (CVM) Using the May to September 2004 Sample

River Segment	Seasonal Angler Days	Average Net WTP per Angler Day	Seasonal Net WTP
Henry's Fork Total	168,656	$89.84	$15,151,502
South Fork Total	196,199	$74.96	$14,706,957
SW Wyoming Total	95,563	$100.29	$9,583,634
Grand Total	460,418	$85.86	$39,442,092

The net WTP for fishing as estimated by CVM but using angler day estimates derived from IDFG for the Henry's Fork would increase the annual value to $22.9 million, but lower the South Fork to $9.2 million.

Additional Net Economic Value from Catching an Additional Fish: Using the contingent valuation willingness to pay question along with the natural variation in fish catch at the different river segments, a pooled logistic regression model was estimated that allowed for calculation of anglers' additional willingness to pay to catch an additional trout. For the Henry's Fork, the marginal or incremental value per fish caught is $12.56, while for the South Fork it is a value of $23.30 per trout. Pooling data on the number of cutthroat caught across the South Fork and WY2 and WY 4 and estimating a pooled logistic regression, yields a marginal or incremental value of $22.45 per cutthroat trout, very similar to what was previously obtained for the South Fork for trout overall.

The usefulness of this information for management purposes relates to comparing these incremental benefits to the cost of increasing the number of trout. For example, stream habitat improvement projects or maintaining instream flows at critical times to increase spawning or overwintering of trout may have significant costs. But if biologists can estimate the number of additional trout that would grow to catchable size and the number of times each adult trout is caught, then this product can be multiplied by $23.30 per adult fish to arrive at a rough estimate of the benefits of these efforts. In addition, developments that would adversely affect trout habitat and angler catch would have opportunity costs to anglers of $22-23 per trout no longer caught. These losses would need to be compared to the gains from the development to determine if the overall benefits to society from the development are worth the costs.

Net Economic Value of Yellowstone Cutthroat Trout Fishing

Table E-6 presents the net willingness to pay of anglers for cutthroat trout fishing on the South Fork and three stretches of the Snake River through Jackson Hole and Flat Creek (WY 4). As above, we relied upon the CVM estimates of net WTP for the South Fork (1-4) and for Flat Creek (WY 4). However, WY 2/3 values are calculated using the Travel Cost Method (TCM) because its greater statistical significance than the CVM for Wyoming segments 2/3. In total, cutthroat trout fishing has a net economic value to anglers of $20 million annually. The average net economic value per angler day is $83.64, quite similar to the overall South Fork/Snake River average. This is not too surprising as slightly more than half the angler days target YCT.

Table E-6. Net Economic Value of Cutthroat Trout Fishing

River Segment	Estimated Angler Days Targeting YCT	Value per Angler Day	Estimated Annual Value
South Fork 1	62,640	$104.03	$6,516,439
South Fork 2	82,618	$90.25	$7,456,275
South Fork34	13,267	$47.83	$634,561
WY2/3	73,895	$53.91	$3,983,558
WY4 (Flat Creek)	12,916	$149.29	$1,928,230
Total	**245,336**	**$83.64**	**$20,519,062**

Net Economic Value of Rafting and Other River Recreation

Table E-7 below presents estimates of the net willingness to pay per day for rafting and other river recreation on the Henry's Fork, South Fork and the three stretches of the Snake River in southwest Wyoming. The net economic value of rafting and other river recreation is substantial, providing more than a half million dollars in benefits along the Henry's Fork, nearly $1.5 million along the South Fork, and $16.2 million annually along the Snake River through Jackson Hole and in the Canyon reach of the Snake River in Wyoming.

Table E-7. Net Economic Value of Rafting and Other River Recreation

	Total Other Visitor Days	CVM Value per Day	Total Season Value
Henry's Fork	9,123	$64.29	$586,518
South Fork	10,976	$134.79	$1,479,455
Wyoming	125,504	$128.90	$16,177,278
Total	**145,603**		**$18,243,251**

Comparing Recreation Values to Other Economic Uses of the Snake River

The net willingness to pay of the local visitors and non-local visitors who fish, boat and participate in other river based recreation along the Snake River represents a net economic benefit totaling $57.6 million each year. These recreation values are can be compared to the net economic value (total revenue minus total costs) of the irrigated agriculture using procedures specified by the U.S. Water Resources Council and used by agencies such as the U.S. Bureau of Reclamation. Specifically, the net WTP of recreation is a National Economic Development (NED) benefit that is in the same category of benefits as net farm income or value of hydropower. Thus these net WTP values of recreation can be compared dollar per dollar with dollars of net farm income and hydropower.

Total Economic Effects of River Recreation Along the Snake River and Its Tributaries.

In terms of net economic value to the visitors, combining the $39.4 million of fishing recreation with the $18.2 million of other river recreation yields an annual economic value to anglers and other visitors of $57.6 million annually.

In terms of employment in Southeastern Idaho 1,137 jobs are supported by anglers and boaters. In southwest Wyoming more than 800 jobs are supported by angler and boater expenditures. Combining fishing recreation of jobs with the other river recreation jobs a total of 1,937 direct and indirect jobs in the two state regional area is supported by fishing, boating and other river related recreation.

Figures 1 and 2 presents two different ways of viewing the bottom line of this study. Figure 1 shows the amount that each recreation activity that contributes to the total $52.7 million in income in Southeast Idaho and Southwest Wyoming (the sum of $29 million income from HF angler spending, $12 million income from SF angler spending, $5.5 million income from SW Wyoming angler spending, and $5.5 million income from boater spending in SW Wyoming and $.7 million from boater spending on the South Fork). This figure also shows the distribution of the nearly $58 million in participant recreation benefits or consumer surplus (e.g., $15 million in angler benefits on the HF, $14.7 million angler benefits on the SF, $9.5 million angler benefits in SW Wyoming, $16.2 million in boater benefits in SW Wyoming and $2 million in boater benefits on the SF). These recreation benefits are received by visitors Southeast Idaho and Southwest Wyoming as well as visitors from outside the region.

Figure 2 presents an alternative way to view the total economic contribution that each recreation activity provides to businesses and employees in the region (community/county income) and recreation benefits provided to residents of the region and visitors from outside the region. The total economic effect is the height of the column. The expenditures of non local visitors translates into community income via the input-output model and multiplier effects. The benefits to the visitor or participant in excess of their expenditures is the consumer surplus or willingness to pay in addition to their expenditures.

Figure 1. Southeast Idaho (Bingham, Bonneville, Freemont, Jefferson, Madison and Teton) and Southwest Wyoming (Teton) County Income and Participants Recreation Benefits generated from River Based Recreation in Southeast Idaho and Southwest Wyoming.

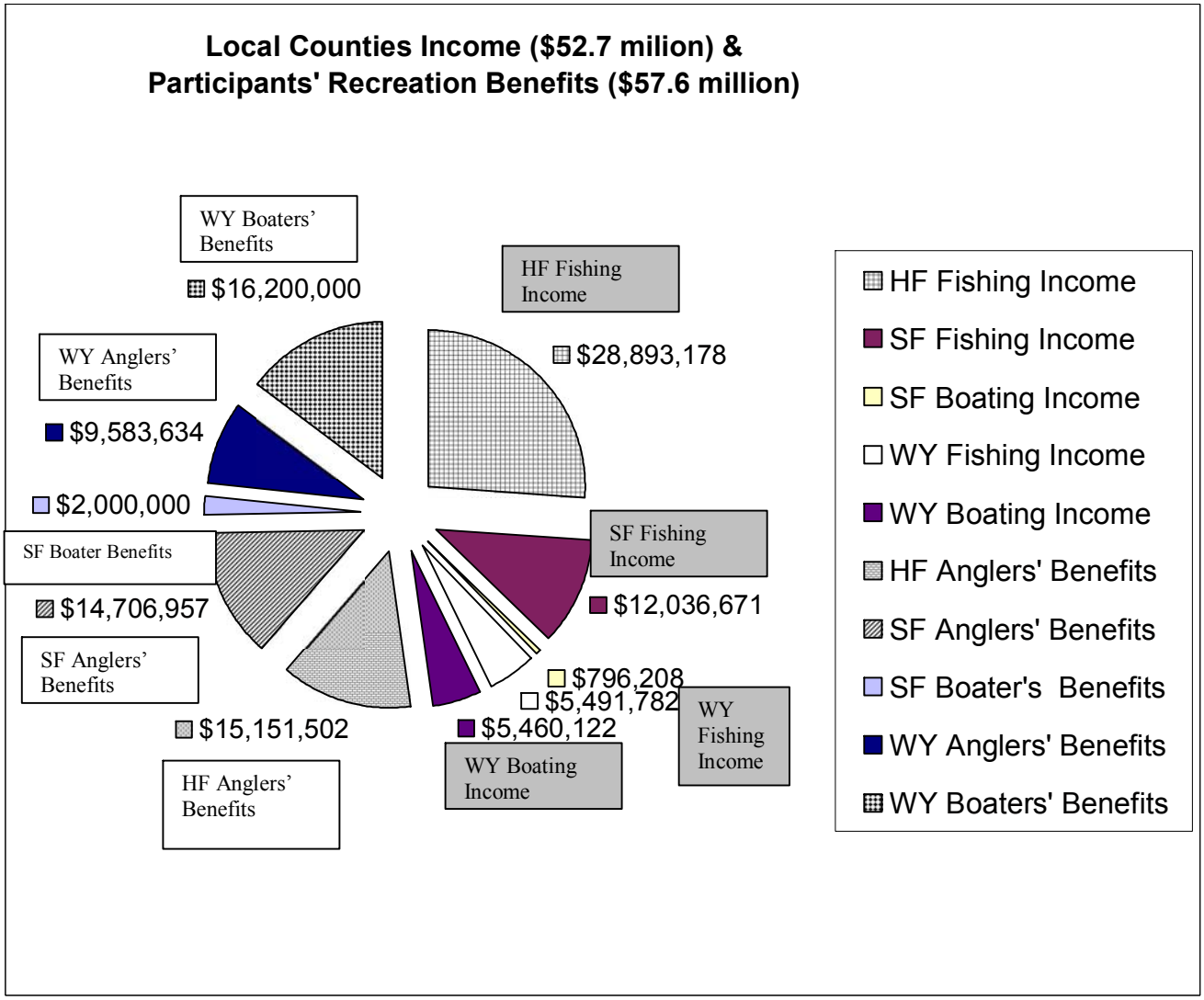
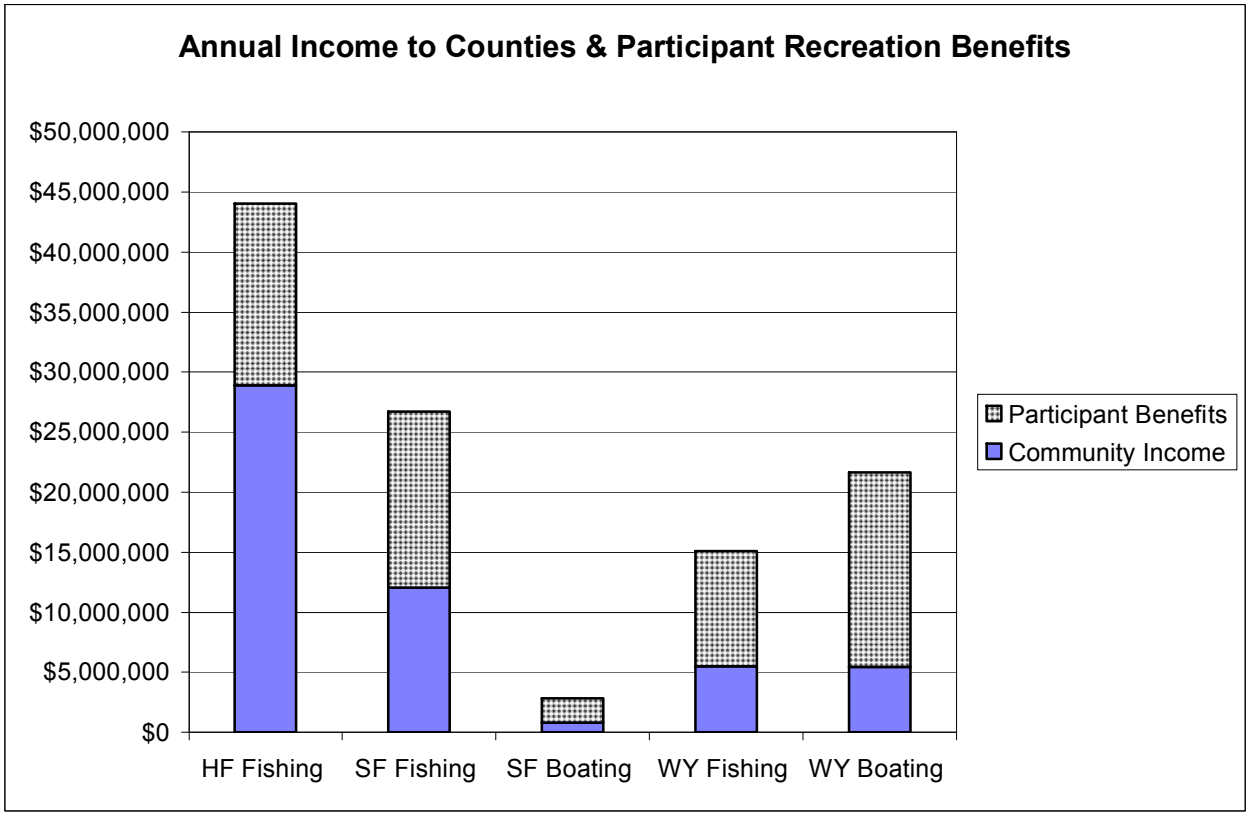


Figure 2. Total Economic Contribution of River Based Recreation Activities to Southeast Idaho (Bingham, Bonneville, Freemont, Jefferson, Madison and Teton) and Southwest Wyoming (Teton)



These substantial economic benefits and community income are dependent on maintaining the physical habitat and other components of fisheries habitat such as water quality. Incompatible land uses, decreases in water flows at critical times and deterioration in water quality can put these substantial economic values at risk. Attention to these issues by private landowners, county and state officials as well as federal water and land management personnel is critical to protect the fishery and recreational resources of the Snake River. If properly managed, the river and its fisheries are a renewable resource that can continue to provide these benefits for decades to come. With increased attention and cooperation among landowners, county and state officials and federal land management personnel, these economic benefits can be increased.

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Chapter 1
Introduction and Study Purposes

1.1 Overview of Study Objectives

This study was undertaken to provide local, state and federal resource managers and public officials information on the economic effects of fishing and boating along the South Fork of the Snake River and the Henry's Fork with current and improved water resource management. The economic effects are made of two components. First is the **local economic activity** supported by angler and boater expenditures. These expenditures translate into jobs in southeast Idaho and Teton County, Wyoming. The second economic effect is the **net economic value** these rivers and fisheries resources provide to the visitors themselves. Specifically, the visitors receive a "consumer surplus" or value in excess of their actual expenditures from the opportunity to fish and/or boat on the Snake River. This valuation information provides an indication of recreation benefits to all river users, whether local or non-local or out of state users. Net economic value is considered by federal agencies, such as the Bureau of Reclamation, as net benefits when the agency performs benefit-cost analyses of water projects, hydropower or other natural resource decisions. Another important objective is to estimate how visitation, economic activity and net economic value would change with improved catch of native/wild trout (e.g., number of fish and size of wild/native fish).

The geographic scope of this study is to estimate the current net economic value and economic activity from river recreation along distinct reaches of the upper Snake River from its headwaters in Jackson Hole to the confluence with the Henry's Fork, from Henry's Lake to its confluence with the South Fork of the Snake River. We also evaluated Flat Creek, a tributary of the Snake River in Jackson Hole, Wyoming.

1.2. Need for the Study

Balanced natural resource management, whether multiple use (e.g., U.S. Forest Service, Bureau of Land Management) or multiple purpose (e.g., Bureau of Reclamation, Federal Energy Regulatory Commission) requires information on the benefits and costs of alternative actions. Typically market prices for irrigated agricultural outputs and hydroelectricity have resulted in these commodities appearing to be the highest valued use of water. However, there has been growing recognition that recreation provides economic benefits to participants themselves. Since 1983 these non-market recreation benefits are supposed to be included in federal agency benefit-cost analyses (U.S. Water Resources Council, 1983). However, because they are largely non-marketed it is difficult to directly observe such values. Nonetheless, accepted methodologies are available and were used to estimate these values in Idaho nearly 20 years ago (Sorg, et al. 1986). But keeping these values current with market values of commodities requires periodic surveys and analyses of recreational fishing benefits. The last survey to include net economic values for portions of the Snake River was in 1991 (Pratt, 1992) and 1996 for the Henry's Fork (Nowell and Kerkvliet, 2000). It is believed that use and economic benefits may have substantially increased since these studies, but new valuation data is needed to quantify this. In the last couple of decades, some anglers and fishery managers have shifted their primary focus from catchable trout to "wild" (that is, self sustaining) trout, and to native trout such as the Yellowstone cutthroat trout (YCT). To date, there

has been little research that attempts to estimate separate values for fishing for wild/native trout in general and YCT trout in particular. This present study includes survey questions asking about species targeted to allow separate valuation and economic impact analyses on YCT anglers.

Recreational angler spending also provides positive economic effects to local communities that supply the hotels, restaurants, and sporting goods used by visitors. These sales support direct local jobs, and through the multiplier effects, support jobs in a variety of other sectors of the local economy. It is important to quantify the local income and jobs provided by fishing to debunk the false dichotomy of "jobs versus the environment" when it comes to protecting the natural resources that our healthy recreational fisheries depend upon. A healthy ecosystem can support a healthy economy.

This information is critically important to wise natural resource management in the upper Snake River. This river passes through a region where recreation is becoming a major industry, rivaling, and in some cases, surpassing traditional industries of the region. While this is quite obvious in Jackson Hole, we believe it is likely to be quietly occurring in communities throughout the upper Snake River. The high quality recreational trout fisheries, including opportunities to catch native cutthroat trout, aids in retaining existing residents in the region, and attracts new residents to the region. In essence the clear, coldwater of the upper Snake River and its scenic environment is the natural capital of the region.

To maintain this natural capital in perpetuity requires objective information on the return that capital provides to the residents of the region in the form of their own recreational fishing benefits, and the return to the businesses of the region. This study quantifies the net economic values to anglers, and the positive economic effects to local communities from the trout fisheries along the upper Snake River. This information will be useful to county, state and federal agencies that each year make numerous natural resource decisions affecting the upper Snake River. It is our hope that the information provided in this study will assist those decision-making processes, and in doing so promote the recognition of the value and compatibility of the non-market natural capital inherent in the upper Snake River as well as traditional water uses such as irrigated agriculture, hydropower generation and flood control. The information on the economic value of instream flows needed to maintain or enhance wild/native fisheries may identify potential opportunities for dry year water leasing.

Chris Jansen Lute of the Bureau of Reclamation has indicated that developing information on the economic value and local economic effects of the Snake River would be a useful complement to their Ecologically Based System Management Project on the Snake River. Their joint research project with University of Montana is being undertaken "...to determine the hydrologic regimes necessary to maintain a properly function ecosystem for the long-term aquatic resources…." (Lute, 2003a). In November 2003, the Bureau did an evaluation of the existing regional economic information for the Snake River and found it incomplete. In particular, nearly all the existing recreation surveys did not collect the necessary data to estimate regional economic effects, and the one survey

that collected this data did so on only a small part of the river (Lute, 2003b). The Bureau of Reclamation is very interested in a comprehensive survey effort that would provide economic information.

Discussions with Monica Zimmerman of Bureau of Land Management (BLM) in the Idaho Falls Field Office indicated that BLM has interest in having economic information for updating their ten year old joint BLM and U.S. Forest Service 1991 Snake River Activity Operations Plan. This plan is what the two agencies use for managing recreation use along a major portion of the Snake River in our study area.

