SPORT-FISHING USE AND VALUE:
SNAKE RIVER BASIN OF CENTRAL IDAHO

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EXECUTIVE SUMMARY

Two surveys were conducted on sport fishers in the Snake River Basin in central Idaho for the purposes of: (1) measuring willingness-to-pay for fishing trips and, (2) measuring expenditures by sport fishers. The surveys were conducted by a single mailing using a list of names and addresses collected from anglers in the Snake River Basin and surveys distributed by guides during April 15, 1998 through November 30, 1998. The sportfishing demand survey resulted in 257 usable responses. The sportfishing spending survey had 259 useable responses.

In comparison to the Lower Snake River Reservoir surveys and the Upstream of Lewiston surveys, the central Idaho surveys were hindered by a lack of central sites where anglers could be contacted by clerks to obtain the names and addresses of those willing to participate in the survey. The inclusion of a two dollar bill as an incentive payment also was not allowed for the central Idaho surveys but was used in the prior surveys. One result was that a much larger share of the returned surveys were incomplete. About 31 percent of the returned sportfishing demand surveys were missing critical information and could not be used for the demand analysis although they were useful to estimate averages. The response rates for the travel cost survey and the spending survey were not measurable because of the diverse methods used to distribute the surveys.

The sportfishing demand analysis used a model that assumed anglers did not (or could not) give up earnings in exchange for more free time for sportfishing. This model requires extensive data on angler time and money constraints, time and money spent traveling to the river fishing sites, and time and money spent during the sportfishing trip for a variety of possible activities. The travel cost demand model related sportfishing trips (from home to site) per year by groups of sport fishers (average about 5.78 trips per year based on a sample of 335 anglers) to the dollar costs of the trip, to the time costs of the trip, to the prices on substitute or complementary trip activities, and other independent variables. The dollar cost of the trip was based on reported travel distances from home to site times the cost per person of 7.6 cents per mile.

The primary objective of the demand analysis was to estimate willingness-to-pay per trip for fishing in the Snake River Basin in central Idaho. Consumer surplus (the amount by which total consumer willingness-to-pay exceeds the costs of production) was estimated at $37.68 per person per travel cost trip. The average number of sportfishing trips per year from home to the Snake River Basin in central Idaho was 5.78 resulting in an average annual willingness-to-pay of $218 per year per angler. The total annual willingness-to-pay for all anglers in the Snake River Basin of central Idaho is estimated at $22.9 million. Trout was the primary specie caught with nearly 70 percent of anglers including trout in their catch. The fishing value for recovered sea run salmon would be an additional $11.4 million (see pages 34-35).

The angler spending survey resulted in an average expenditure of $840.40 per group per trip and $239.43 per individual angler per trip. Multiplying spending per angler per trip times the number of trips per year (6.48) resulted in an annual fishing trip-related cost of $1,551.51 per year per angler.

Total annual spending by anglers was found by multiplying spending per angler per year ($1,551.51) times the estimated number of unique anglers (104,948) or $1,551.51 x 104,948 = $162.8 million per year angler spending in Central Idaho.

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MEASURING SPORTFISHING DEMAND

The sportfishing “demand” survey provided detailed information on samples of individuals who participated in fishing in the Snake River Basin in central Idaho. The information provided by these samples was used to infer the spending behavior of anglers in the Snake River Basin in central Idaho. In capsule, the data collected by the demand survey provided information that was used to estimate the “willingness-to-pay” (marginal benefits) by consumers for various amounts of sportfishing. Estimation of the marginal benefits (demand) function allowed calculation of “net economic value” per sportfishing trip. The outdoor recreationist spending survey showed spending patterns useful in estimating the stimulus to jobs and business sales in the region created by anglers attracted to the Snake River Basin in central Idaho. The surveys also provided information on transportation, lodging, and other outdoor recreation activities enjoyed by anglers.

A public good like the Snake River Basin differs in two significant ways from a competitive firm. First, the public good is very large relative to the market that it serves; this is one of the reasons that public agencies are involved. Because of the size of the recreation site, as output (sportfishing access) is restricted the price that people are willing to pay will increase (a movement up the market demand curve). Price is no longer at a fixed level as faced by a small competitive firm. Second, the seller (a public agency) does not act like a private firm which charges a profit-maximizing price. A public good has no equilibrium market price that can easily be observed to indicate value or, i.e., marginal benefit.

If output for sportfishing in the Snake River Basin in central Idaho was supplied by many competitive firms, market equilibrium would occur where the declining market demand curve intersected the rising market supply curve. The competitive market equilibrium is economically “efficient” because total consumer benefits are maximized where marginal cost equals marginal benefits. If marginal costs exceed marginal benefits in a given market “rational” consumers will divert their spending to other markets. A competitive market price would indicate the marginal benefit to consumers of an added unit of sportfishing recreation. However, calculation of total economic value produced would require knowledge of the market demand because many consumers would be willing-to-pay more than the equilibrium price. The amount by which total consumer willingness-to-pay exceeds the costs of production is the total net benefit or “consumers surplus.” If output was supplied by many competitive firms, statistical estimation of a market demand curve could use observed market quantities and prices over time.