Chapter 2
Details of Study Methodology

2.1 Geographic Area of Study

The study area starts at the headwaters of the Snake River in Jackson Hole, Wyoming and goes to the confluence of the Henry's Fork of the Snake River, and includes the Henry's Fork. There are three main study sections: (a) 75 miles of the Snake River from in Grand Teton National Park to top of Palisade Reservoir; (b) 66 miles of the South Fork from below Palisade Dam to the confluence of the Henry's Fork; (c) the 117 miles of the Henry's Fork. While the river could be broken down into numerous segments, there is a trade-off between specificity of segments and accuracy of estimates for each segment. Discussions with Trout Unlimited, Henry's Fork Foundation, U.S. Bureau of Reclamation, Idaho Department of Fish and Game, and Bureau of Land Management suggested that 11 river segments might strike a good balance between geographic specificity for natural resource and water management decisions, and adequate sample size for modeling purposes. The river segments studied were:

- Wyoming 1 Jackson Lake to Southern Boundary of Grand Teton National Park
- Wyoming 2 (WY 2) Southern Boundary of Grand Teton National Park to Wilson Bridge and South Park Bridge in Jackson Hole, Wyoming
- Wyoming 3 (WY 3) South Park Bridge to Alpine Junction (Palisades Reservoir inlet)
- Wyoming 4 (WY 4) Flat Creek, Wyoming
- Henry's Lake (HF 1) Boat launch and hatchery
- Henry's Fork (HF 2) Headwaters of the Henry's Fork to Riverside Campground (Mack's Inn, the Box Canyon takeout, North Harriman State Park)
- Henry's Fork (HF 3) from Riverside Campground to Ashton Dam
- Henry's Fork (HF 4) from Ashton Dam to confluence with So. Fork Snake River-Menan (Ora Bridge, Vernon Bridge, Seeley's, Chester Dam, Fun Farm).
- South Fork 1 (SF 1): Palisades Dam to Conant
- South Fork 2: (SF 2): Conant Boat Ramp to Byington Boat Ramp
- South Fork 3: (SF 3) Byington Boat Ramp to Lorenzo Bridge.
- South Fork 4: (SF 4) Lorenzo Bridge to confluence with Henry's Fork at Menan

Discussions with Jim Fredricks of Idaho Fish and Game indicate that there is general consistency between our larger river segments and Idaho Fish and Game's sections.

2.2 Economic Methods for Estimating Net Economic Value to Visitors

The U.S. Water Resources Council (1983) recommends the Travel Cost Method (TCM) and Contingent Valuation Method (CVM) as two approved methods for estimating the net economic value of recreation to visitors. TCM involves using variation in visitors' travel costs as prices, and the number of trips taken as quantities to trace out a demand curve for recreation at a particular river segment. From the demand curve, the amount the visitor would pay in addition to or over and above their travel cost can be calculated. This amount is the angler's net willingness to pay or consumer surplus (Loomis and Walsh, 1997). This is

considered the national economic efficiency value of the resource to society. The value is conceptually comparable to profits of farmers, developers, etc.

Travel Cost Method (TCM)
The specific type of TCM to be adopted in this study is an individual observation count data model. This type of multiple regression model is appropriate given the integer nature of the number of trips taken. The basic model specification is:
Q (individual annual trips) = Bo+B1(travel cost) +B2(income) +B3(river segment catch) +B4(Substitutes)

Where the B's represent slope coefficients to be estimated with multiple regression.

A Poisson count data models employs an exponential form of the quantity of trips (λ) for the demand function such as:

(2) $\lambda = exp\ (P, Z;B)$:

where: λ; the mean of Quantity of annual trips taken by an angler
P; travel cost variable
Z; the demand shift variables such as fish catch and availability of substitute recreation areas.
B is a vector of slope coefficients relating the independent variables to the dependent variable (annual trips).

It is well established in the literature that a TCM demand model account for travel time (Cesario, 1976; McConnell and Strand, 1981; Englin and Shonkwiler, 1995a). One approach to account for travel time is to include travel time as a separate variable in the TCM demand equation (McConnell and Strand, 1981). However, due to the high correlation between travel cost, travel distance and travel time, it is difficult to include travel time as a separate variable when using either travel cost or travel distance in the demand function. A longstanding parallel approach to including travel time is to use a fraction of the wage rate as a shadow price on travel time and combine it with travel cost as the price variable (Cesario, 1976; McConnell and Strand, 1981; Englin and Shonkwiler, 1995a). This is also the approach recommended by the U.S. Water Resources Council (1979; 1983) in its guidelines for federal agency use of the TCM. Following Cesario's recommendation, those of U.S. Water Resources Council and the recent evidence of Englin and Shonkwiler (1995a), we use one-third the visitor's wage rate as the value of travel time. This was calculated from our sample using reported income, number of persons in the household that work, and assuming 2000 working hours per year.

We utilize survey questions to distinguish visitors by whether fishing was their primary activity or not. Specifically, we asked if their trip to the river was the primary or sole destination (trip purpose coded as #1) or one of many equally important reasons for their trip from home (trip purpose #2). These are included in the travel cost model, while visitors indicating this trip was just an incidental stop on a trip taken for other purposes or to other destinations, cannot be directly included. As noted below in the report, the vast majority of visitors were on primary or sole destination visits, with a few on trip purpose

#2. Only a couple of visitors sampled at each site reported that the Henry's Fork or South Fork in Idaho were an incidental stop. So this bodes well for our TCM model for these two river drainages. In contrast, the Snake River through Jackson Hole (Wyoming segments 2 and 3) had many more visitors on trip purposes #2 and #3 due to the proximity of Jackson Hole and the many attractions there.

Because the sample was conducted on-site there may be a concern with over-representing more frequent visitors. This is known as endogenous stratification (Englin and Shonkwiler, 1995b). This was corrected for in the count data TCM using the procedure of Englin and Shonkwiler (1995b), which has been shown to yield WTP or consumer surplus estimates not significantly different than a population survey (Loomis, 2003).

Contingent Valuation Method (CVM)
CVM involves constructing a simulated market to directly elicit the additional amount the visitor would pay so as to be able to visit this area of the river, rather than some other river. The payment approach was an increase in trip costs, as this has worked very well in our past studies and avoids implying the study is to increase user fees. A dichotomous choice question format that makes the CVM question more market like (e.g., would you pay an increase in trip costs of $X, where the level of $X varies across the sample) is used. The dichotomous choice question format is commonly used in CVM studies (Loomis and Walsh, 1997). The data is analyzed using a logistic regression model.

2.3. Economic Methods for Estimating Local Economic Effects to Communities
In order to estimate the local (e.g., county) income and employment generated by fishing and rafting expenditures, questions asking about visitor expenditures were asked in the survey. Expenditures were broken down into types of spending such as food and beverage, lodging, transportation, angling equipment, shuttles etc., as these economic sectors generate different number of jobs per dollar of spending and have different multipliers. Because anglers outside the region purchase items used during the trip in their home locale distinguishing between expenditures made in our Snake River study region versus outside the region allows for a more accurate analysis of local economic impacts. In addition to expenditure data the survey asks pertinent information such as length of the trip and number of persons in the group or party to standardize the expenditure data for use in the regional economic model.

The regional economic model that calculates the direct, indirect and total job effects builds upon models previously developed for the southeast Idaho counties by Dr. Robinson at University of Idaho. These models were updated by Don Reading with the assistance of Dr. Robinson.

The IMPLAN (Minnesota Implan Group, 1997) model for calculating impacts was used for Teton County, Wyoming. IMPLAN is a widely used input-output model originally developed by the U.S. Forest Service, and now used nationwide. We have previously developed an IMPLAN model for Teton County Wyoming and Idaho that was used by the National Park Service and U.S. Fish and Wildlife Service to evaluate regional

economic effects of changes in recreation use at Grand Teton National Park (Loomis and Caughlan, 2004).

2.4. Contingent Visitation to Estimate Change in Use, Benefits and Economic Effects with Changes in Fishing Quality.

Beyond incorporating fish catch into the CVM and TCM models, anglers were asked how the number of trips they take would change with improved fishing quality (e.g., twice their daily catch rates and a 25% increase in the current size of fish caught). By linking these changes in visitation responses to the average consumer surplus or WTP from the CVM and TCM models we can estimate the increase in economic benefits of recreational fishing with an improved fishery and fishing quality. By linking the change in trip response to the regional economic model, we can estimate the increase in local economic effects such as income and jobs that would occur if fishing quality were improved affected. These relationships between changes in trips and fishing quality may be useful to estimate the change in jobs and county income from avoiding degradation of watershed health that could, in turn, reduce economic benefits to anglers and surrounding communities. This method has proven useful for evaluating how possible changes in visitor use in response to changes in elk and bison management in Grand Teton National Park and the National Elk Refuge might affect the Teton County, Wyoming's economy (Loomis and Caughlan, 2004).

2.5. Data Collection

2.5.1. Visitor Intercept and Mail-back Survey

As in several past recreation surveys (Loomis, 2004; Richardson and Loomis, 2004) we have used a procedure that has resulted in survey response rates of 65% to 70%. This procedure is to hand the individual a mail back survey packet with a postage paid return envelope, and obtain their name/address for follow up mailings. We then sent a reminder post-card and, if necessary, a complete mailing of the survey with a new cover letter and postage paid return envelope to non-respondents. Our target sample would be individuals of driving age or older, so they can make their own trip decisions. People who were previously surveyed are not given another survey.

In Richardson and Loomis (2004) we had success training college students to make the initial contact and hand out the surveys. With sufficient training and monitoring they did a good job. We used the same approach here. We dressed interviewers in polo shirts and hats of the local university(Idaho State University), and had them wear name tags to identify themselves.

2.5.2. Sample Design: Sample Sizes and Duration of Sampling

To allow for the potential to estimate separate recreation demand and benefit estimates for each of the 11 river segments, we budgeted to sample nine days at each river segment. Since we believe that relatively more use occurs on the weekends we scheduled four weekdays and five weekend days of sampling for each of the rivers. The nine days were spread from May to mid September, but the distribution of days within the months depended on the seasonality of the use of the river segment. For two of the sections of the Henry’s Fork that were open for fishing when we started the survey, we start sampling

mid-May and continue through early July and then again from Labor Day until the end of September. For other early season river segments we sampled three days each in June, July, and August, while for other late season rivers we may concentrate the nine days of sampling in July, August and early September. Trout Unlimited (TU) and the Henry's Fork Foundation (HFF) helped to identify which time frames should be sampled for each river segment to yield the most representative sample.

In terms of total sampling days, the 11 river segments and nine days of sampling, yields 99 sampling days. We hired five interviewers who were assisted by a HFF intern for interviews and a TU intern for angler counts. To enhance staffing flexibility, all the interviewers were trained to handle all the different river segment areas. The overall goal of 99 sampling days was achieved, but due to weather and scheduling problems, Henry's Lake was undersampled late in the season (September). However, with the assistance of a Henry's Fork Foundation intern, we were able to add extra sampling days at Henry's Fork river segment 2, so the overall total target of 99 days was obtained.

In order to have an accurate count of visitors, interviewers kept daily records of number of cars in the parking lot when they arrived and when they left. Specifically, for each sampling day, a log was kept that recorded number of cars and any refusals that day. To enhance the accuracy of the visitor counts, a TU intern also counted the number of anglers on the river on several of the same days Idaho State University students were sampling so as to provide an estimate of anglers per vehicle.

2.5.3. Survey Design

The survey was intially drafted based on past successful Idaho fishing surveys including Sorg, et al. (1986) and South Fork Snake River Trout Economic Survey of Dr. Reading. Following Dillman's Tailored Design Method (2001), we developed an eight page booklet survey. Our goal was be to keep it short, with just 5 pages of questions (the first page was a coverpage, one page was a drawing and the backcover was blank; see Appendix A for a copy of the survey). The key questions included annual number of trips, primary purpose of trips, recreation activities participated in, fish species targeted (Yellowstone cutthroat trout, rainbows, brown trout, brook trout, etc.), primary mode of fishing, detailed trip expenditure profile, geographic regions of those expenditures, travel time, on-site time, contingent valuation and contingent visitation questions, and demographics (including residence zip code). The draft survey was circulated to the partners/collaborators to obtain their input during a meeting in Idaho Falls in April and subsequently via email. The questionnaire was also reviewed by the interviewers, several of whom regularly fished the area's rivers, to ensure it was comprehensible.

Interviewers were trained on two separate trips to ensure familiarity with the survey purpose, the procedures for intercepting visitors (as they returned to their vehicles), visitor intercept locations at each site, recording of refusals, etc. The first training trip occurred in April for the Henry's Fork and the second in May for the South Fork and Wyoming Rivers.

All interviewers wore Idaho State University shirts and hats, along with name tags. Individuals were given surveys, and their name and address recorded for mailing a reminder postcard one week later, and follow up survey if they did not return the original survey within four weeks.

Chapter 3
Results of Survey Sampling, Visitor Use Estimates, and Descriptive Statistics of Anglers and Boaters

Chapter Highlights:

- **1,272 surveys were handed out over 99 sampling days from May through September 2004.**
- **A 64% survey response rate was achieved.**
- **A total of 460,000 angler days were reported.**
- **245,000 of the total angler days targeted Yellowstone Cutthroat Trout.**
- **A total of nearly 150,000 visitor days of river recreation by non-anglers.**
- **This chapter also reports information on characteristics of trips, and composition of angler catch.**

3.1 Results of Survey Sampling

Table 1 provides the completed number of sampling days per site. There were three extra days sampled at Henry's Fork 2 due to efforts by an HFF volunteer. At seven other sites the target of nine sampling days was achieved, but we were under by 1-2 days at two sites due to a combination of bad weather and missed interviews at the end of the season in mid September which could not be made up. Due to the very wet and cold spring, there were fewer visitors than expected and hence the number of surveys handed out was less than we had hoped for at South Fork 3 and 4. Thus for the cutthroat trout and some other analysis the two river segments are combined.

Table 1. Number of Days Sampled and Surveys Handed Out

SITE	# Days Sampled	# Surveys Handed Out
Henry's Lake 1	7	82
Henry's Fork 2	12	182
Henry's Fork 3	9	106
Henry's Fork 4	9	76
South Fork 1	9	86
South Fork 2	8	94
South Fork 3	9	47
South Fork 4	9	41
Wyoming 2	9	157
Wyoming 3	9	285
Wyoming 4	9	116
TOTALS	**99**	**1,272**

Typically interviewers sampled seven hours a day beginning at 11am and lasting until 6pm. They would count the number of cars remaining in the parking lot when they left, and the estimated numbers of anglers/boaters in these cars are incorporated into our use estimates.

A total of 1330 contacts were made on-site by the interviewers. A total 1272 surveys were handed out, with 58 people refusing to take a survey. This represents less than a 5% refusal rate on site. Of the 1272 surveys handed out, 34 turned out undeliverable when follow up mailings were performed, and thus follow up contacts via reminder postcards and second surveys could not be delivered. In total we received back 787 surveys as of October 18, 2004. The overall response rate is 63.6% out of deliverable surveys as of October 18, 2004. This is a reasonably good response rate, given the length of the survey and the fact that many people given the survey were on vacation. It is comparable to similar survey response rates of 65% obtained by Loomis (2001) on the Snake River through Jackson Hole using a similar procedure. With over 700 surveys returned the margin of error on most responses is plus or minus 3.5% to 3.8% (Babbie, 1992).

3.2 Procedures for Estimating Season Use

To estimate daily visitor use at the sampled sites, the following approach was used. First the number of cards handed out plus the number of people on site that refused to accept a survey were added together, and that sum was then expanded by the on-site sample fraction (which was usually one, but at the commercial river rafting take out sites along Wyoming 2 and 3, it was 10%). Then the number of vehicles at the sampling point when the interviewer left was added to this sum, as these were anglers or boaters that had not returned by the time we were done sampling (usually at 6 or 7pm). Then this total was multiplied by the number of visitors per car. For most sites this number came from the survey responses, with the median being 2 persons per car. However for some South Fork sites such as South Fork 1, 2, 3, and also Wyoming 2, we had site specific estimates on several days of the number of anglers/boaters on the river and the number of vehicles in the parking lot provided by a TU intern at the site. We used these estimates to calculate the number of anglers per vehicle at the site on these days. These estimates ranged from a low of 1.29 to a high of 2.89 per vehicle. However, the on-site estimates were frequently either equal to the survey median of 2 per vehicle or quite close (e.g., 1.5 or 1.8).

The expansion from the sampled use estimate to the seasonal use estimate was performed by matching weekend and weekdays not sampled with the closest corresponding weekday or weekend sampled at that site.

To arrive at annual use we multiplied the estimated number of visitors at each site by the survey sample average annual trips per visitor to each site and the survey average number of days per trip at each site. There is no double counting of visitors with this approach, as each person was only given one survey during the season. If someone had already been sampled we did not give him or her another survey. As a double check we could compare names/addresses of people already sent surveys. No duplicate surveys were found. Table 2 provides total seasonal use by anglers and other visitors (non angling boaters, picnickers, campers, etc.) using the survey proportions of anglers and other visitors.

Table 2 indicates about 178,000 visitor days at the four sections of the Henry's Fork, with about 80-90% being anglers. At the four sections of the South Fork there are over

200,000 visitor days, with 65%-95% being anglers depending on the river segment. There are an estimated 221,000 visitor days along the Snake River in southwest Wyoming, with an even split of anglers and rafters on WY 2, 85% rafters on WY 3 and 90% anglers on WY 4 (Flat Creek).

Table 2.
Total Season Use Estimates for Anglers and Other River Visitors for May-September 2004

	Total Season Visitors	% Anglers	Annual Days Per Angler	Total Angler Days	% Other Visitor	Annual Days Per Visitor	Total Other Visitor Days	Total Visitor Days
Henry's Fork								
HF1 (Lake)	4,244	92.5%	10.42	40,922	7.5%	1.8	570	41,492
HF2	4,790	85.6%	19.25	78,916	14.4%	2.96	2,044	80,960
HF3	3,134	81.4%	8.51	21,698	18.6%	4.59	2,682	24,380
HF4	4,822	89.1%	6.31	27,120	10.9%	8.39	4,397	31,517
Total	16,990			168,656				178,349
South Fork								
SF1	5,552	78.4%	18.50	80,565	21.6%	2.09	5,555	86,120
SF2	4,482	91.7%	22.32	91,724	8.3%	8.6	3,212	94,936
SF3	2,449	94.1%	9.33	21,504	5.9%	9	1,296	22,801
SF4	1,162	64.3%	3.22	2,405	35.7%	2.2	913	3,318
Total	13,645			196,198				207,175
Wyoming								
WY2	20,129	45.8%	6	55,354	54.2%	2.769	30,190	85,544
WY3	38,850	15.1%	4.35	25,532	84.9%	2.89	95,314	120,846
WY4	2,194	90.8%	7.37	14,677	9.2%	1.33	269	14,947
Total	61,173			95,563				221,337
Total for All Sampled Sites				**460,418**			**146,443**	**606,861**

These estimates are somewhat lower than those of the Idaho Department of Fish and Game (IDFG) for 2003 for the Henry's Fork. Using IDFG estimates of trips and our estimate of days per trip, IDFG estimate would be 255,423 angler days for Henry's Lake and the Henry's Fork versus ours of 168,656 angler days. Most of the difference with our estimate relates to Henry's Lake, where our estimate is 40,922 angler days, but IDFG's estimate is more than double this at 106,449. However, with regard to the South Fork, our estimate of 196,199 angler days is substantially higher than the equivalent angler days from IDFG of 123,278. Summing our estimate of the Henry's Fork and South Fork yields 364,855 angler days while IDFG is estimated at 378,701, quite similar overall. Some of the differences in estimates may be due to differences in weather in 2003 and 2004. Spring of 2004, especially around Memorial Day was quite wet and cold. In addition, the sampling protocols have slight differences. Nonetheless, overall the two estimates are within the sampling variability one might expect.

3.3 Survey Responses on How Angler Trips Would Change with Improved Fishing Conditions

Table 3 presents how angler trips would change to the river segment with an improvement in fishing quality. Two questions were asked: How would angler trips change with (a) a doubling of the daily catch rate of their targeted species; (b) if fish size were 25% larger. Anglers indicated they would substantially increase their days fishing if catch per day were to double or fish size increase by 25%. As can be seen in the table, either change results in a similar increase. However, biologically, only an increase in catch rates or larger fish is possible, usually not both in the long run. These responses do not reflect the entry of new anglers to visiting these sites if fishing quality would increase, an effect that is likely (Ribaudo and Epp, 1984). Nonetheless, the 64.5% increase in angler days with a 100% increase in catch (i.e., doubling of catch) is a less than proportional response, and the elasticity of .645 is in the general magnitude of what has been found in terms of actual angler response to higher trout catch rates (typically around .43 to .456; see Cooper and Loomis, 1990; Loomis and Fix, 1998). The elasticity of .645 is only slightly higher than the average of .455 as estimated by the TCM (discussed below). The angler response to a 25% increase in fish size yields a similar elasticity at .663.

These changes in angler use with changes in catch rate and fish size can also be used to calculate effects of reductions in fish catch and fish size on angler use.

Table 3. Comparison of Angler Days with Current and Improved Fishing Quality.

	Existing Fishing Conditions		**Twice Daily Catch**			**25% Increase Fish Size**	
	Annual Days Per Angler	Total Angler Days	Annual Days Per Angler	Total Angler Days	Catch Elasticity	Annual Days Per Angler	Total Angler Days
Henry's Fork							
HF1 (Lake)	10.42	40,922	18.49	72,615	0.77%	19.86	77,996
HF2	19.25	78,916	32.25	132,210	0.68%	29.89	122,536
HF3	8.51	21,698	13.47	34,344	0.58%	14.28	36,410
HF4	6.31	27,120	10.54	45,300	0.67%	11.18	48,050
South Fork							
SF1	18.5	80,565	34.17	148,806	0.85%	32.07	139,661
SF2	22.327	91,724	29.92	122,918	0.34%	30.44	125,054
SF3	9.33	21,504	15.46	35,633	0.66%	17.13	39,482
SF4	3.22	2,405	7.375	5,509	1.29%	8.41	6,282
Wyoming							
WY2	6	55,354	11.1	102,405	0.85%	10.55	97,330
WY3	4.35	25,532	7.11	41,732	0.63%	8.83	51,827
WY4	7.37	14,677	7.91	15,753	0.07%	10.55	21,010
Total for Sampled Sites		460,418		757,224			765,638
Percent Change				64.5%			66.3%
Catch Elasticity of a 1% change				.645%			.663%

3.4 Yellowstone Cutthroat Trout Angler Use Estimates

Table 4 presents the percentage of visitors to the South Fork and Wyoming portions of the Snake River that said they were targeting Yellowstone cutthroat trout. Not surprisingly, on WY 4 (Flat Creek) it was nearly 90% (Yellowstone cutthroat trout are the only trout species present in Flat Creek), although it was 77% on South Fork 2. In total, an estimated 245,336 angler days were targeting Yellowstone cutthroat trout on these seven river segments.

Table 4 Percent and Number of Anglers Days Targeting Yellowstone Cutthroat Trout (YCT)

River Segment	**Percentage of Anglers Targeting YCT**	**Estimated Angler Days Targeting YCT**
South Fork 1	57%	62,640
South Fork 2	77%	82,618
South Fork 3	50%	12,171
South Fork 4	36%	1,096
Wyoming 2	27%	50,317
Wyoming 3	9%	23,578
Wyoming 4	88%	12,916
TOTAL		**245,336**

3.5 Survey Responses Regarding Activities and Travel Modes

3.5.1. Table 5 presents the responses of Henry's Fork Anglers and visitors regarding the percent participating in various activities and their travel modes to the Henry's Fork. On Henry's Lake (HF 1) and Henry's Fork 3, three-fourths of the anglers fished from a boat, while on the Henry's Fork through Harriman State Park, most anglers fished from shore or waded. Rafting and sightseeing were the most popular activities of HF 2 non-fishing visitors. The vast majority of Henry's Fork anglers traveled by car. Over all segments of the Henry's Fork, about equal numbers traveled by RV or plane. Most of the visitors traveled an average of 300-500 miles one- way to the Henry's Fork, except for HF 3 which appears to be used mostly by locals for boating.

Table 5 Descriptive Statistics Regarding Activities and Travel by Visitors to the Henry's Fork.

	HF1 Anglers	HF2 Anglers	HF2 Visitors	HF3 Anglers	HF3 Visitors	HF4 Anglers
Fish Shore/Wade	46.0%	95.8%	N/A	75.5%	N/A	85.7%
Fishing from Boat	76.2%	35.8%	N/A	71.4%	N/A	59.5%
Raft	6.3%	12.6%	81.3%	14.3%	16.7%	4.8%
Picnic	14.3%	17.9%	18.8%	22.4%	25.0%	19.0%
Camp	20.6%	25.3%	25.0%	16.3%	0.0%	14.3%
Hiking	7.9%	18.9%	43.8%	12.2%	0.0%	9.5%
Motorboat	22.2%	4.2%	0.0%	10.2%	75.0%	0.0%
Sightsee	27.0%	29.5%	56.3%	30.6%	8.3%	26.2%
Bike	4.8%	7.4%	12.5%	2.0%	0.0%	0.0%
Wildlife Viewing	20.6%	48.4%	37.5%	30.6%	8.3%	33.3%
ATV	11.1%	5.3%	12.5%	0.0%	0.0%	2.4%
Travel by Car	82.5%	89.5%	87.5%	85.4%	83.3%	88.1%
Travel by RV	14.3%	9.5%	0.0%	12.5%	8.3%	4.8%
Travel by Plane	4.8%	9.5%	12.5%	8.3%	0.0%	14.3%
Travel Time	4.0	7.8	6.4	5.3	0.6	4.2
Travel Distance	318.9	529.3	503.6	367.4	29.0	503.4
in Group	3.4	3.6	5.3	3.4	5.0	2.9

3.5.2. Table 6 presents the responses of South Fork anglers and visitors regarding the percent participating in various activities and their travel modes to the South Fork. The most frequently used fishing mode on all the South Fork stretches was a boat, however, 50% or more of anglers also fished from shore or waded. Rafting and wildlife viewing were the most popular activities of SF 1 non-fishing visitors. The vast majority of South Fork anglers traveled by car. Most of the visitors traveled an average of 120 to 230 miles one way to the South Fork sections 1, 2 and 3. Only South Fork 4 appeared to attract anglers from significantly further away.

Table 6 Descriptive Statistics Regarding Activities and Travel by Visitors to the South Fork.

	SF1 Anglers	SF1 Visitors	SF2 Anglers	SF3 Anglers	SF4 Anglers
Fish Shore/Wade	51.2%	N/A	65.5%	53.3%	66.7%
Fishing from Boat	92.7%	N/A	96.4%	70.0%	88.9%
Raft	9.8%	54.5%	10.9%	16.7%	33.3%
Picnic	19.5%	18.2%	10.9%	20.0%	11.1%
Camp	26.8%	18.2%	32.7%	13.3%	11.1%
Hiking	4.9%	9.1%	3.6%	13.3%	11.1%
Motorboat	17.1%	27.3%	23.6%	13.3%	0.0%
Sightsee	24.4%	36.4%	36.4%	26.7%	55.6%
Rock Climbing	2.4%	18.2%	0.0%	0.0%	0.0%
Bike	0.0%	0.0%	3.6%	0.0%	0.0%
Wildlife Viewing	34.1%	45.5%	50.9%	36.7%	55.6%
ATV	12.2%	9.1%	3.6%	0.0%	11.1%
Travel by Car	85.4%	100.0%	87.0%	83.3%	88.9%
Travel by RV	12.2%	0.0%	5.6%	3.3%	11.1%
Travel by Plane	4.9%	0.0%	9.3%	10.0%	33.3%
Travel Time	4.5	3.7	3.3	1.3	3.8
Travel Distance	238.7	180.4	233.1	122.2	670.8
# in Group	3.5	4.1	3.2	3.7	5.9

3.5.3. Table 7 presents the responses of anglers and visitors to the Snake River in Wyoming regarding the percent participating in various activities and their travel modes to the Wyoming stretches of the Snake River. About three-fours of anglers on WY 2 and WY 3 fished by boat, but about two-thirds of anglers also fished from shore or waded. Rafting, sightseeing, and wildlife viewing were the most popular activities of non-fishing visitors. Because many of the visitors to this section of the Snake River originate from Jackson Hole, a substantial proportion had flown into Jackson and then rented cars. The average distance traveled was 500 miles or more one way to the Wyoming stretches of the Snake River. The group sizes are also quite large indicating family or extended family and large group trips.

Table 7 Descriptive Statistics Regarding Activities and Travel by Visitors to the Snake River in Wyoming.

	WY1 Visitors	WY2 Anglers	WY2 Visitors	WY3 Anglers	WY3 Visitors	WY4 Anglers
Fish Shore/Wade	N/A	78.3%	N/A	73.9%	N/A	98.4%
Fishing from Boat	N/A	65.2%	N/A	69.6%	N/A	22.6%
Raft	84.2%	52.2%	75.9%	78.3%	89.2%	11.3%
Picnic	36.8%	43.5%	38.9%	43.5%	28.3%	21.0%
Camp	21.1%	17.8%	16.7%	47.8%	29.2%	12.9%
Hiking	47.4%	32.6%	37.0%	39.1%	40.0%	30.6%
Motorboat	0.0%	2.2%	1.9%	4.3%	0.0%	3.2%
Sightsee	47.4%	63.0%	77.8%	60.9%	40.8%	32.3%
Rock Climbing	0.0%	0.0%	0.0%	8.7%	5.8%	1.6%
Bike	21.1%	2.2%	3.7%	4.3%	2.5%	4.8%
Widllife Viewing	36.8%	69.6%	59.3%	60.9%	44.2%	41.9%
ATV	5.3%	0.0%	3.7%	4.3%	0.8%	1.6%
Travel by Car	84.2%	84.8%	75.9%	87.0%	87.5%	93.4%
Travel by RV	10.5%	4.3%	14.8%	17.4%	6.7%	1.6%
Travel by Plane	5.3%	34.8%	35.2%	26.1%	20.0%	21.0%
Travel Time	11.3	7.5	11.6	6.0	8.3	6.0
Travel Distance	771.3	680.8	931.5	513.4	616.8	559.3
# in Group	8.8	4.6	4.9	10.8	7.8	2.8

3.6 Survey Responses Regarding Important Attributes of the Trip, Crowding and Potential Changes in Permitting Requirements

In section C of the survey individuals were asked to indicate how important each feature or motivation was for their decision to visit the Snake River. The question asked respondents to rate these attributes or reasons for their trip on a four point scale where 1 was not important, 2 was somewhat important, 3 was important, and 4 was very important. The degree of crowding they experienced on their most recent trip was rated on a nine point scale with 1-2 not at all crowded, 4-5 slightly crowded; 6-7 moderately crowded and 8-9 extremely crowded. Finally, individuals were asked to indicate whether having to reserve a permit ahead of time would change their decision to visit the Snake River, and if so, whether they would take more or fewer trips.

As shown in Table 8, top rated reasons for visiting the Henry's Fork include Enjoying Nature(Nature Importance), opportunity to relax (Relax Importance), enjoying solitude (Solitude Importance), catching large numbers of trout, wildlife viewing and catching trophy trout. Generally speaking most visitors felt slightly crowded. Having to reserve a permit ahead of time would cause at least 47% to as many as 73% of the visitors to

change their number of trips, with the net effect being a reduction of at least 1.4 trips per person to as much as nearly nine trip reduction each year.

Table 8. Response of Henry's Fork Anglers and Visitors Regarding Important Trip Attributes, Crowding and Permitting.

	HF1 Anglers	HF2 Anglers	HF2 Visitors	HF3 Anglers	HF3 Visitors	HF4 Anglers
Raft Importance*	1.8	1.8	2.8	1.9	2.5	1.5
Motorboat Imp	2.8	1.2	1.7	1.5	3.6	1.2
Relax Importance	3.6	3.5	3.5	3.5	3.6	3.5
Nature Importance	3.7	3.6	3.7	3.6	3.3	3.7
Camp Importance	2.2	2.2	2.2	2.3	2.4	1.8
Solitude Importance	3.5	3.5	3.4	3.6	3.0	3.7
Wildlife Viewing	3.4	3.3	3.5	3.1	2.9	3.4
Group Activities	3.1	2.6	3.3	2.5	3.1	2.3
Catch Large #'s of Trout	3.4	2.8	1.7	3.5	2.2	3.3
Cutthroat Trout	2.8	2.4	1.6	2.7	1.9	2.6
Catch Trophy Trout	3.4	3.3	1.8	3.0	2.1	3.0
Catching Fish to eat	2.2	1.2	1.5	1.7	1.8	1.5
Hike Importance	1.5	1.6	2.5	1.5	1.4	1.4
Bike Importance	1.5	1.4	1.9	1.3	1.2	1.2
ATV Importance	1.7	1.1	2.3	1.2	1.9	1.1
Degree of Crowding**	3.7	4.8	4.0	4.4	4.9	5.1
Would Change # of Trips If had to reserve Permit	55.0%	46.7%	68.8%	61.7%	72.7%	47.5%
Change in # Trips If permit required	-2.0	-3.0	-1.4	-5.3	-8.8	-2.9

* All importance questions were on a four point scale from 1= not important, 2=somewhat important, 3= important, 4= very important.

** Degree of Crowding was a 9 point scale with 1-2 not at all crowded, 4-5 slightly crowded; 6-7 moderately crowded and 8-9 extremely crowded.

As shown in Table 9, top rated reasons for visiting the South Fork include Enjoying Nature (Nature Importance), opportunity to relax (Relax Importance), enjoying solitude (Solitude Importance), and wildlife viewing. Catching large numbers of trout and catching trophy trout were important but not as important as on the Henry's Fork. Generally speaking, most visitors felt slightly crowded. Having to reserve a permit ahead of time would cause at least 45% to as many as 82% of the visitors to change their number of trips, with the net effect being a reduction of at least 1 trip to as many as nearly 10 trips each year. South Fork visitors seem more adverse to permit requirements than Henry's Fork.

Table 9. Response of South Fork Anglers and Visitors Regarding Important Trip Attributes, Crowding and Permitting.

	SF1 Anglers	SF1 Visitors	SF2 Anglers	SF3 Anglers	SF4 Anglers
Raft Importance*	2.2	3.2	1.7	2.1	2.4
Motorboat Imp	2.0	1.7	2.2	1.7	1.4
Relax Importance	3.6	4.0	3.5	3.6	3.8
Nature Importance	3.5	4.0	3.5	3.7	3.7
Camp Importance	2.4	1.8	2.3	2.5	2.6
Solitude Importance	3.5	3.6	3.3	3.6	3.7
Wildlife Viewing	3.2	3.7	3.3	3.4	3.7
Group Activities	2.6	2.9	2.6	3.0	2.9
Catch Large #'s of Trout	3.2	1.6	3.2	2.9	2.8
Cutthroat Trout	2.7	1.7	2.7	2.6	2.8
Catch Trophy Trout	2.8	1.5	2.9	2.6	2.7
Catching Fish to eat	1.6	1.3	1.4	2.0	1.4
Hike Importance	1.2	1.4	1.2	1.5	1.8
Bike Importance	1.1	1.0	1.1	1.2	1.6
ATV Importance	1.5	1.6	1.4	1.2	1.7
Degree of Crowding**	5.0	4.3	4.5	4.5	3.7
Would Change # of Trips If had to reserve Permit	82.5%	45.5%	78.2%	58.6%	55.6%
Change in # Trips If permit required	-6.7	-1.8	-10.3	-7.1	-1.0

* All importance questions were on a four point scale from 1= not important, 2=somewhat important, 3= important, 4= very important.

** Degree of Crowding was a 9 point scale with 1-2 not at all crowded, 4-5 slightly crowded; 6-7 moderately crowded and 8-9 extremely crowded.

As shown in Table 10, top rated reasons for visiting the Wyoming Snake River were similar to the South Fork and include Enjoying Nature (Nature Importance), opportunity to relax (Relax Importance), enjoying solitude (Solitude Importance), and wildlife viewing. Catching large numbers of trout and catching trophy trout were important but not as important as on the Henry's Fork. Opportunities to catch cutthroat trout was important for anglers on WY 2 and WY 3, and between important and very important for WY#4 (Flat Creek) anglers. Visitors on WY1 and 2 through Jackson Hole did not feel very crowded, but visitors to WY#3 felt between slightly crowded and moderately crowded as did anglers on WY 4 (Flat Creek). Having to reserve a permit ahead of time would cause about half the visitors to change their number of trips, with the net effect being a reduction of at least 1-2 trips. While this seems relatively small reduction, many visitors to these stretches of the river only take 1-2 trips per year.

Table 10. Response of Wyoming Snake River Anglers and Visitors Regarding Important Trip Attributes, Crowding and Permitting.

	WY1 Visitors	WY2 Anglers	WY2 Visitors	WY3 Anglers	WY3 Visitors	WY4 Anglers
Raft Importance*	3.2	2.6	3.0	3.2	3.6	2.1
Motorboat Imp	1.2	1.2	1.1	1.3	1.2	1.2
Relax Importance	3.5	3.6	3.4	3.3	3.5	3.6
Nature Importance	3.7	3.6	3.6	3.4	3.7	3.7
Camp Importance	1.6	1.8	1.8	2.1	2.3	2.3
Solitude Importance	3.2	3.3	3.0	3.3	3.3	3.6
Wildlife Viewing	3.6	3.6	3.3	3.1	3.3	3.4
Group Activities	3.5	3.0	2.6	3.0	3.1	2.5
Catch Large #'s of Trout	1.2	2.8	1.3	2.5	1.3	3.2
Cutthroat Trout	1.1	3.0	1.4	2.5	1.4	3.4
Catch Trophy Trout	1.1	2.5	1.2	2.2	1.2	3.1
Catching Fish to eat	1.1	1.3	1.1	1.6	1.3	1.1
Hike Importance	2.9	2.0	2.1	2.0	2.3	2.0
Bike Importance	1.9	1.4	1.4	1.4	1.5	1.5
ATV Importance	1.2	1.1	1.2	1.3	1.2	1.1
Degree of Crowding**	3.0	3.3	2.6	5.1	4.7	4.4
Would Change # of Trips If had to reserve Permit	36.84%	51.11%	50.00%	45.45%	56.30%	46.67%
Change in # Trips If permit required	-1.3	-2.1	-1.3	-2.0	-2.4	-2.8

* All importance questions were on a four point scale from 1= not important, 2=somewhat important, 3= important, 4= very important.

** Degree of Crowding was a 9 point scale with 1-2 not at all crowded, 4-5 slightly crowded; 6-7 moderately crowded and 8-9 extremely crowded.

3.7 Distribution of Fish Species Targeted and Angler Catch

Table 11 presents information on Henry's Fork anglers regarding the species they were targeting and their catch per day. For HF 2- 4, rainbow trout was the primary species targeted, and catch rates on these three sections average between 4 and 7 fish caught (but not necessarily kept) per day. Fishing for brown trout was the second most commonly sought after species in the lower stretches of the Henry's Fork. Flyfishing was the most common fishing method for HF 2-HF 4. About 20% of anglers used a guide.

Table 11. Percentage of Henry's Fork Anglers Targeting each Species and Daily Catch Rate.

	HF1 Anglers	HF2 Anglers	HF3 Anglers	HF4 Anglers
% Rainbow	51.7%	92.6%	83.0%	95.1%
RBTCaught	1.66	3.94	7.11	5.90
% Cuthroat	48.3%	16.0%	23.4%	19.5%
CUTCaught	0.7	0.3	1.0	1.0
% WhiteFish	16.7%	20.2%	36.2%	26.8%
WhiteCaught	0.2	0.7	3.3	1.5
% Brown Trout	18.3%	19.1%	44.7%	48.8%
BRWNCaught	0.1	0.4	1.5	1.5
% Brook Trout	18.3%	7.4%	8.7%	7.5%
BRKCaught	0.2	0.1	0.3	0.0
% Other Species	21.7%	5.4%	4.3%	7.7%
OTSPCaught	0.7	0.2	0.2	0.3
Hours Fly Fishing	3.1	6.6	5.0	5.4
Hours Bait Fishing	2.4	0.1	0.9	0.7
Hours Lure	1.9	0.1	0.8	0.4
% Using Guide	11.7%	19.6%	19.6%	24.4%

Table 12 presents information on South Fork anglers regarding the species they were targeting and their catch per day. For the South Fork, cutthroat trout, rainbow trout and brown trout were most commonly sought after species. Catch rates on these three sections average between 3 and 4 fish caught (but not necessarily kept) per day. Fly fishing was the most common type of fishing method on the South Fork. About 20% of anglers used a guide. The percentage of anglers using a guide increased as one moved down river, reaching more than one-third of anglers in SF 4.

Table 12. Percentage of South Fork Anglers Targeting each Species and Daily Catch Rate.

	SF1 Anglers	SF2 Anglers	SF3 Anglers	SF4 Anglers
% Rainbow	68.4%	74.5%	52.2%	71.4%
RBTCaught	2.6	3.8	1.6	3.6
% Cuthroat	78.9%	92.0%	73.9%	71.4%
CUTCaught	4.4	6.6	2.3	3.2
% WhiteFish	23.68%	36.00%	17.39%	14.29%
WhiteCaught	1.3	2.8	0.7	14.3
% Brown Trout	42.1%	74.0%	73.9%	71.4%
BRWNCaught	1.9	4.0	3.5	3.9
% Brook Trout	7.89%	18.00%	4.35%	0.00%
BRKCaught	0.1	0.1	0.1	0.0
% Other Species	7.9%	12.0%	8.7%	0.0%
OTSPCaught	1.4	0.7	0.7	0.0
Hours Fly Fishing	4.3	5.8	3.3	3.4
Hours Bait Fishing	0.4	0.6	0.5	1.0
Hours Lure	1.0	1.3	1.3	2.0
% Using Guide	7.9%	11.3%	17.4%	37.5%

Table 13 presents information on Snake River through southwest Wyoming anglers regarding the species they were targeting and their catch per day. Cutthroat trout was the dominant species targeted. Catch rates on these three sections average 9.6 cutthroats per day on WY 2, 5 cutthroat per day on WY 3 and three cutthroat per day on WY 4 (Flat Creek). Flyfishing was the most commonly type of fishing method on all three stretches of river. About 40% of anglers used a guide on WY 2 through Jackson Hole, 20% on WY 3, and just 12% on WY 4.

Table 13. Percentage of Southwest Wyoming Anglers Targeting each Species and Daily Catch Rate.

	WY2 Anglers	WY3 Anglers	WY4 Anglers
% Rainbow	30.3%	21.4%	24.1%
RBTCaught	1.2	2.8	1.7
% Cutthroat	81.8%	92.9%	94.8%
CUTCaught	9.6	5.2	3.1
% White Fish	30.3%	21.4%	17.2%
WhiteCaught	1.2	0.7	3.9
% Brown Trout	12.1%	21.4%	12.1%
BRWNCaught	0.4	0.7	1.3
% Brook Trout	12.1%	7.1%	8.6%
BRKCaught	0.125	0	3.375
% Other Species	9.1%	0.0%	5.2%
OTSPCaught	0.7	0.0	1.0
Hours Fly Fishing	5.5	4.1	5.0
Hours Bait Fishing	0.1	0.2	0.1
Hours Lure	1.1	0.9	0.3
% Using Guide	43.8%	20.0%	12.1%

Chapter 4
Results of Statistical Analysis of Angler Demand and Net Economic Value Calculated from Travel Cost Method and Contingent Valuation Method

Chapter Highlights:
Net Economic Value of Fishing to Anglers is:

- Henry's Fork: $90 per angler day for an annual total of $15 million
- South Fork: $75 per angler day for an annual total of $14.7 million
- SW Wyoming: $100 per day for an annual total of $9.5 million
- The additional net economic value per fish caught is $13 for the Henry's Fork and $23 for the south Fork

4.1 Travel Cost Method (TCM) Analysis for the Henry's Fork and South Fork

This section presents the details of the travel cost method demand curves. It is from these demand curves that the net willingness to pay or consumer surplus is calculated. The reader unfamiliar with multiple regression may wish to skip to Table 21 to see the benefit estimates derived from these demand curves.

A particular type of multiple regression analysis using count data distributions was performed to estimate the recreational fishing demand curve and calculate net economic value of fishing at each of the river segments. To be consistent with the assumptions of the travel cost model, only anglers who had fished at the river segment intercepted as their primary purpose/sole destination or one of equally important destinations is used in the analysis. Individuals who indicated that fishing on this river was just an incidental stop as part of a longer trip are not included in the TCM analysis, but they are legitimate to include in the CVM analysis (which is performed below).

The basic principle of using multiple regression to estimate a TCM recreation demand curve is that the annual number of trips (ANNUAL TRIPS) is the dependent variable, and the explanatory variables are called the independent variables. In essence, the number of trips taken depends upon the independent variables such as travel cost, fish catch, and angler's income. The coefficients on the independent variables are slope coefficients, indicating the rate of change in the dependent variable for a one unit change in the log of the dependent variable. Various test statistics such as the z-statistic tell us whether the independent variable has a statistically significant effect on the dependent variable (e.g., number of trips). If the z-statistic is over 1.96 that indicates there is only a 5% chance that the independent variable does not a systematic effect on the number of trips taken.

As a technical note, the TCM demand model has been corrected for on-site sampling (i.e., endogenous stratification) using the approach of Englin and Shonkwiler (1995a).

The independent or explanatory variables are:
TRAVCOST&TIME which is the one-way travel distance reported in the survey multiplied by round trip travel cost per mile (two times the sample average 10 cents per mile per person, i.e., adjusted for the number of people in the group) plus one-third

sample wage rate as a proxy for the value of time multiplied by the respondent's travel time. The wage rate was calculated by using sample household income divided by the number of people in the household that worked and then by 2000 hours per year per worker. The one-third the wage rate was used as the shadow price of the value of travel time, per the U.S. Water Resources Council (1979; 1983) convention and confirmed in empirical analyses by Englin and Shonkwiler (1995b).

TOTFISHC is total fish catch of the angler including all species reported in the survey (rainbow trout, cutthroat trout, brown trout, brook trout and whitefish). Occasionally a total fish catch squared term (TOTFISHCSQ) is included to allow for greater nonlinearity if that appears more consistent with angler behavior.

INC is household income reported in the survey.

ANOTHER is a proxy variable for the composite price of substitute sites. As suggested by Smith (1993) ANOTHER is annual trips to other areas outside southeast Idaho and southwest Wyoming (our study area). In essence the ANOTHER variable moves inversely with the price of substitutes. The more trips a person makes to other sites, the lower their price of substitutes, and vice versa.

TOTHRS is the total hours spent on the trip. It is included to account for length of stay. For some sites it is omitted due to insignificance likely due to limited variation in trip length possible to that site (i.e., many of the river segments are so short that day trips are the norm).

Constant is included as a constant term or intercept.

The statistical results in the following tables indicates the travel cost (price) coefficient is statistically significant and negative in all of the demand curves. This means the higher the travel costs the fewer trips a visitor takes. In addition, catch rate is a statistically significant variable, in all but one of the river segments. This allows us to estimate the effect of increasing catch on number of angler trips taken. The overall demand equations are also statistically significant as judged by the highly significant likelihood ratio statistic (this statistic indicates that, taken as a group, all the slope coefficients on the independent variables are significantly different from zero). How well the regression line fits the data (or how close the regression line is to the data points) is indicated by the R-squared. The R-squared indicates the percentage variation in the dependent variable (e.g., the annual number of trips) explained by the independent variables. Considering the data is individual angler trips, the regression demand equations do a good job of explaining the number of angler trips. With one exception, all the equations explain at least 25% of the variation in angler trips, and three of the equations explain more than 50% percent of the variation in angler trips. This is a reasonably good job for individual observation cross section data.

In the tables below, the variables which are shown in bold indicate they are statistically significant at the 10% or better (i.e., 5% or 1%), meaning the respective confidence level is 90% or better (i.e., 95% or 99%).

Table 14. Henry's Fork 1 Anglers Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS
Sample: 1 59
Number of observations: 47

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.434080**	**0.232738**	**6.161765**	**0.0000**
TRAVEL COST&TIME	**-0.008627**	**0.001494**	**-5.774041**	**0.0000**
TOTFISHC	**0.123157**	**0.016024**	**7.685739**	**0.0000**
INC	-5.11E-07	1.78E-06	-0.286200	0.7747
ANTOTHER	**-0.040282**	**0.017207**	**-2.341044**	**0.0192**
TOTHRS	**0.010707**	**0.003445**	**3.107769**	**0.0019**

R-squared	0.625	Current Catch Elasticity	.283
Std. Error of regression	4.034		
Log likelihood	-136.44		
Restricted Log likelihood	-198.01		
LR statistic (5 d.o.f.)	**123.28**		
Probability (LR statistic)	**0.000000**		

Bold indicates statistically significant variables at the 10% level or better.

Table 15. Henry's Fork 2 Anglers Trip Purposes 1 and 2.

Dependent Variable: ANNUAL TRIPS

Number of observations: 73

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**0.889105**	**0.165178**	**5.382712**	**0.0000**
TRAVEL COST&TIME	**-0.007730**	**0.000782**	**-9.884651**	**0.0000**
TOTFISHC	**0.104169**	**0.023660**	**4.402788**	**0.0000**
TFISHCSQ	**-0.002803**	**0.000938**	**-2.987460**	**0.0028**
INC	**7.40E-06**	**8.76E-07**	**8.447253**	**0.0000**
ANTOTHER	**0.011015**	**0.005071**	**2.172186**	**0.0298**
TOTHRS	**0.001086**	**0.000652**	**1.665461**	**0.0958**

R-squared	0.3737	Current Catch Elasticity	.43
Std. Error of regression	5.2411		
Log likelihood	-241.10		
Restricted Log likelihood	-331.24		
LR statistic (6 d.o.f.)	**180.28**		
Probability (LR statistic)	**0.0000**		

Bold indicates statistically significant variables at the 10% level or better.

Table 16. Henry's Fork 3, Anglers Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS Number of observations: 35 Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.073620**	**0.098635**	**21.02314**	**0.0000**
TRAVEL COST&TIME	**-0.009037**	**0.002385**	**-3.789559**	**0.0002**
ANTOTHER	-0.000519	0.014411	-0.036026	0.9713
R-squared	0.17735			
Std. Error of regression	6.73391			
Log likelihood	-152.833			
Restricted Log Likelihood	-182.341			
LR statistic (2 d.o.f.)	**59.015**			
Probability (LR statistic)	**1.53E-13**			

Bold indicates statistically significant variables at the 10% level or better.

Table 17. Henry's Fork 4, Anglers Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS Number of observations: 32 Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.211530**	**0.244511**	**4.95492**	**0.0000**
TRAVEL COST&TIME	**-0.006850**	**0.001715**	**-3.99495**	**0.0001**
TOTFISHC	**0.132007**	**0.022850**	**5.77701**	**0.0000**
INC	-4.26E-06	2.77E-06	-1.54076	0.1234
ANTOTHER	-0.032085	0.027722	-1.15738	0.2471
R-squared	0.5376	Current Catch Elasticity		.858
Std Error of regression	3.3129			
Log likelihood	-72.060			
Restricted Log likelihood	-114.690			
LR statistic (4 d.o.f.)	**85.266**			
Probability (LR statistic)	**0.0000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 18. South Fork 1, Anglers Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS				
Number of observations: 33				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.023275**	**0.142045**	**14.24391**	**0.0000**
TRAVEL COST&TIME	**-0.003816**	**0.001090**	**-3.500746**	**0.0005**
TOTFISHC	**0.040354**	**0.002796**	**14.43414**	**0.0000**
INC	-1.59E-06	1.18E-06	-1.349360	0.1772
ANTOTHER	0.003874	0.002734	1.416622	0.1566
R-squared	0.5949	Current Catch Elasticity		.30
Std. Error of regression	7.8721			
Log likelihood	-151.790			
Restricted Log likelihood	-259.428			
LR statistic (4 d.o.f.)	**215.2748**			
Probability (LR statistic)	**0.0000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 19. South Fork 2 Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS				
Number of observations: 48				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.869973**	**0.089013**	**32.24230**	**0.0000**
TRAVEL COST&TIME	**-0.042191**	**0.003630**	**-11.62334**	**0.0000**
TOTFISHC	**0.017945**	**0.003420**	**5.247612**	**0.0000**
INC	**1.61E-06**	**8.09E-07**	**1.986091**	**0.0470**
ANTOTHER	**0.035352**	**0.005340**	**6.620485**	**0.0000**
R-squared	0.3179	Current Catch Elasticity		.22
Std Error of regression	19.489			
Log likelihood	-441.096			
Restricted Log likelihood	-664.540			
LR statistic (4 d.o.f.)	**446.887**			
Probability (LR stat)	**0.0000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 20. South Fork 3 Anglers Trip Purposes 1 and 2

Dependent Variable: ANNUAL TRIPS				
Number of observations: 20				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.958505**	**0.253934**	**7.712646**	**0.0000**
TRAVEL COST&TIME	**-0.047270**	**0.011293**	**-4.185776**	**0.0000**
TOTFISHC	**0.188377**	**0.056887**	**3.311418**	**0.0009**
TFISHCSQ	**-0.012514**	**0.003545**	**-3.530313**	**0.0004**
INC	**5.56E-06**	**2.21E-06**	**2.515391**	**0.0119**
ANTOTHER	-0.008479	0.019479	-0.435291	0.6634
R-squared	0.276992	Current Catch Elasticity		.64
Std. Error of regression	10.18471			
Log likelihood	-99.57438			
Restricted Log likelihood	-138.2791			
LR statistic (5 d.o.f.)	**77.40951**			
Probability (LR statistic)	**2.89E-15**			

Bold indicates statistically significant variables at the 10% level or better.

Table 21 provides the estimates of net willingness to pay (WTP) derived from the TCM. Since the count data models are equivalent to a semi log functional form, net WTP per trip is the reciprocal of the TRAVEL COST&TIME coefficient. To calculate net WTP per angler day, the net WTP per trip is divided by the number of days per trip for each site. Due to limited sample size SF 4 TCM demand and benefits could not be estimated. Therefore we use the values for SF 3 as a proxy for SF 4 elsewhere in this report. A pooled model for SF 3 and SF 4 for cutthroat trout fishing is presented later in this report.

Table 21 Anglers WTP per Day from Travel Cost Model

SITE	Mean WTP	Lower 90% CI	Upper 90% CI
HF1 Lake	$46.18	$35.96	$64.51
HF2	$43.12	$36.98	$51.70
HF3	$56.98	$39.68	$101.02
HF4	$55.30	$39.17	$94.02
SF1	$86.20	$58.65	$162.61
SF2	$11.34	$9.93	$13.21
SF3	$17.78	$12.76	$29.28
SF4	NA	NA	NA

4.2 Contingent Valuation Method (CVM) Analysis of the Henry's Fork and South Fork

CVM can be used to estimate the net willingness to pay value for a trip that is applicable to both single destination and multiple destination trips as well as multiple purpose fishing trips. The specific question asked after the expenditure question was: "As you know, the costs of travel such as gasoline often increase. If the total cost of this most recent trip had been $XX higher, would you have made this trip to the River Segments visited? Yes No". The $XX is the dollar amount the respondent was asked to pay. It varied from $2 to $950. The range was selected such that we expected that everyone would agree to pay $2 more and that no one or very few people would pay the additional $950 per trip. The premise of rising gasoline prices was quite credible, as the price of gas had risen from about $1.50 a gallon to over $2.00 a gallon during the spring time.

This dichotomous choice question is analyzed using a logistic regression model since the dependent variable is coded one, if the respondent states "yes", and zero if the respondent states "no". For purposes of estimating site specific values, we estimated a simple logit model with just the dollar amount (bid) as the independent variable to conserve degrees of freedom since some site specific samples were fairly small. In order to estimate the marginal value of catching an additional trout, the Henry's Fork sites were pooled together, and the South Fork river segments were pooled together.

The logit model results are presented in Table 13 along with the median WTP. The median WTP is calculated as Constant/Bid Coefficient. Confidence intervals are calculated using an approach of Park, Creel and Loomis.

Table 22. Contingent Valuation Logit Regression Results, WTP and Trip Characteristics for Anglers on the Henry Fork

Variable	HF1 (Lake)	HF2	HF3	HF4
Constant (t-values)	**2.44 (4.37)*** **	**1.824 (4.46)*** **	**1.838 (3.31)*** **	**1.574 (3.03)** **
Bid Coefficient	**-.003442 (-3.369***)**	**-.001598 (-1.728)***	**-.000349 (-2.976)** **	**-.003139 (-2.47)** **
McFadden R^2	.21	.032	.183	.150
Mean net WTP per angler day	**$82.62**	**$104.90**	**$79.08**	**$65.50**
90% Lower CI	$61.77	$63.88	$53.45	$39.71
90% Upper CI	$123.66	$500.18	$125.08	$135.84
# in group	3.42	3.63	3.42	2.9
Trip length in days	2.51	3.0	1.95	2.64

*, **, and *** indicates significant at the 10%, 5% and 1% levels, respectively.

With the exception of South Fork segment 4, the logit models performed well with the bid coefficient being negative, indicating the higher the dollar amount visitors were asked to pay, the less likely they were to pay this. This corresponds with common sense and economic theory. The coefficients were significant at the 10% level or higher, and most of the McFadden R squares were respectable.

Table 23. Contingent Valuation Logit Regression Results, WTP and Trip Characteristics for Anglers on the South Fork in Idaho

Variable	SF1	SF2	SF3	SF4
Constant (t-values)	**1.436 (2.63)*** **	**1.600 (3.41)*** **	**1.862 (1.66)***	n.s
Bid Coefficient	**-.003766 (-2.456***)**	**-.003373 (-2.728)*** **	**-.02169 (-1.79)***	n.s
McFadden R^2	.15	.139	.453	.21
Mean WTP per angler day	**$62.74**	**$95.83**	**$36.07**	Using SF 3 (SF 4 n.s.)
90% Lower CI	$34.87	$63.43	$.92	N/A
90% Upper CI	$118.42	$171.72	$74.37	N/A
# in group	2	2.37	2	
Trip length in days	3.04	2.09	1.19	

*, **, and *** indicates significant at the 10%, 5% and 1% levels, respectively.

4.3 Comparison of TCM and CVM Values and Past Literature

The CVM dollar values per angler day are fairly high for both the Henry's Fork and South Fork 1 and 2 reflecting the relatively high fishing quality and experience perceived by the anglers. These CVM derived values are higher than the TCM values for

the respective rivers, except for South Fork 1 where the TCM value is about one-third larger. It may be plausible that the CVM values are generally higher than the TCM since, the CVM applies to all trips including multiple destination/multiple purpose trips. Past research has shown that the consumer surplus on multiple destination/multiple purpose trip is often much larger than single destination trips. The reason for the higher consumer surplus on the multiple destination/multiple purpose trips may be related to the fact that if the travel costs to the area are incurred for business or other purposes, then the incremental cost of staying over an extra day for fishing has low costs. But the angler receives the same high value of the experience, and with lower costs, the **net** willingness to pay or willingness to pay in excess of their minimal fishing costs is rather large. This pattern of high multiple destination trip values has been found in past studies of recreation on the Snake River through Jackson Hole (Loomis, forthcoming, 2005) and for non-consumptive wildlife viewing (Loomis, et al. 2002).

Further perspective on the TCM and CVM values can be found by comparing the TCM and CVM values to past estimates of fishing values per day in the intermountain west by Rosenberger and Loomis (2001). These authors report an average value of $41 in 1996 dollars, which when updated to 2004 would be $48 per angler day. This $48 value is similar to the TCM values for the Henry's Fork segments, but is higher than for the South Fork TCM values with the exception of South Fork 1.

Table 24 presents a range of estimates for the overall value to anglers for fishing on the Henry's Fork and South Fork. Based on our estimated angler days for the Henry's Fork, fishing has a net economic value to anglers of between $8 million annually as estimated from the TCM demand curve and $15 million annually as estimated using contingent valuation. The net economic value to anglers fishing on the South Fork ranges from $8.4 million annually as estimated from the TCM demand curve to $14.7 million annually as estimated using contingent valuation. The economic value for both rivers is between $16 and $30 million dollars annually to anglers. That is, anglers would pay between $16 million and $30 million more per year to maintain the current level of fishing quality at the Henry's Fork and South Fork of the Snake rivers.

Table 24. Net Economic Value of Fishing on the Henry's Fork and South Fork using TCM and CVM.

	Angler Days	TCM Value Per day	Season Value	CVM Value Per day	Season Value
Henry's Fork					
HF1 (Lake)	40,922	$46.18	$1,889,833	$82.62	$3,380,976
HF2	78,916	$43.12	$3,403,019	$104.90	$8,278,288
HF3	21,698	$56.98	$1,236,353	$79.08	$1,715,878
HF4	27,120	$55.30	$1,499,668	$65.50	$1,776,360
HFTotal	168,656		$8,028,873		$15,151,502
South Fork					
SF1	80,565	$86.20	$6,944,875	$62.74	$5,054,648
SF2	91,724	$11.34	$1,040,225	$95.83	$8,789,911
SF3	21,504	$17.78	$382,284	$36.07	$775,649
SF4*	2,405	$17.78	$42,775	$36.07	$86,748
SF Total	196,198		$8,410,139		$14,706,956
Total	364,854		$16,439,012		$29,858,459

*. The value per day for SF4 is based on the value for SF3, the immediately upstream segment.

The net WTP for fishing as estimated by CVM but using angler day estimates derived from IDFG for the Henry's Fork would increase the annual value to $22.9 million, but lower the South Fork to $9.2 million. Most of the gain in net economic value for the Henry's Fork is related to IDFG much higher use estimates for Henry's Lake (106,449 angler days), as the use estimates for the river sections of the Henry's Fork are quite similar (IDFG is 148,975 estimated angler days, while our estimate from the above table for HF 2-HF 4 is 127,734 angler days).

4.4. Estimating How Angler Benefits per Day Increase with Increase Catch on the Henry's Fork and South Fork

In order to estimate how the value of a trip increases with the opportunity to catch an additional trout, the data were pooled across the four segements of the Henry's Fork and the logit model was re-estimated including total trout catch as an independent variable. For the Henry's Fork the variable has the expected positive sign indicating WTP rises with the number of trout caught. However the coefficient is not quite significant at conventional levels of 10% or better but would be considered significant at the 15% level. Dividing the coefficient on TOTFISHC by the coefficient on BID, yields a marginal value per fish caught of $12.56. Table 25 provides these results for the Henry's Fork.

Table 25. Pooled CVM Logit Equation to Estimate Marginal Value Per Fish Caught at the Henry's Fork.

Dependent Variable: YESPAY
Number of observations: 234

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.830380**	**0.266325**	**6.8727**	**0.0000**
BID	**-0.002923**	**0.000527**	**-5.5460**	**0.0000**
TOTFISHC	0.036708	0.025669	1.4300	0.1527

Mean dependent variable	0.739	Std. Error Regression	0.406
Log likelihood	-116.4524		
Restr. Log likelihood	-134.2624		
LR statistic (2 d.o.f.)	**35.61989**	McFadden R-squared	0.1326
Probability (LR statistic)	**1.84E-08**		
Observations Dependent=0	61	Total observations	234
Observations Dependent=1	173		

Bold indicates statistically significant variables at the 10% level or better.

A similar pooling of CVM response data across the four segments of the South Fork in Idaho was performed and total trout catch included as a variable in the logit model. In this case not only is the coefficient positive, but it is statistically significant at conventional levels (i.e., 1%). As shown below in Table 26, the number of fish caught is statistically significant at the 1% level. Dividing the coefficient on TOTFISHC by the coefficient on BID, yields a marginal value of $23.30 per trout, a sizeable value.

Table 26. Pooled CVM Logit Equation to Estimate Marginal Value Per Fish Caught at the South Fork in Idaho.

Dependent Variable: YESPAY
Number of observations: 120

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**0.549225**	**0.326020**	**1.6846**	**0.0921**
BID	**-0.003235**	**0.000854**	**-3.7893**	**0.0002**
TOTFISHC	**0.075391**	**0.028169**	**2.6764**	**0.0074**
Mean dependent variable	0.5833	Std. Error Regression		0.4467
Log likelihood	-68.979			
Restricted Log likelihood	-81.503			
LR statistic (2 d.o.f.)	**25.047**	McFadden R-squared		0.15366
Probability (LR statistic)	**3.64E-06**			
Observations Dependent=0	50	Total observations		120
Observations Dependent=1	70			

Bold indicates statistically significant variables at the 10% level or better.

4.5 Estimating how Angler Visitation to the Henry's Fork and South Fork Increase with Increase Catch Rates

Changes in visitation with changes in fish catch rate, were calculated from the angler survey responses and were reported above in Table 3. They are summarized in column three of Table 27 below for comparison with the catch elasticities calculated from the TCM demand curve. Overall river segments the catch elasticities from the contingent visitation indicates a .645% change in trips with a 1% change in catch.

Using the TCM demand model coefficient on fish catch, we can also calculate how angler trips
would change with fish catch. Technically this is the fish catch elasticity that can be calculated from the coefficient on fish catch times the mean TOTFISHC as:
(1) $B_{TOTFISHC}$ * MEAN TOTFISHC

As shown in Table 18, the response of angler trips to an increase in catch averages .46% change in trips with a 1% change in catch as estimated from the Travel Cost Method. Thus, a 1% increase in catch is estimated to result in between a .45% and .65% increase in angler use, and conversely for decreases in angler catch.

This elasticity is used to calculate the percent change in visitation for the regional economic impact model of employment, following procedures developed in Loomis and Caughlan (2004).

Table 27. Response of Angler Trips to Fish Catch (Elasticities) Calculated Using TCM and Contingent Behavior.

	TCM Catch Elasticity	Contingent Visitation Catch Elasticity
Henry's Fork		
HF1 (Lake)	0.28	0.77
HF2	0.43	0.68
HF3		0.58
HF4	0.86	0.67
South Fork		
SF1	0.30	0.85
SF2	0.22	0.34
SF3	0.64	0.66
SF4		1.29
Overall Average	0.46	0.65

4.6. Travel Cost and Contingent Valuation Analysis of Angling on the Snake River Segments WY 2 (Jackson Hole), WY 3 (Canyon Stretch) and WY 4 (Flat Creek)

The Snake River, starting at the southern boundary of Grand Teton National Park and running through Jackson Hole to South Park Bridge (WY2) is a popular place to fish. There are several public access points and extensive levees along the river that allow fishing from shore. The relatively slow-moving nature of the Snake River in this section allows anglers to wade as well. The backdrop of the Tetons and the opportunity to see wildlife, including bald eagles, along the river provides a high quality fishing experience. From South Park Bridge to the town of Alpine (WY3) is the whitewater section of the Snake River, but is also popular with anglers due to the steep walled canyon. Finally, Flat Creek (WY 4) is a tributary of the Snake River just north of the Town of Jackson in the National Elk Refuge. It is a highly desirable area to fish during the three month season from August through October.

4.6.1. Travel Cost Method Analysis of Snake River Segments WY2, 3 and 4

Table 28 presents the angler TCM demand equation and the catch elasticity for WY2. The travel cost coefficient and the total fish catch coefficient are statistically significant at the 1% level. The measure of substitute variable is also statistically significant at the 1% level as well. The explanatory power of the equation is remarkably high with 97% of the variation in angler trips explained by the model. The fish catch elasticity is .23, meaning that a 10% increase in fish catch would result in a 2.3% increase in angler trips. The mean net WTP is $44.68 per angler day, with a 90% confidence interval of $32 to $72 per angler day.

Table 28. Angler TCM Demand Equation for WY 2

Dependent Variable: ANNUAL TRIPS Number of observations: 32 Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	-0.280193	0.387309	-0.723436	0.4694
TRAVEL COST&TIME	**-0.013063**	**0.003046**	**-4.288945**	**0.0000**
TOTFISHC	**0.048180**	**0.004981**	**9.673459**	**0.0000**
ANTOTHER	**0.288238**	**0.046439**	**6.206876**	**0.0000**
R-squared	0.975172	Catch Elasticity		.23
Std Error of regression	1.273145	Mean net WTP per day		$44.68
Log likelihood	-36.51825	Lower 90% CI		$32.39
Restriced Log likelihood	-186.0157	Upper 90% CI		$71.97
LR statistic (3 d.o.f.)	**298.9949**			
Probability (LR statistic)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Due to the small number of observations for WY3 (the whitewater stretch between South Park Bridge and Alpine), we were not able to estimate a separate TCM demand equation.

Therefore, we pooled the observations from WY3 with WY2 to provide some indication of the value of fishing on this lower section of the Snake River in Teton County, Wyoming. The travel cost and total fish catch coefficients are statistically significant at the 1% level. The explanatory power of the equation is excellent at 82%. The catch elasticity is .18 meaning that a 10% change in angler catch would yield a 1.8% increase in angler days. The mean net WTP is $53.58 per angler day, with a 90% confidence interval of $39 to $84 per angler day.

Table 29. TCM Angler Demand Equation for WY2 and 3

Dependent Variable: ANNUAL TRIPS
Sample: 79 115 242 262
Number of observations: 49

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**0.900298**	**0.196987**	**4.570353**	**0.0000**
TRAVEL COST&TIME	**-0.014930**	**0.003254**	**-4.588773**	**0.0000**
TOTFISHC	**0.043093**	**0.003728**	**11.55925**	**0.0000**
ANTOTHER	**0.007871**	**0.003378**	**2.329694**	**0.0198**
R-squared	0.822227	Catch Elasticity		.18
Std. Error of regression	2.784046	Mean net WTP per day		$53.58
Log likelihood	-83.87053	Lower 90% CI		$39.44
Restricted Log likelihood	-231.4525	Upper 90% CI		$83.53
LR statistic (3 d.o.f.)	**295.1640**			
Probability (LR statistic)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Examination of the angler survey data for WY4, Flat Creek indicated that all but one of the anglers single destination anglers intercepted were targeting cutthroat trout. As such the WY 4 overall angler analysis and cutthroat trout analysis is identical, and is reported below in Table 30. The travel cost coefficient is significant at the 1% level and the cutthroat trout catch variable is statistically significant at the 10% level. The catch elasticity is .14 indicating a 10% change in angler catch would increase angler trips by 1.4%. This low catch elasticity may in part be attributable to the short season, which limits the number of additional trips anglers can take. However, there is a very high net WTP or net economic value to anglers of $124 per angler day.

Table 30. Wyoming 4 (Flat Creek) Cutthroat Trout Fishing TCM

Dependent Variable: ANNUAL TRIPS
Number of observations: 46

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**3.541455**	**0.168568**	**21.00903**	**0.0000**
TRAVEL COST&TIME	**-0.008039**	**0.001437**	**-5.593101**	**0.0000**
CUTCAUGHT	**0.042022**	**0.025269**	**1.662996**	**0.0963**
INC	**-1.61E-05**	**2.15E-06**	**-7.472850**	**0.0000**
ANTOTHER	**-0.026632**	**0.015100**	**-1.763709**	**0.0778**
TOTHRS	-0.001624	0.001466	-1.107560	0.2681

R-squared	0.419491	Current Catch Elasticity	.14
Std. Error of regression	8.138943	Mean net WTP per day	$124.39
Log likelihood	-206.3382	Lower 90% CI	$96.13
Restricted Log likelihood	-329.0961	Upper 90% CI	$176.21
LR statistic (5 d.o.f.)	**245.5158**		
Probability (LR statistic)	**0.000000**		

Bold indicates statistically significant variables at the 10% level or better.

4.6.2. Contingent Valuation Method Analysis of Snake River Segments WY 2, 3 & 4

Table 31 presents the net willingness to pay or net economic value of fishing in these three areas as estimated by the CVM. This analysis includes all trip types including primary purpose, equal purpose and fishing that was just an incidental part of the overall trip to the Jackson Hole area.

Table 31. Results of CVM Logit Model and WTP Estimates for All Anglers to the Snake River in Wyoming.

Variable	WY2	WY3	WY4 (Flat Creek)
Constant (t-values)	**2.0169 (3.57)*** **	**3.305 (2.554)*** **	**2.95 (2.48)*** **
Bid Coefficient	**-.003358 (-2.60)*** **	**-.0048 (2.33)** **	**-.47853[a] (-2.089)** **
McFadden R^2	.16	.315	.074
Mean net WTP per angler day	**$104.68**	**$62.59**	**$149.29**
90% Lower CI	$71.14	$42.00	$50.22
90% Upper CI	$198.36	$108.09	$6644

*, **, and *** indicates significant at the 10%, 5% and 1% levels, respectively.

a. Log of bid amount.

The critical bid coefficient is statistically significant at the 5% level. The per angler day values are fairly high as well.

4.6.3 Comparison of TCM and CVM Values and the Existing Literature

As before the CVM values for all trip types are higher than the TCM values, especially for WY2. In particular for WY2, the CVM net economic value per angler day ($104) is more than twice that from the TCM net economic value ($45). However, for WY4, Flat Creek, the CVM value of $149 per angler day is similar to the TCM estimate of $124 per angler day. Our TCM values for WY2 ($45) and the pooled WY2/WY3 ($54) are similar to the past literature values for fishing in the Intermountain west. In particular Rosenberger and Loomis report an average value of $41 in 1996 dollars, which when updated to 2004 would be $48 per angler day. This $48 value is similar to the TCM values to our $45 and $54 value and the $63 per angler day from the CVM for WY 3. However, the high quality of fishing Flat Creek is evident with both the TCM and CVM values of $124 and $149 per angler day being substantially larger than the average from the literature.

4.6.4 Total Annual Net Economic Value of Fishing on the Snake River in Teton County Wyoming.

Table 32 presents the annual net economic value received by anglers fishing the Snake River through Jackson Hole (WY2), the Snake River from South Park Bridge to Alpine (WY 3) and Flat Creek (WY4). The net economic value ranges from $5.6 million annually as estimated by TCM annually to $9.6 million annually for all trip types as estimated by CVM.

Table 32. Total Net Economic Value per Angler Day at WY2, WY3 and WY4 (Flat Creek) Estimated Using TCM and CVM.

Wyoming	Angler Days	TCM Value Per Day	Total Value	CVM Value Per day	Total Value
WY2	55,354	$44.68	$2,472,943	$104.68	$5,794,457
WY3	25,532	$53.58	$1,368,091	$62.59	$1,598,048
WY4	14,677	$124.39	$1,825,725	$149.29	$2,191,129
Total	95,563		$5,666,758		$9,583,634

4.7. Yellowstone Cutthroat Angler Trip Analysis
4.7.1. Yellowstone Cutthroat Angler Trip Analysis using Travel Cost Method

The tables below present a TCM demand analysis of those anglers that indicated in the survey they were specifically targeting cutthroat trout. There were sufficient observations to estimate separate demand equations for the South Fork 1 and South Fork 2, and then a pooled equation for South Fork 3 and 4. In Wyoming, river segments WY 2 and WY 3 were pooled together for the TCM analysis, and then WY 4 Flat Creek estimated separately.

In all of the demand equations, the travel cost or price is negative and statistically significant. The explanatory power of the TCM models is quite good with at least 36% to as much as 84% of the variation in angler trips explained by the demand equations.

In addition, the number of cutthroat caught was positive and statistically significant as well. Thus we report the cutthroat trout elasticities in with the regression results. The elasticities are fairly high for the South Fork 2 and South Fork 3/4 at .66 and .636, respectively. Thus a 1% increase in the number of cutthroat trout caught (not necessarily kept) would result in a .6% increase in trips. For the Wyoming segments of the Snake River (segments WY 2/ 3) and Flat Creek (WY 4), the elasticities are smaller at .13.

Table 33. South Fork 1 Cutthroat Trout Fishing TCM (Trip Purposes 1 & 2)

Dependent Variable: ANNUAL TRIPS Number of observations: 25				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.430846**	**0.158366**	**15.34956**	**0.0000**
TRAVEL COST&TIME	**-0.008869**	**0.003404**	**-2.605196**	**0.0092**
CUTCAUGHT	**0.044346**	**0.003853**	**11.50996**	**0.0000**
INC	-2.31E-06	1.50E-06	-1.532862	0.1253
ANTOTHER	**-0.023205**	**0.008652**	**-2.681928**	**0.0073**
TOTHRS	**0.004944**	**0.001722**	**2.870543**	**0.0041**
R-squared	0.615623	Current Catch Elasticity		.233
Std. Error of regression	8.743550			
Log likelihood	-132.3479			
Restricted Log likelihood	-213.9072			
LR statistic (5 d.o.f.)	**163.1184**			
Probability (LR statistic)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 34. South Fork 2 Cutthroat Trout Fishing TCM (Trip Purposes 1 & 2)

Dependent Variable: ANNUAL TRIPS Number of observations: 40				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.397288**	**0.144151**	**16.63036**	**0.0000**
TRAVEL COST&TIME	**-0.035863**	**0.005474**	**-6.552019**	**0.0000**
CUTCAUGHT	**0.096562**	**0.009473**	**10.19342**	**0.0000**
INC	1.42E-06	1.33E-06	1.061920	0.2883
ANTOTHER	**0.016357**	**0.006148**	**2.660667**	**0.0078**
TOTHRS	**-0.013376**	**0.004387**	**-3.048803**	**0.0023**
R-squared	0.366655	Current Catch Elasticity		.66
Std. Error of regression	14.98240			
Log likelihood	-281.5829			
Restricted Log likelihood	-452.0937			
LR statistic (5 d.o.f.)	**341.0216**			
Probability (LR statistic)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 35. South Fork 3 & 4 Cutthroat Trout Fishing TCM (Trip Purposes 1 & 2)

Dependent Variable: ANNUAL TRIPS
Number of observations: 20

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.994029**	**0.230939**	**8.634459**	**0.0000**
TRAVEL COST&TIME	**-0.061210**	**0.013882**	**-4.409342**	**0.0000**
CUTCAUGHT	**0.214431**	**0.049412**	**4.339639**	**0.0000**
INC	**6.01E-06**	**3.11E-06**	**1.934974**	**0.0530**
ANTOTHER	0.024735	0.020707	1.194525	0.2323
R-squared	0.486506	Current Catch Elasticity		.636
Std. Error of regression	7.630875			
Log likelihood	-70.08957			
Restricted Log likelihood	-133.7255			
LR statistic (4 d.o.f.)	**127.2719**			
Probability (LR statistic)	**0.000000**			

Table 36. Wyoming 2 and 3 Cutthroat Trout Fishing TCM (Trip Purposes 1 & 2)

Dependent Variable: ANNUAL TRIPS
Number of observations: 31

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.675903**	**0.282629**	**5.929682**	**0.0000**
TRAVEL COST&TIME	**-0.014840**	**0.003270**	**-4.538783**	**0.0000**
CUTCAUGHT	**0.032646**	**0.003838**	**8.506576**	**0.0000**
INC	-2.01E-06	2.27E-06	-0.885329	0.3760
ANTOTHER	0.003214	0.003476	0.924520	0.3552
R-squared	0.841388	Current Catch Elasticity		.13
Std. Error of regression	3.318716			
Log likelihood	-62.92048			
Restricted Log likelihood	-178.9506			
LR statistic (4 d.o.f.)	**232.0602**			
Probability (LR statistic)	**0.000000**			

Table 37. Wyoming 4 (Flat Creek) Cutthroat Trout Fishing TCM (Trip Purposes 1 & 2)

Dependent Variable: ANNUAL TRIPS Number of observations: 46 Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**3.541455**	**0.168568**	**21.00903**	**0.0000**
TRAVEL COST&TIME	**-0.008039**	**0.001437**	**-5.593101**	**0.0000**
CUTCAUGHT	**0.042022**	**0.025269**	**1.662996**	**0.0963**
INC	**-1.61E-05**	**2.15E-06**	**-7.472850**	**0.0000**
ANTOTHER	**-0.026632**	**0.015100**	**-1.763709**	**0.0778**
TOTHRS	-0.001624	0.001466	-1.107560	0.2681
R-squared	0.419491	Current Catch Elasticity		.138
Std. Error of regression	8.138943			
Log likelihood	-206.3382			
Restricted Log likelihood	-329.0961			
LR statistic (5 d.o.f.)	**245.5158**			
Probability (LR statistic)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 38 presents the net willingness to pay or consumer surplus calculated from the TCM demand models for cutthroat trout fishing. There is quite a bit of variation in the mean WTP, with South Fork 1 and Wyoming 4 (Flat Creek) having very high net willingness to pay in excess of current costs. The remainder of the South Fork river segments have a significantly lower value per angler day.

Table 38. Mean WTP Per Angler Day and 90% Confidence Intervals for Cutthroat Trout Fishing Estimated Using the Travel Cost Method

River Segment	Mean WTP	90% Lower CI	90% Upper CI
SF1	$100.22	$61.46	$271.33
SF2	$14.87	$11.89	$19.86
SF3-4	$15.41	$11.23	$24.58
WY2-3	$53.91	$39.57	$84.56
WY4	$124.39	$96.13	$176.21

4.7.2 Yellowstone Cutthroat Trout CVM analysis

Table 39 presents the contingent valuation method analysis of anglers who indicated in the survey they were fishing for cutthroat trout. As with the TCM analysis, South Fork 3 and 4 were pooled as was WY 2 and WY 3 because of the limited sample sizes.

Overall the logit equations all have negative and statistically significant bid coefficients at the 5% or 1% level except WY 2/3. CVM net willingness to pay per angler day of cutthroat trout fishing are similar to the TCM estimates of net willingness to pay for SF 1 and WY 4. For the other river segments, the mean CVM WTP to pay per angler day are generally higher than the TCM. As noted previously in part this is due to the CVM incorporating all types of cutthroat fishing trips including multiple destination and multiple purpose. Due to the statistical insignificance of the bid coefficient for WY 2/3, net WTP is not calculated.

Table 39. Contingent Valuation Logit Regression Results, WTP and Trip Characteristics for Cutthroat Trout Anglers on the South Fork of Snake River in Idaho (SF1-4) and Wyoming (WY2-WY4)

Variable	SF1	SF2	SF3-SF4	WY2&3	WY4
Constant (t-values)	**2.657 (2.95)*** **	**5.0379 (2.80)*** **	**4.436 (1.864)** **	**1.568 (2.878)*** **	**2.95 (2.486)*** **
Bid Coefficient	**-.004545 (-2.379***)**	**-.82855[a] (-2.530)*** **	**-.9713[a] (-2.155)** **	**-.001935 (-1.483)**	**-.4785[a] (-2.089)** **
McFadden R^2	.23	.186	.263	.05	.075
Mean net WTP per angler day	**$104.03**	**$90.25**	**$47.83**	**Bid n.s.**	**$149.29**
90% Lower CI	$76	$44	4.23		$50.22
90% Upper CI	$211	$499	$125		$6644
# in group	1.96	2.377	1.90	2.0	1.77
Trip length	2.86	2.038	1.06	2.1	1.8

*, **, and *** indicates significant at the 10%, 5% and 1% levels, respectively.
a. This equation uses the natural log of the bid amount.

Using CVM, the marginal value or incremental net willingness to pay of catching one more cutthroat trout can be estimated from the CVM logit model adding cutthroat trout caught as an independent variable. Due to the relatively small samples in terms of the number of cutthroat trout anglers at each river segment, the data was pooled across the South Fork segments 1-4 and Wyoming sections (WY2-WY4). As shown below in Table 40, the number of cutthroat caught is statistically significant at the 10% level. Dividing the coefficient on CUTCAUGHT by the coefficient on BID, yields a marginal value of $22.45 per cutthroat trout, very similar to what was previously obtained for the South Fork for trout overall.

The usefulness of this information for management purposes relates to comparing these incremental benefits to the cost of increasing the number of cutthroat trout. For example, stream habitat improvement projects or maintaining instream flows at critical times to increase spawning or overwintering of cutthroat trout may have significant costs. But if biologists can estimate the number of additional cutthroat trout that would be grow to catchable size, the number of times each adult cutthroat trout are caught, then this product can be multiplied by $22.45 per adult fish to arrive at a rough estimate of the benefits.

Table 40. Pooled CVM Logit Equation to Estimate Marginal Value Per Cutthroat Trout Caught at the South Fork in Idaho (SF1-4) and Wyoming (WY2-4).

Dependent Variable: YESPAY Number of observations: 179 Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**1.068697**	**0.270734**	**3.947410**	**0.0001**
BID	**-0.002468**	**0.000621**	**-3.971392**	**0.0001**
CUTCAUGHT	**0.055415**	**0.031680**	**1.749223**	**0.0803**
Mean dependent variable	0.659218	Std. Error of Regression		0.451190
Log likelihood	-104.2070			
Restr. log likelihood	-114.8380			
LR statistic (2 d.o.f.)	**21.26185**	McFadden R-squared		0.092573
Probability (LR statistic)	**2.42E-05**			
Observations Dependent=0	61	Total observations		179
Observations Dependent=1	118			

Bold indicates statistically significant variables at the 10% level or better.

4.7.3. Annual Net Economic Value of Cutthroat Trout Fishing

Table 41 presents the annual economic value of cutthroat trout fishing on the South Fork and Teton County Wyoming stretches of the Snake River, including the Flat Creek tributary (WY 4). There is a good match in value per day between TCM and CVM for South Fork 1 ($100 for TCM vs $104 for CVM) and Wyoming 4 ($124 for TCM vs $149) for CVM. However, TCM yields lower values per angler day for South Fork 2 and South Fork 3/ 4. As noted previously, in part the higher value estimates from CVM may be due to CVM valuing all trips, including multiple destination trips, which tend to yield higher net WTP.

Using just the TCM estimates suggests that cutthroat trout fishing provides annual net economic value of $13.3 million. Using the CVM estimates for SF 1- 4, WY 4 and using the TCM estimate of WY 2/3 (because of the statistical insignificance of the CVM bid coefficient) yields an estimate of $20.5 million for the seven river segments that support cutthroat trout fishing.

Table 41. Estimated Net Economic Value of Yellowstone Cutthroat Trout (YCT) Fishing Estimated Using TCM and CVM

River Segment	Estimated Angler Days Targeting YCT	TCM Value per Day	Estimated Annual Value	CVM Value per Day	Estimated Annual Value
SF1	62,640	$100.22	$6,278,047	$104.03	$6,516,439
SF2	82,618	$14.87	$1,228,646	$90.25	$7,456,275
SF3/4	13,267	$15.41	$204,510	$47.83	$634,561
WY2/3	73,895	$53.91	$3,983,558	N/A	N/A
WY4 (Flat Creek)	12,916	$124.39	$1,606,667	$149.29	$1,928,230
TOTAL	**245,336**		**$13,301,428**		**$20,519,062 ***

* Calculated using TCM value for WY 2/ 3

Chapter 5
Results of Statistical Analysis of Boater Demand and Net Economic Value using TCM and CVM

5.1 Henry's Fork and South Fork in Southeast Idaho

Chapter Highlights:
Net Economic Value of Boating to Visitors is:

- Henry's Fork: $64 per day for an annual total of $.5 million
- South Fork: $135 per angler day for an annual total of $1.5 million
- SW Wyoming: $129 per day for an annual total of $16 million

The Henry's Fork and South Fork also attract thousands of visitors who are not fishing, but are drawn by the natural beauty, the river and the opportunities for boating such as rafting and kayaking. Table 42 presents the net WTP per visitor day as estimated using the contingent valuation method (CVM). For the purposes of this report a visitor day is a person visiting for all or part of a day, rather than a standardized 8 or 12 hour day as used by some federal agencies.

Table 42. Results of CVM Logit Model and WTP Estimates for Visitors to the Henry's Fork and South Fork.

Variable	Henry's Fork Sites (2-4)	South Fork Sites (1-4)
Constant (t-values)	.44154 (.97)	.956 (1.63)*
Bid Coefficient	-.002934 (-1.576)	-.003548 (-1.63)*
McFadden R^2	.076	.13
Mean net WTP per visitor day	$64.29	$134.79

*, **, and *** indicates significant at the 10%, 5% and 1% levels, respectively.

As can be seen from Table 42 the mean net economic values (net WTP) values for recreation on the Henry's Fork and South Fork are sizeable.

Table 43 and 44 present the results of the Travel Cost Method demand models for non fishing visitors to Henry's Fork sites 2-4 (essentially the river segments) and the South Fork Sites 1-4. The travel cost coefficient is statistically significant at the 1% and 10% levels, respectively for the two equations. Both of the overall equations are statistically significant at the 1% level as judged by the likelihood ratio statistic. The R square indicates a fairly high explanatory power of the equation with nearly half the variation in trips to the Henry's Fork explained by the TCM regression equation. The TCM regression equation explains more than half of the variation in trips to the South Fork.

Table 43. Travel Cost Method Demand Model for Visitors to Henry's Fork Sites 2-4

Dependent Variable: ANNUAL TRIPS
Number of observations: 28

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.250684**	**0.173994**	**12.93544**	**0.0000**
TRAVEL COST&TIME	**-0.049853**	**0.007520**	**-6.629729**	**0.0000**
INC	4.04E-07	2.49E-06	0.161757	0.8715
ANTOTHER	**0.098461**	**0.019796**	**4.973819**	**0.0000**
R-squared	0.4766	Net WTP per Visitor Day=		$17.00
Std. Error of regression	6.2403	Lower 90% CI=		$13.63
Log likelihood	-116.13	Upper 90% CI =		$22.59
Restricted log likelihood	-175.56			
LR statistic (3 d.o.f.)	**118.86**			
Probability (LR statistic)	**0.0000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 44. Travel Cost Method Demand Model for Visitors to South Fork Sites 1-4

Dependent Variable: ANNUAL TRIPS
Number of observations: 18

Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.439429**	**0.316612**	**7.704791**	**0.0000**
TRAVEL COST&TIME	**-0.004225**	**0.002575**	**-1.640698**	**0.1009**
INC	**-2.11E-05**	**4.26E-06**	**-4.941550**	**0.0000**
ANTOTHER	**0.054681**	**0.021533**	**2.539391**	**0.0111**
R-squared	0.565	Net WTP per Visitor Day=		$236.68
Std Error of regression	4.540	Lower 90% CI=		$118.19
Log likelihood	-54.797	Upper 90% CI =		N/A
Restricted log likelihood	-85.615			
LR statistic (3 d.o.f.)	**61.635**			
Probability (LR statistic)	**2.63E-13**			

Bold indicates statistically significant variables at the 10% level or better.

The net WTP per visitor day for the Henry's Fork as estimated by the TCM at $17 per day is quite a bit less than for CVM estimate at $64 per day. However, the TCM estimate for the South Fork is substantially larger at $236 per day than the CVM estimates of $134 per visitor day.

Nonetheless, the net economic value to non-fishing visitors to the Henry's Fork estimated by CVM is more than a half million dollars annually. The net economic value of non-fishing rafting, kayaking and other non-fishing related recreation on the South Fork is

between $2.6 million (TCM) and $1.5 million (CVM) annually. This is a sizeable economic value per day and per season on the South Fork.

Table 45. Range of Net Economic Value to Visitors to Henry's Fork and South Fork in Idaho.

	Total Other Visitor Days	TCM Value per Day	Total Season Value	CVM Value per Day	Total Season Value
Henry's Fork	9,123	$17.00	$ 155,091	$64.29	$586,527
South Fork	10,976	$236.68	$2,597,800	$134.79	$1,479,455
Total	20,099		$2,752,891		$2,065,982

Section 5.2 Snake River in Teton County Wyoming

The Snake River at the Moose Junction area in the southern section of Grand Teton National Park (WY1) and running through Jackson Hole to South Park Bridge (WY2) is a popular day use boating stretch. This section of the river is used by private and commercial rafters and well as kayakers. This stretch is marketed for "scenic float" trips as the backdrop of the Tetons and the opportunity to see wildlife(including bald eagles) along the river provides a high quality and relaxing float trip. From South Park Bridge to the town of Alpine (WY3) is a very popular whitewater section of the Snake River. Several commercial rafting companies run day-use trips through the steep-walled canyon section, and it is also very popular with private rafters and kayakers.

Table 46 presents the net willingness to pay or net economic value of boating in these two sections as estimated by the TCM. The travel cost coefficient is statistically significant in both models. The net WTP per day is $10 a day for the upper Snake River in WY 1 and WY 2. The consumer surplus for the South Park Bridge to Alpine section (sometimes called the Canyon section) is $29 per day. We believe the relatively low value per day for the upper Snake River (WY 1/2) is in part due to TCM demand estimation having to omit many non local visitors who were on multiple destination trips, and focus primarily on the locals. This limitation is overcome using the CVM displayed below.

Table 46. TCM Demand Equation for WY1 and WY2 Boaters

Dependent Variable: ANNUAL TRIPS Number of observations: 38				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**4.443979**	**0.634674**	**7.001990**	**0.0000**
TRAVEL COST&TIME	**-0.097472**	**0.026442**	**-3.686311**	**0.0002**
INC	**-1.18E-05**	**4.05E-06**	**-2.926669**	**0.0034**
ANTOTHER	**-0.137276**	**0.057006**	**-2.408121**	**0.0160**
R-squared	0.576947	Mean WTP per Day		$10.26
S.E. of regression	2.334225	Lower 90% CI		$7.09
Log likelihood	-30.49685	Upper 90% CI		$18.53
Restr. Log likelihood	-95.56877			
LR statistic (3 d.o.f.)	**130.1438**			
Probability (LR stat)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 47. TCM Demand Equation for WY 3 Boaters

Dependent Variable: ANNUAL TRIPS Number of observations: 71				
Variable	Coefficient	Std. Error	z-Statistic	Probability
Constant	**2.677814**	**0.163837**	**16.34437**	**0.0000**
TRAVEL COST&TIME	**-0.034148**	**0.003911**	**-8.730411**	**0.0000**
INC	**-5.21E-06**	**1.90E-06**	**-2.744909**	**0.0061**
ANTOTHER	-0.003273	0.006550	-0.499729	0.6173
R-squared	0.189606	Mean WTP per Day		$29.28
S.E. of regression	6.030623	Lower 90% CI		$24.64
Log likelihood	-210.1494	Upper 90% CI		$36.08
Restr. Log likelihood	-307.8272			
LR statistic (3 d.o.f.)	**195.3555**			
Probability (LR stat)	**0.000000**			

Bold indicates statistically significant variables at the 10% level or better.

Table 48 presents the net willingness to pay or net economic value of boating in these two sections as estimated by CVM. Since CVM can value all three types of trips (single purpose, equal purpose and incidental trips) it is applied to value all of them. The value for the upper Snake River covering the southern part of Grand Teton National Park (WY 1) through the Wilson bridge to South Park Bridge (WY 2) has a very high value per day trip of $278. This is substantially larger than the TCM value, which in part may be due to the relatively high value of multiple destination trips in this reach of the river (Loomis, forthcoming, 2005). The net WTP for WY 3 from whitewater section from South Park Bridge to Alpine has a relatively high value as well at $81.45 per day.

Table 48. Results of CVM Logit Model and WTP Estimates for Rafters/Kayakers to the Snake River in Teton County, Wyoming.

Variable	WY1-2	WY3
Constant (t-values)	2.4737 (4.51)***	1.8118 (5.58)***
Bid Coefficient	-.002803 (-2.621)	-.004371 (-4.72)***
McFadden R^2	.122	.22
Mean net WTP per visitor day	$278.70	$81.45
90% Lower CI	$198.11	$62.74
90% Upper CI	$555.84	$109.82

Table 49 presents the annual net economic value for WY 1/WY 2 and WY 3 estimated using TCM and CVM. As with several other analyses in this report the TCM provides a lower value than CVM. The annual net economic value is estimated at $3.1 million using TCM values per day and $16.2 million annually using values derived from CVM.

Table 49. Annual Net Economic Value of Rafting, Kayaking and Other River Based Recreation on the Snake River in Teton County, Wyoming Estimated Using TCM and CVM.

River Segments	Visitor Days	TCM Value Per Day	Total TCM Value	CVM Value Per day	Total CVM Value
WY1 & WY2	30,190	$10.26	$309,730	$278.70	$8,413,953
WY3	95,314	$29.28	$2,791,203	$81.45	$7,763,325
Total	125,504		$3,100,933		$16,177,278

Chapter 6
Regional Economic Effects of Angler and Boater Spending on the Economies of Southeastern Idaho and Teton County Wyoming.

Chapter Highlights:

Current Jobs and Income Related to Fishing on the Snake River in Southeast Idaho and Southwest Wyoming based on May –September sampling.

River	Current Jobs	Current Income
Henry's Fork	851	$29 million
South Fork	341	$12. million
SW Wyoming	268	$ 5.5 million
Totals	**1460**	**$46 million**

- 5.0 jobs per 1000 angler days on the Henry's Fork
- 1.7 jobs per 1000 angler days on the South Fork
- 2.8 jobs per 1000 angler days on the Snake River in southwest Wyoming.

Current Jobs and Income Related to Boating & General Recreation on the Snake River in Southeast Idaho and Southwest Wyoming.

River	Current Jobs	Current Income
Henry's Fork/ So. Fork	22	$796,208
SW Wyoming	538	$10.9 million
Totals	**560**	**$11.7 million**

Section 6.1 Description of the Southeast Idaho Economy

To analyze the economic impact on the region from recreational expenditures occurring on the South Fork of the Snake River and the Henrys Fork, six counties adjacent to these river reaches were selected: Bingham, Bonneville, Fremont, Jefferson, Madison, and Teton. The total population of these counties was 193,823 in 2002 and is 14.5% of the states total population of 1.3 million.

Table 50. Six County Population

County	2002 Population	Percent of Regional Population
Bingham	42,458	21.9%
Bonneville	85,180	43.9%
Fremont	11,859	6.1%
Jefferson	19,781	10.2%
Madison	27,686	14.3%
Teton	6,859	3.5%
TOTAL	193,823	

As can be seen in Table 50 above two-thirds of the population resides in Bingham and Bonneville counties with the City of Idaho Falls accounting for more than a quarter with a 2002 population of 50,730. While the six county region has the reputation as a rural farm economy the major employer in the region is the federal government at the Idaho Nuclear Laboratory (INL; formally the INEEL). This facility employment is more than 2,500 and has provided a stable economic base for the area and has caused numerous spin-off businesses. The second largest employer of the region is Melaleuca, Inc.. This firm produces cosmetics, vitamins, and soaps that are sold worldwide, and it employs 1,300 people. Brigham Young University – Idaho, located in Rexburg (Madison County) has an enrollment of over 11,000 and employs 1,122. The region does have a strong agriculture economic base, with over 7% of those employed engaged in farming. Idaho's famous potatoes are the major cash crop of the six county area.

Table 51. 2001 Per Capita Income of the Six County Area

County	2001 Per Capita Personal Income
Bingham	$19,340
Bonneville	$24,806
Fremont	$16,759
Jefferson	$19,975
Madison	$14,319
Teton	$15,919
Idaho	$24,506
United States	$30,438

Per Capita personal income of the regions is relativity low with only Bonneville County exceeding – slightly -- the state level. The state as a whole has relatively low per capita income and is only 80% of the national average.

Table 52. Industry Breakdown of Full Time and Part Time Employment for Six County Region, 2000.

	Six Southeast Idaho Counties	
Industry	# Jobs	% of County Total
Total farm	7,448	7.35%
Total nonfarm	93,844	92.65%
Ag. Services, forestry, fishing	2,217	2.19%
Mining	D*	---
Construction	7,321	7.23%
Manufacturing	7,048	6.96%
Transport/utilities	3,262	3.22%
Wholesale trade	7,877	7.78%
Retail trade	17,734	17.51%
Insurance/real estate	4,369	4.31%
Services	30,570	30.18%
Government	13,446	13.27%
Total full-time and part time employment	**101,292**	

*(D) not shown to avoid disclosure of confidential information, but the estimates for this are included in the totals.

This area is the gateway to Yellowstone National and Grand Teton National Parks, with the regional airport being located in Idaho Falls. This, along with world class fly fishing on the South Fork of the Snake River and the Henrys Fork, has created an economy bolstered by recreation activity, especially in areas near the Wyoming border. This area has become a bedroom community for rapidly growing Jackson Hole, Wyoming, as well as a recreation magnet for its mostly wealthy residents. The traditional economic base of the region has been natural resource industries, primarily timber, mining, and agriculture. However, the region is evolving into a more recreation based economy.

6.2 Southeast Idaho Input-Out Model

The input-output model used to measure the impact of recreational expenditures was originally developed by M. Henry Robison at the University of Idaho, supported through a grant from the Bureau of Land Management. [1] He has updated the model parameters for the six counties that are the focus of this study. This model uses traditional input-output methodology from IMPLAN and is 'ground truthed' with recent county data applicable to the six county region.

These models were selected for use in this analysis for two reasons. First, they were the best available source of current economic data at the community level. Second, the input-output model contains the most up-to-date data on counties affected directly by recreational expenditures. However, the input-output method is not without its drawbacks. It is static, rather than dynamic, providing a snap-shot of the economy at one point in time, even though the economy is really in constant change.

Change is especially the rule in the counties that are the focus of this study--which largely derive their economic health from the surrounding natural resources. Therefore, a major drawback of input-output analysis is its focus on the economic structure of the past, rather than on the economy's current state or the current trend. It tends to *underestimate* the real economic impact of recreational activities, because the infrastructure and support industries in these communities were developed to support traditional economic activities. As the economics shift from their traditional extractive nature to a more recreational base industries that support structure for this activity will grow. This, in turn, will mean more of the dollars expended on recreation will remain in the communities -- creating even greater economic activity. In economic terms it would mean higher multipliers for recreational activities and hence, larger secondary impacts.

6.3 Southeast Idaho Six County Visitor Trip Spending Regional Economic Effects

The first step in the analysis was to split the survey sample into local v. non-local trips. Local was defined as those residents who reside in the six county Idaho region (Bingham, Bonneville, Fremont, Jefferson, Madison, and Teton) plus residents of Teton and Lincoln counties in Wyoming. Non-local trips were split into fishing on the South Fork, fishing on the Henry's Fork, and those who engaged in recreational activities other than fishing.

Table 53 below shows the percentage of local and non-local visitors and the corresponding number of local and non local angler visitor trips based on the survey results.

[1] A Social, Economic and Fiscal Analysis of Custer and Lemhi Counties, Idaho: And Models, Technical Report in Fulfillment of Cooperative Agreement, No. D-040-A-2-006, March 1994.

Table 53. Number and Percentage of Local and Non Local Anglers

	Henry's Fork		South Fork	
	Percent of respondents	Visitor Trips	Percent of respondents	Visitor Trips
Total Angler Visitor Trips		**31,721**		**39,497**
Non Local Anglers	48.02%	15,232	19.12%	7,552
Local Anglers	51.98%	16,489	80.88%	31,945
Total Non Angler Visitor Trips		**1,823**		**2,064**
Non local Non Anglers	25.97%	473	30.53%	630
Local Non Anglers	74.03%	1,350	69.47%	1,434

However, the number of trips can be misleading, for spending by anglers and non-anglers alike. As one would expect, the hours of effort at the main site are significantly higher for local residents than for non-local residents. For the Henrys Fork 78.7% of the main site hours were non-local, for the South Fork non-local were 41.1% of the total. And for non-anglers non-local hours were close to the trip percentages at 30.67%. Trip expenditures are adjusted by these amounts for use in the input-output calculations.

In order to account for the differing motivations for visitor spending or coming to the South Fork or Henrys Fork it is important to note overall trip purpose. To account for this we stratified visitors by their primary trip purpose (Table 54).

Table 54. Breakdown of non local survey respondents by trip purpose

	Henry's Fork	South Fork
Non Local Anglers		
Primary	67.60%	73.21%
Equal	29.61%	19.64%
Incidental	2.79%	7.15%
Non Local Non Anglers		
Primary	13.33%	16.67%
Equal	66.67%	66.66%
Incidental	20.00%	16.67%

Table 55 below shows trip expenditures for anglers in the Henry's Fork and the South Fork and for non-angler non-local spending in the six county area. Airfares are excluded from the analysis because they will have no or very little local economic impact (airfare is purchased in the non-residents home town, outside the region). These trip expenditures are in line with and somewhat lower than those found in other studies. For example the *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Idaho* published by the U.S. Departments of Interior and Commerce, found fishing expenditures by U.S. residents in the state to be $718 per trip. Non-angler expenditures are significantly lower than that for individuals whose main purpose was to fish. The Henry's Fork has only slightly higher per trip values than the South Fork of the Snake River.

Table 55. Average Visitor Spending per Trip of Anglers and Visitors to the Six County Area

	Henry's Fork Anglers	South Fork Anglers	Non-Anglers
Gas & oil for Auto &/or Boat	$26.42	$25.36	$43.50
Restaurants	$28.28	$27.05	$44.00
Grocery Stores	$32.78	$29.32	$28.50
Supplies/fishing tackle/other retail	$35.34	$31.54	$12.00
Camping on Public Lands	$40.49	$34.78	$0.00
Camping on Private Lands	$40.83	$35.08	$0.00
Hotel/motel	$41.27	$35.98	$127.70
Equipment rental	$50.92	$47.75	$0.00
Guide fees	$51.39	$48.73	$0.00
Fishing License & Entrance Fees	$62.58	$62.43	$14.90
Launching & Shuttle Fees	$64.74	$64.55	$2.60
Rental Car	$64.98	$65.31	$98.00
Other (misc. supplies)	$72.62	$73.26	$72.62
Total Spending per Trip	**$612.65**	**$581.14**	**$443.82**

Table 56 shows the economic impacts associated with the Henry's Fork and South Fork of the Snake River angler visitation. These tables show the direct impact, the indirect impact (e.g., the multiplier effect), and the summed total impact of income and jobs. Note this reflects just spending in the region by non-residents, since it is non-resident spending that represents an inflow of new money into the region (i.e., export demand).

Table 56. Economic Impacts of Non Local Angler Spending on the Six County Region

Six County Area	HF Angler	SF Angler	Non-Angler
Number of Non Local Visitor Days	80,989	37,513	1,189
Direct Effects			
Income ($/year)	$17,593,736	$7,294,027	$511,905
Jobs	518	207	14
Indirect and Induced Effects			
Income ($/year)	$11,299,442	$4,742,644	$284,303
Jobs	333	134	8
Total Effects			
Income ($/year)	$28,893,178	$12,036,671	$796,208
Income Multiplier	1.64	1.65	1.56
Jobs	851	341	22
Jobs Multiplier	1.64	1.65	1.56

The income and jobs multipliers for recreation in Southeast Idaho average 1.6, meaning that each initial dollar of income or each direct job creates another .6 jobs indirectly through spending and re-spending of money in the local economy.

Expenditures from anglers on the Henry's Fork have the highest impact on the six county region supporting 851 jobs and an annual economic impact of $29.0 million. The South Fork also has a major economic contribution to the region effecting 341 jobs and $12 million in total spending from both direct and indirect impacts.

To facilitate application of these results to calculating job effects associated with increases and decreases in angler days, we can express these effects in terms of jobs per 1000 angler days. For the Henry Fork this is 5.4 jobs per 1000 angler days, 5.0 jobs per 1000 angler days on the South Fork.

As the economy evolves from its traditional natural resource base of timber, mining, and agriculture into a more recreation based economy the recreation multiplier can be expected to increase meaning angler and non-angler impacts on the region can be expected to be greater.

This table summarizes the gain in income and employment at the Henry's Fork (HF) and South Fork (SF) with doubling fish catch and increasing size of fish caught. As is indicated in the table there is a potential for significant increases in income and

employment in Southeast Idaho with improvements in fishing quality.

Table 57 Change in Income and Employment with Doubling of Fish Catch and 25% Increase in Fish Size

	Existing	Double Catch	Gain for 2X Catch	+25% size	Gain for +25% Size
HF Income	$28.9 million	$48.7 million	$19.8 million	$48.8 million	$19.9 million
SF Income	$12.0 million	$19.2 million	$7.2 million	$19.0 million	$7.0 million
HF Jobs	851	1435	584	1438	587
SF Jobs	341	543	202	539	198

6.4. Description of the Teton County Wyoming and Idaho Economy

For analyzing the regional economic effects of fishing and rafting on the Wyoming portions of the Snake River, we used Teton County Wyoming (which includes the town of Jackson, which is a primary destination for visitor services such as hotels, restaurants, guide services, etc). Partly because of its scenic and recreational activities, Teton County's year round population has increased several fold between 1960 and 2000. Approximately 97% of Teton County's total land area is managed by the federal government leaving only 3% of the county's land base under private ownership. As a result of the high amenity and limited land, the cost of housing in Teton County has skyrocketed. Due to this high cost of living in Jackson, a large percentage of Jackson's tourism-based service and trade industry workforce live in communities outside of Teton County and commute to work in Jackson. The towns of Victor and Driggs, located in Teton County, Idaho have been the most affected by this trend. In order to capture tourist spending in Jackson and the respending of the large percentage of tourism industry workers' salaries that live in Victor and Driggs, Teton County, Wyoming and Teton County, Idaho were chosen to represent the local economy.

The 2000 Census estimated total population for the local economy (Teton County WY and ID) at 24,250 persons. Seventy five percent (18,251 persons) lived in Teton County, WY, and 25% (5,999 persons) lived in Teton County, ID. In 2000, total full and part-time employment for the local economy was estimated at 25,607 jobs; 89% (22,828 jobs) were in Teton County, WY and 11% (2,779 jobs) were in Teton County, ID (BEA 2002). Given that there are more jobs in Teton County, WY than there are people, and that Teton County, Idaho accounts for 25% of the local population but for only 11% of the local jobs, it is reasonable to include Teton County, Idaho as part of the local Jackson economy.

According to the Jackson Hole Almanac, tourism, investments, professional services, real estate, and construction are the major components of the Teton County, Wyoming economy. Local and regional employment for 2000 is shown in Table 57. Most jobs pertaining to the recreation and tourism industry are found in the retail trade (spending on supplies, souvenirs, restaurants, and grocery stores) and service (spending on hotels, gas stations, amusement, and recreation activities) sectors in an economy. Over 55% of the private sector jobs in Teton County, WY and ID are retail trade or service-based, thus the local economy is highly dependent on tourism for its private job base.

Table 57. Industry Breakdown of Full Time and Part Time Employment for Teton County WY & ID, 2000.

Industry	Teton County WY and ID	
	# Jobs	% of County Total
Total farm	610	2.4%
Total nonfarm	24,997	97.6%
Private	22,486	87.8%
Ag. Services, forestry, fishing	580	2.3%
Mining	D*	---
Construction	3,534	13.8%
Manufacturing	639	2.5%
Transport/utilities	659	2.6%
Wholesale trade	D*	---
Retail trade	4,737	18.5%
Insurance/real estate	2,566	10.0%
Services	9,382	36.6%
Government	2,511	9.8%
Total full-time and part time employment	**25,607**	

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002. *(D) not shown to avoid disclosure of confidential information, but the estimates for this are included in the totals.

According to the U.S. Dept. of Commerce (2002), while service and retail trade accounted for over 55% of total local employment in 2000, these industries only accounted for 32% of local income. With the increased technological flexibility to work from remote locations starting in the 1990s, many of Jackson's new residents brought their wealth with them in the form of income from investments, or by providing personal services (Charture Institute 2003). Therefore, Jackson's attractiveness as a place to live has become a bigger economic driver in terms of growth in population and personal income than the tourism industry (Charture Institute 2003). Table 58 shows local, regional, and national per capita personal income for 2000. In 2000, average per capita personal income in Teton County, Wyoming was well over $20,000 higher than the state or national average (U.S. Dept. of Commerce, 2002).

Table 58. Personal Income for Teton County WY and ID, and Wyoming, 2000.

	Teton County Wyoming	Teton County Idaho	State of Wyoming	United States
Per capita personal income	$52,640	$15,577	$27,941	$29,760

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002.

6.4 Southwestern Wyoming Regional Economic Effects

Natural and scenic resource issues have a direct and profound effect on the economic well-being of both Teton counties. Both employment and taxable sales receipts in the local economy are dominated by the retail and service sectors, fueled primarily by tourist activities. Tourism is dominated by summer visitation revenue sources followed by winter visitation and, to a far lesser degree, "shoulder-season" (spring or fall) tourism. Annual summer visits to nearby Grand Teton National Park range between 1-1.5 million visitors with substantial visitation to the Snake River downstream of the Park where use is on unregulated land administered by the Bureau of Land Management and, further downstream, on National Forest land.

Spending associated with river recreation such as fishing and rafting generates considerable economic effects for the local and regional economy. Thus, river and water management activities related to the management of upstream reservoirs can impact local and regional visitation and hence spending by visitors and fishing and rafting guides.

A tourist usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, food, supplies, and recreational equipment rental. As more visitors come to an area, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from visitor purchases from local businesses represent the *direct* effects of visitor spending within the economy. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of visitor spending within the county. The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The indirect and induced effects are known as the secondary effects of visitor spending. These secondary effects are often referred to as the "multiplier effect". The sums of the direct and secondary effects describe the total economic impact of visitor spending in the local economy.

The visitor survey results were used to estimate Snake River visitor spending per day to determine the economic impacts associated with current fishing and rafting visitation. Economic impacts are typically measured in terms of number of jobs and income supported.

Economic input-output models are commonly used to predict the total level of regional economic activity that would result from a change in visitor spending. For Teton County, Wyoming and Idaho, the IMPLAN modeling software was used to analyze the economic impacts associated with current Snake River visitor spending. IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving as many as 528 sectors (Olson and Lindall, 1996).

Defining the Local Economic Region

A region (and its economy) is typically defined as all counties within a 30-60 mile radius of the travel destination. Only spending that takes place within this local area is included as stimulating the changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. The town of Jackson Hole, Teton County Wyoming, is the primary area providing visitor support services such as hotels, restaurants and guides for visitors to Wyoming sections (WY2, WY3 and WY4) of the Snake River.

Details of the Regional Economic Impact Model

IMPLAN state and county data profiles for the year 2000 were used in this study. The IMPLAN county level employment data were adjusted with the US Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System (REIS) data at the 1 digit Standard Industrial Code (SIC) level for the year 2000. The IMPLAN state level employment data were adjusted with the 2000 REIS data at the 2 digit SIC level. Total value added and total industry output data were scaled proportionally with employment changes in the model. U.S. Census Bureau, Census of Retail Trade data were used to further check personal income for the key industries in the state model. IMPLAN's regional purchase coefficients were adjusted to better reflect typical spending patterns between locals and non-locals.

To facilitate the local economic impact analysis, the Snake River rafters and anglers were first split between locals (e.g., residents of Teton County WY and ID) and those living outside of Teton County WY and ID (hereafter referred to as non-locals). The reason for this split is two fold. First, Teton counties, WY and ID are the main focus of our impact analysis. It is the impact area. Money flowing into Teton counties, WY and ID from outside is considered new money injected into that economy. Second, if Teton County, WY and ID residents visit the Snake River more or less due to the management changes, they will correspondingly change their spending of their money elsewhere in Teton County, WY and ID, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level.

Table 59 shows the percentage of local and non-local visitors and the corresponding number of local and non local angler and boater visitor days based on the survey results.

Table 59. Number and Percentage of Local and Non-local Anglers and Rafters.

	WY2		WY3		WY4	
	Percent of respondents	Visitor days	Percent of respondents	Visitor days	Percent of respondents	Visitor days
Total Angler Visitor Days		**55,354**		**25,532**		**14,677**
Non Local Anglers	77.3%	42,774	86.4%	22,050	59.0%	8,662
Local Anglers	22.7%	12,580	13.6%	3,482	41.0%	6,015
Total Boater Visitor Days		**30,190**		**95,314**		
Non local Boaters	85.2%	25,717	90.8%	86,577		
Local Boaters	14.8%	4,473	9.2%	8,737		

Accounting for Trip Purpose in Regional Economic Analysis

When allocating visitor spending, it is important to account for the differing motivations visitors have for coming to Jackson Hole, and the importance of fishing and/or boating on the Snake River in relation to the overall trip purpose. To account for this we stratified visitors by their primary trip purpose (Table 60).

Table 60. Breakdown of non local survey respondents by trip purpose

	WY 2	WY3	WY4
Non Local Anglers			
Primary	17.6%	36.8%	25.0%
Equal	67.6%	47.4%	61.1%
Incidental	14.7%	15.8%	13.9%
Non Local Boaters			
Primary	4.3%	37.6%	
Equal	67.4%	42.2%	
Incidental	28.3%	20.2%	

To estimate the number of days spent in the Jackson Hole area during their trip we used the following guidelines: For primary trip purpose anglers and boaters, the total time at river segments was assumed to be their time in Jackson Hole. If the reported time was less than eight hours, it was assumed the respondent spent 1 day in the Jackson area. For equal and incidental trip purpose Snake River anglers, we used the average length of stay in Jackson of equal trip purpose visitors that participated in fishing activities from a survey of Grand Teton National Park summer non local visitors (4.71 days) in 2002 (Loomis and Caughlan, 2004). Similarly, for equal and incidental Snake River rafters, we used the average length of stay of equal trip purpose visitors that participated in boating activities from the Grand Teton National Park survey of summer non local visitor data (4.32 days). For equal and incidental Snake River anglers that reported a total time spent on river segments longer than 4.71 days (and boaters spending more than 4.32 days), their total time spent on river segments was used as their total time in Jackson. It is assumed that average trip length for the Snake River anglers/boaters would be the same as the Grand Teton National Park anglers/boaters because the Snake River runs through Grand Teton National Park and there is no reason to believe anglers/boaters in the Park would be different to those outside the Park.

Table 61. Trip Profiles of Primary Purpose, Equal Purpose and Incidental Anglers and Boaters

	WY2 Anglers			WY3 Anglers			WY4 Anglers		
	Primary	Equal	Incidental	Primary	Equal	Incidental	Primary	Equal	Incidental
Days spent at the river segment	1.8	1.8	1.2	5.0	1.8	2.9	6.2	3.4	0.6
Days spent in the Jackson Hole area	1.8	4.8	4.7	5.0	5.3	4.8	6.2	5.9	4.7
	WY2 Boaters			**WY3 Boaters**					
	Primary	Equal	Incidental	Primary	Equal	Incidental			
Days spent at the river segment	1.0	0.8	0.6	1.6	1.0	0.4			
Days spent in the Jackson Hole area	1.0	4.3	4.3	1.6	4.4	4.3			

Calculating Current Expenditures per Angler and Visitor Day
For each respondent, expenditures were divided by the number of days spent in the Jackson Hole area to determine the total spending per day per group. This was then divided by the number of persons in group that shared expenses to determine the spending per day per person for each respondent. The average spending per person per day was calculated for anglers and boaters by trip purpose (primary, equal, and incidental) for each river segment.

An overall average spending profile was created for anglers and boaters for each river segment that accounted of the proportion of number of visitor days and spending for each trip purpose. This is a weighted average, where the weights are the proportion of visitors on each type of trip. For example, of WY 2 Anglers, 17.6% are primary trip purpose visitors, 67.6% are equal trip purpose, and 14.7% are incidental visitors. To determine the average amount of spending and the resulting economic impacts associated with WY 2 anglers, the following formula was used to calculate an overall weighted average spending per angler day:

> WY 2 Angler Average Spending per Person per Day = 17.6%*(WY 2 angler *primary* purpose average spending per person per day) + 67.6%*(WY 2 angler *equal* purpose average spending per person per day) + 14.7%*(WY 2 angler *incidental* purpose average spending per person per day).

Table 62 shows the average amount spent locally in the Jackson area by non-local anglers and boaters by river segment. The amounts of local spending in Teton County are the average expenditures non-local anglers and boaters (living outside Teton County, WY and ID) reported spending in the Jackson Hole area. Not every group had expenditures in every category, so these numbers represent an average across all visitors, including some who had no expenditure in that category. The average expenditures reported in each

category were divided by the average number of persons in each group sharing the expenses and then divided by the average number of days spent in the Jackson Hole area to determine the average spending per person per day for each trip purpose.

The expenditures in Teton County are fairly sizeable, even on a per person per day basis. In particular, anglers spend $168 per person per day on WY#2 and $136 per person per day fishing WY#4 (Flat Creek). Boaters (rafters/kayakers) on WY#2 spend slightly more than $110 per day while rafters on the popular WY #3 spend about $84 per person per day.

Table 62. Average Visitor Spending of Anglers and Visitors to the Wyoming Sections of the Snake River

	WY 2 Anglers	**WY 3 Anglers**	**WY 4 Anglers**		**WY 2 Boaters**	**WY 3 Boaters**
	$	$	$		$	$
Gas & oil for Auto &/or Boat	9.19	8.37	10.26		4.99	8.32
Restaurants	27.39	13.79	26.61		21.13	15.58
Grocery Stores	8.07	6.16	7.75		6.44	5.43
Supplies/fishing tackle/other retail	14.68	4.11	8.03		1.50	2.05
Camping on Public Lands	0.20	1.68	0.84		1.96	0.68
Camping on Private Lands	2.02	2.19	1.12		3.89	1.30
Hotel/motel	59.01	20.13	50.61		47.81	22.88
Equipment rental	0.94	1.73	0.99		0.56	1.69
Guide fees	24.76	10.27	3.40		6.86	6.19
Fishing License & Entrance Fees	4.18	2.15	7.02		0.50	0.30
Launching & Shuttle Fees	0.82	0.00	0.14		0.30	5.49
Rental Car	16.05	8.37	15.17		11.61	7.81
Other (misc. supplies)	1.24	0.28	4.37		3.46	6.52
Total Spending	**168.55**	**79.24**	**136.31**		**111.03**	**84.24**

6.5 Results of Regional Economic Analysis on Wyoming Segments of the Snake River

The economic impacts associated with spending by non local Snake River visitors are estimated by the following equation:

Number of non local visitors*average spending* regional multiplier = Regional Economic Effect on County Income

Estimates from Table 60 provide the annual number of non local visitor days. Survey results on visitor spending (Table 62) provide the average spending per visitor day. The IMPLAN modeling system was used to derive the multipliers that capture the indirect inter-industry linkages and induced effects needed to determine the total economic impacts of visitor spending.

Table 63 shows the economic impacts associated with the Snake River angler visitation, impacts associated with boater visitation is shown in Table 64. These tables show the direct impact, the indirect impact (e.g., the multiplier effect), and the summed total impact of income and jobs.

Table 63. Economic Impacts of Non Local Angler Spending on Teton County Wyoming and Idaho Economies

Teton County WY and ID	WY 2 Anglers	WY 3 Anglers	WY 4 Anglers	**WY Anglers Total**
Number of Non Local Visitor Days	42,774	22,050	8,662	**73,486**
Direct Effects				
Income ($/year)	$2,584,475	$611,606	$427,897	**$3,623,978**
Jobs	148.7	34.3	22.2	**205.2**
Indirect and Induced Effects				
Income ($/year)	$1,335,693	$312,740	$219,371	**$1,867,804**
Jobs	45.2	10.5	7.3	**63**
Total Effects				
Income ($/year)	$3,920,168	$924,346	$647,268	**$5,491,782**
Jobs	193.9	44.8	29.5	**268.2**

As can be seen, there is a substantial amount of angler use of WY2 emanating from the southern boundary of Grand Teton National Park, and including the Wilson Bridge to South Park Bridge stretch of the Snake River. In particular, this stretch supports nearly 200 direct and indirect jobs in Teton County, Wyoming and Idaho. Angler use of the lower stretch of the Snake River below South Park Bridge to the town of Alpine supports about 45 jobs. On WY4 (Flat Creek) the three month fishing season supports nearly 30 jobs. In total, 268 jobs and $5.5 million income are provided by anglers fishing along the Snake River the two sections of the Snake River in Wyoming and Flat Creek. The employment multiplier is approximately 1.31 indicating that every direct job in tourism

(guides, hotel workers, restaurant employees, sales clerks, etc.) generates another .31 jobs in support industries.

Table 64. Economic Impacts of Non-Local Boater Spending on the Teton County Wyoming and Idaho Economies

Teton County WY and ID	WY 2 Boaters	WY 3 Boaters	**WY Boaters Total**
Number of Non Local Visitor Days	25,717	86,577	**112,294**
Direct Effects			
Income ($/year)	$1,016,429	$2,554,822	**$3,571,251**
Jobs	56.1	150.3	**206.4**
Indirect and Induced Effects			
Income ($/year)	$542,525	$1,346,346	**$1,888,871**
Jobs	18.3	45.3	**63.6**
Total Effects			
Income ($/year)	$1,558,953	$3,901,168	**$5,460,122**
Jobs	74.5	195.6	**270**

As can be seen, there is a substantial amount of boater use of WY2 emanating from the southern boundary of Grand Teton National Park, and including the Wilson Bridge to South Park Bridge stretch of the Snake River. In particular, this stretch supports nearly 75 direct and indirect jobs in Teton County Wyoming and Idaho. The 86,577 boater days on the lower stretch of the Snake River below South Park Bridge to the town of Alpine supports nearly 200 jobs. In total, 270 jobs and $5.46 million income are provided by private and commercial boating along the two sections of the Snake River in Wyoming.

Table 65. Total Angler and Boater Spending Impacts on Teton County Wyoming and Idaho Economies

Teton County WY and ID	WY Anglers Total	WY Boaters Total	**WY Snake River Visitor Total**
Number of Non Local Visitor Days	73,486	112,294	**185,780**
Direct Effects			
Income ($/year)	$3,623,978	$3,571,251	**$7,195,229**
Jobs	205.2	206.4	**411.6**
Indirect and Induced Effects			
Income ($/year)	$1,867,804	$1,888,871	**$3,756,675**
Jobs	63	63.6	**126.6**
Total Effects			
Income ($/year)	$5,491,782	$5,460,122	**$10,951,904**
Jobs	268.2	270	**538.2**

Combining the regional economic effects of fishing and boating along the Snake River in Wyoming supports an estimated 538 jobs and nearly $11 million in income in Teton County Wyoming and Idaho. Using the contingent visitation response of anglers in terms of additional trips if they could double their catch or catch fish that were 25% larger, we are able to calculate how the income and employment would increase with either of these improved fishing conditions (biologically it is usually possible to increase number of fish or size of fish, but not both). As illustrated in Table 66, there is a potential for a substantial increase in income to Teton County Wyoming and Idaho from the additional visitation associated with improved fishing conditions. An additional 195 to 200 jobs would be supported by the additional angler visitation and spending resulting from doubling catch rates or increasing fish size, respectively.

Table 66. Increase in Total Income and Total Jobs in Teton County Wyoming and Idaho from Doubling Current Catch Rate or from a 25% increase in Size of Fish Caught

	Existing	Double Catch	Gain for 2X Catch	+25% size	Gain for +25% Size
WY2 Income	$3,920,168	$7,252,318	+$3,332,149	$6,892,907	+$2,972,738
WY3 Income	$924,346	$1,510,842	+$586,495	$1,876,315	+$951,969
WY4 Income	$647,268	$694,721	+$47,452	$926,559	+$279,290
WY2 Jobs	193.9	358.7	+164.8	340.9	+147.0
WY3 Jobs	44.8	73.2	+28.4	90.9	+46.1
WY4 Jobs	29.5	31.7	+2.2	42.2	+12.7

Yellowstone Cutthroat Trout Regional Economic Effects

It is worth noting that a sizeable amount of the income and employment related to trout fishing on the South Fork in Idaho and the three river segments in southwest Wyoming relate to Yellowstone cutthroat trout fishing.

Of the South Fork anglers, those targeting Yellowstone cutthroat trout supported 273 of the 341 total jobs, and $9.6 of the $12 million in income produced by South Fork anglers. In Wyoming, 240 of the 268 jobs and $4.9 million of the $5.5 million in income is related to anglers targeting Yellowstone cutthroat trout.

Chapter 7
Conclusion

Fishing, boating and other river related recreation along the Henry's Fork, South Fork and Wyoming stretches of the Snake River provides substantial economic values to local businesses, workers, communities and visitors. Nearly a half million visitors recreate along the Snake River each year. The non-local visitors spending in Southeast Idaho and Southwest Wyoming generates $52.7 million in direct, indirect and induced income and supports a total of 1460 jobs. A substantial portion of the income and jobs come from anglers targeting Yellowstone cutthroat trout. The number of jobs would increase to about 2400 and income to $75 million if river flows and fishing conditions improved to the point where either anglers could catch twice as many fish or fish that were 25% larger.

The income and jobs multipliers in Southeast Idaho average 1.6, meaning that each initial dollar of income or each direct job creates another .6 jobs indirectly through spending and re-spending of money in the local economy. The income and employment related to river recreation can be compared to that of alternative uses of the water, such as irrigated agriculture.

To facilitate application of these results to calculating job effects associated with increases and decreases in angler days, we can express these effects in terms of jobs per 1000 angler days. For the Henry Fork this is 5.4 jobs per 1000 angler days, 5.0 jobs per 1000 angler days on the South Fork and 3.6 jobs per 1000 angler days on the Snake River in southwest Wyoming.

Beyond the regional economic effects of non-local visitor spending on Southeast Idaho and Southwest Wyoming are the direct benefits to the local residents and non-local visitors who fish, boat and participate in other river based recreation along the Snake River. The net willingness to pay of river visitors along the Snake River represents a net economic benefit totaling $57.6 million each year. These recreation values are **conceptually** comparable to the net economic value (total revenue minus total costs) of the irrigated agriculture (U.S. Water Resources Council, 1983). Specifically, the net WTP of recreation is a National Economic Development (NED) benefit that is in the same category of benefits as net farm income or value of hydropower. Thus these net WTP values of recreation can be compared dollar per dollar with dollars of net farm income and hydropower.

The challenge ahead for Southeast Idaho and Southwest Wyoming is to acknowledge and support the current level of economic activity through wise resource management. The potential of the Snake River as a key regional economic contributor can only be realized through management decisions that support healthy ecological conditions, which in turn support the fishery and recreational based economies. Though it may be challenging, it is possible to implement river operations that provide for irrigated agriculture, hydropower and flood control while supporting ecological conditions for strong native fisheries. The long term combined benefits of supporting natural resources and traditional water uses will strengthen the regional economies of Southeast Idaho and Southwest Wyoming.

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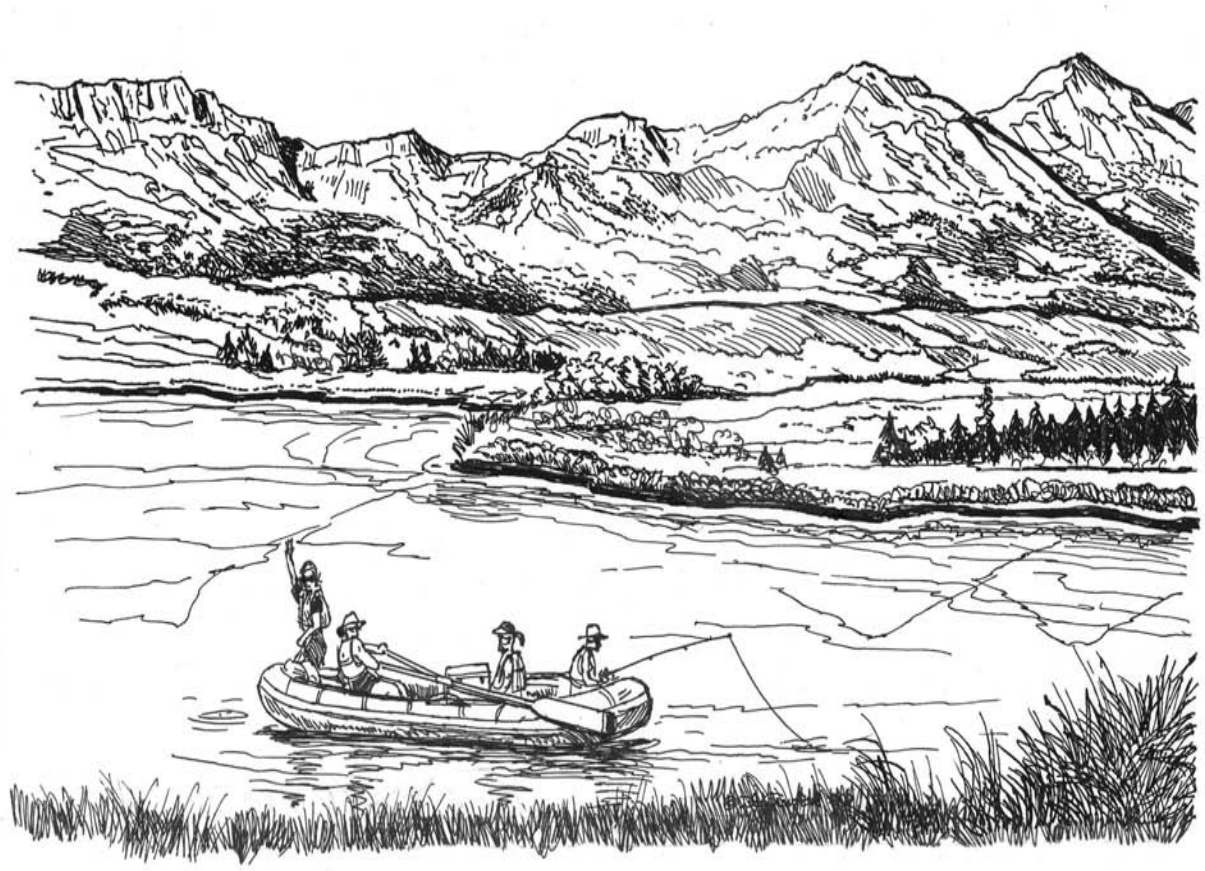
APPENDIX A
COPY OF SURVEY INSTRUMENT

Your Visit to the Snake River & Its Tributaries



What did you think?

Thank you for agreeing to complete this survey. Your answers will be quite helpful to the agencies and groups that manage these areas of the Snake River and its tributaries such as the Henry's Fork. In this survey, when we refer to a **trip** we mean a trip from home to the river and back again. Thanks again, and we look forward to receiving your survey.

Section A. Please tell us about your trip to the Snake River where you received this survey or were contacted by our interviewer.

1. Using the enclosed map, please indicate the primary River Segments you visited on that trip from home:

River Segment # and Name where contacted by our Interviewer	Other River Segment #'s and Names Visited on Same Trip from Home	Other River Segment #'s and Names Visited on Same Trip from Home
1.	2.	4.
[redacted]	3.	5.

1a. How many trips in the past 12 months did you make to the **River Segment** where you received this survey or were contacted by our interviewer?

_____ #Annual Trips

1b. What was the amount of time you spent on this trip visiting the **River Segment** where you were contacted by our interviewer?

_____# of hours or _____ # of days

1c. If you visited more than one River Segment, what was the total amount of time spent visiting all the River Segments on that trip from home?

_____# of hours or _____ # of days

1d. If you visited more than one River Segment on this trip from home, which of the River Segments listed above was the most important reason for taking your trip?
Most Important River Segment # and name _____

2. Was your trip to the river: (check only one):
____the primary purpose or sole destination of your trip from home?
____one of many equally important reasons or destinations for your trip from home?
____just an incidental stop on a trip taken for other purposes or to other destinations?

3. Please check the activities you participated in during this **trip** from home:

___ Fishing from shore/Wading ___ Fishing from a Boat
___ Rafting, kayaking, canoeing ___ Motorized Boating
___ Picnicking ___ Sightseeing/Photography ___Wildlife viewing
___ Camping ___ Rock climbing ___ ATVs/Motorcycles
___ Hiking ___ Bicycling/Mtn biking
___ Other, please describe_____

3a. If you checked more than one activity, which of these activities was the most important reason for your trip to this area? Most Important Activity_____

4. What were your primary methods of travel (circle all that apply):
Car RV Airplane Other_____

5. What was the one-way **travel time** from your home to the River Segment where you received this survey or were contacted by our interviewer?

_____ # hours _____ # minutes

6. What was your one-way **travel distance** from your home to this River Segment?

_____# one-way miles

7. Including yourself, what was the number of people in your group that traveled on this trip? _____# of people in your group

Section B. Trip Expenditures

Please indicate the amount you and members of your group with whom you shared expenses (e.g., other family members, traveling companions) spent on each category on the **trip** where you were given the survey.

Trip Expense	**Amount Spent in Southeast Idaho Area (Driggs, Island Park, Rexburg, Ashton, Swan Valley, Idaho Falls)**	**Amount Spent SW Wyoming (Alpine, Jackson Hole area)**
Gas & Oil for Auto &/or Boat	$	$
Food/drink: restaurants	$	$
Food/drink: grocery stores	$	$
Supplies/fishing tackle/other retail	$	$
Camping on Public Lands	$	$
Camping at Private Areas	$	$
Hotel/motel	$	$
Equipment rental	$	$
Guide fees	$	$
Fishing License & Entrance Fees	$	$
Launching & Shuttle Fees	$	$
Rental car	$	$
Airline ticket	$	$
Other; Please List_____	$	$

1. Including yourself, how many people in your group shared these expenses on this most recent trip? _____# of persons in your group
2. As you know, some of the costs of travel such as gasoline often increase. If the **total cost** of this most recent trip had been $_____ **higher**, would you have made this trip to the River Segments visited? Circle one: YES NO

Section C. Important Aspects of Your Recreational Trips to this Area

1. Please tell us how important the following activities and natural resources are in terms of your decision to take recreation trips to the Snake River and its tributaries during the year.

Please circle one number for each item	Importance for your decision to visit this River Segment or Area			
	Not Important	Somewhat Important	Important	Very Important
River rafting/canoeing/kayaking unrelated to fishing	1	2	3	4
Motorized Boating	1	2	3	4
Relaxation	1	2	3	4
Enjoying the scenery and nature	1	2	3	4
Camping along the river	1	2	3	4
Enjoying peace and solitude	1	2	3	4
Viewing wildlife (e.g., birds, elk)	1	2	3	4
Group Activities (family, social)	1	2	3	4
Opportunities to catch large #'s of trout	1	2	3	4
Opportunities to fish for cutthroat trout	1	2	3	4
Opportunities to catch trophy trout	1	2	3	4
Catching fish to eat	1	2	3	4
Hiking/rock climbing	1	2	3	4
Mountain biking	1	2	3	4
ORV/ATV	1	2	3	4
Other activities: Please list_____	1	2	3	4

2. How crowded did you think the river segment was where you were visiting? Please circle a number representing how crowded it was.

1	2	3	4	5	6	7	8	9
not at all crowded			slightly crowded		moderately crowded		extremely crowded	

3. Would your decision to visit the Snake River change if you had to reserve permits ahead of time to float or camp along the river?

☐ YES ☐ I would visit ***more*** often→ Estimated Number of **added** yearly trips_____
☐ I would visit ***less*** often→ Estimated Number of **fewer** yearly trips _____
☐ NO change in visits

Section D. If You Went Fishing

If you were fishing, please answer the following questions about the trip and river segment where you were contacted by our interviewer or received the survey. (If you were not fishing, please skip to Section E)

Species targeted at the River Segment where you received the survey

1. Please check the box of the primary species you were targeting or fishing for, and your average number caught (harvested or released) per day on the river segment where you were given the survey or contacted by our interviewer.

☐ Rainbow Trout → # Caught/day _____		☐ Brown Trout→ # Caught/day _____
☐ Cutthroat Trout → # Caught/day _____		☐ Brook Trout → # Caught/day _____
☐ Whitefish → # Caught/day _____		☐ Other Species: Name _____ → # Caught/day _____

2. If you were targeting more than one species, which would you say was the most important species for your decision to visit the River Segment where you were given this survey or contacted by our interviewer?

Name of Most Important Species _____

3. Fishing method

How many hours did you fish on a typical day of this trip using each method?

___ Hours Fly Fishing ___ Hours Bait Fishing ___Hours Lure/Spin Fishing

4. Did you use a guide on this trip? Circle one: Yes → How many days? ____ # Days
No

How Would Changes in Natural Resource Management Affect Your Decision to Visit?

1. In the last 12 months, how many trips from home did you make to the River Segment where you were contacted by our interviewer or received this survey? _____ # Annual Trips

2. Would your decision to visit this River Segment change if you had twice the daily catch rate of your targeted species that you experienced on this trip?

☐ YES → ☐ I would visit ***more*** often→ Estimated Number of **added** yearly trips_____
→ ☐ I would visit ***less*** often→ Estimated Number of **fewer** yearly trips _____
☐ NO change in visits

3. Would your decision to visit this River Segment change if the fish you caught were 25% larger (for example increasing from 12" to 15" fish) ?

☐ YES → ☐ I would visit ***more*** often→ Estimated Number of **added** yearly trips_____
→ ☐ I would visit ***less*** often→ Estimated Number of **fewer** yearly trips _____
☐ NO change in visits

Section E. Please tell us something about yourself.

These last few questions will help us in evaluating how well our sample represents visitors to the area. **Your answers will be kept strictly confidential and will only be used for the analysis of this study. It will not be given to anyone or used for any other purpose. You will not be identified in any way.**

1. Are you? _____ Male _____ Female

2. Age _____ Years

3. Are you employed?
___ NO→Are you retired? __Yes __No (If you are retired or do not work skip to Q#4)
___ YES→ (check one) __Work Full-time __ Work Part-time

3a. Do you take time off from work to participate in outdoor recreation? ___Yes ___No

3b. How many weeks of paid vacation do you receive each year? # of _____ weeks

4. What is your zip code? _____

5. Are you a member of a fishing, hunting or sportsman's organization? ___Yes ___No

6. Are you a member of an environmental organization? ___ Yes ___ No

7. About how many outdoor recreation trips do you take each year to areas outside of southeast Idaho and southwest Wyoming?
_____ Annual # of trips to other areas

8. Your highest level of formal education? (Please circle one)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20+
(Elementary)						(Jr. high or middle)			(High school)			(College or technical school)					(Graduate or professional)		

9. How many members are in your household? _____ persons

10. How many household members contribute to paying the household expenses? _____ persons

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

_____ less than $19,999	_____ $20,000-$29,999	___ $30,000-$39,999
_____ $40,000-$49,999	_____ $50,000-$59,999	___ $60,000-$69,999
_____ $70,000-$79,999	_____ $80,000-$89,999	___ $90,000-$99,999
_____$100,000-$149,999	_____ $150,000-$199,999	___ more than $200,000

Thank you for completing the survey!

If you have any additional comments on the resource management along the Snake River and its tributaries please feel free to write them on the next page. When you are finished, please place the survey in the stamped return envelope and mail it back to us.