METHODS

Economic value (consumers surplus) of a particular output (sportfishing) of a public good also can be found by estimating the consumer demand curve for that output. The economic value of sportfishing in the Snake River Basin in Central Idaho can be determined if a statistical demand function showing consumer willingness-to-pay for various amounts of sportfishing is estimated. Because market prices cannot be observed, (sportfishing is a non-market good), a *surrogate price* must be used to model consumer behavior toward sportfishing (U.S. Army Corps of Engineers 1995; Herfindahl and Kneese 1974; McKean and Walsh 1986; Peterson et al. 1992).

The sportfishing demand survey collected information on individuals at the river showing their number of sportfishing trips per year and their cost of traveling to the river fishing site. The price faced by sport fishers is the cost of access to the fishing site (mainly the time and money costs of travel from home to site), and the quantity demanded per year is the number of sportfishing trips they make to the Snake River Basin. A demand relationship will show that fewer trips to the river are made by people who face a larger travel cost to reach the river from their homes (Clawson and Knetsch 1966). " The Travel cost method (TCM) has been preferred by most economists, as it is based on observed market behavior of a cross-section of users in response to direct out-of-pocket and time cost of travel." (Loomis 1997)[1] "The basic premise of the travel cost method (TCM) is that per capita use of a fishing site will decrease if the out-of-pocket and time costs of traveling from place of origin to the site increase, other things remaining equal." (Water Resources Council 1983, Appendix 1 to Section VIII).

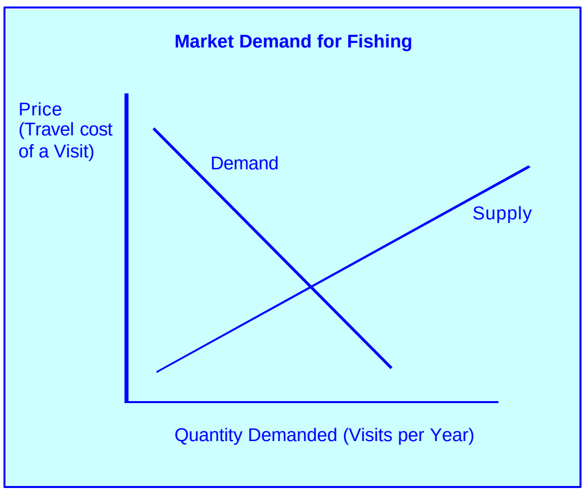

Figure 1 Market demand for fishing.

Figure 1 shows a market for sportfishing. (It is a convention to show price on the vertical axis and quantity demanded on the horizontal axis). A market supply and demand graph for sportfishing shows the economic factors affecting all sport fishers in a region. The demand by anglers for sportfishing trips is negatively sloped, showing that if the money cost of a fishing trip (round trip from home to site and back) rises sport fishers will take fewer trips per year. Examples of how money trip costs might rise include: increased automobile fuel prices, sportfishing regulators close nearby sites requiring longer trips to reach other sites, entrance fees are increased, boat launching fees are raised, or nearby sites become congested requiring longer trips to obtain the same quality sportfishing. The supply of sportfishing opportunities is upward sloping. The upward slope of sportfishing supply is caused by the need to travel ever further from home to obtain quality sportfishing if more people enter the "regional sportfishing market". Increased sportfishing-trips in the region can occur when a larger percentage of the population becomes interested in sportfishing, when more non-local anglers travel to the region to obtain quality sportfishing, or if the local population expands over

[1] Travel cost models are incapable of predicting contingent behavior and involve current users. Another set of economic models, contingent behavior and contingent value models, are typically used for projecting behavior or measuring non-use demand.

time. The market demand/supply graph is useful for describing the aggregate economic relationships affecting angler behavior but a “site-demand” model is used to place a value on a specific sportfishing site.

Figure 2 describes the demand by a typical angler for sportfishing at the Snake River Basin in central Idaho. Angler demand is negatively sloped indicating, that a higher cost or price to visit the sportfishing site will reduce sportfishing visits per year. The supply curve for a given angler to visit a given site is horizontal because the distance from home to site, which determines the cost of access, is fixed. The supply curve would shift up if auto fuel prices increased but it would still be horizontal because the number of trips from home to site per year would not influence the cost per trip.

The vertical distance between the angler’s demand for sportfishing and the horizontal supply (cost) of a sportfishing trip is the net benefit or consumer surplus obtained from a sportfishing trip. The demand curve shows what the angler would be willing-to-pay for various amounts of sportfishing trips and the horizontal line is their actual cost of a trip. As more sportfishing trips per year are taken, the benefits per trip decline until the marginal benefit (added satisfaction to the consumer) from an additional trip equals its cost where cost and demand intersect. The sport fisher does not make any more visits to the river because the money value to this angler of the added satisfaction from another sportfishing trip is less than the trip cost. The equilibrium number of visits per year chosen by the angler is at the intersection of the demand curve and the horizontal travel cost line.

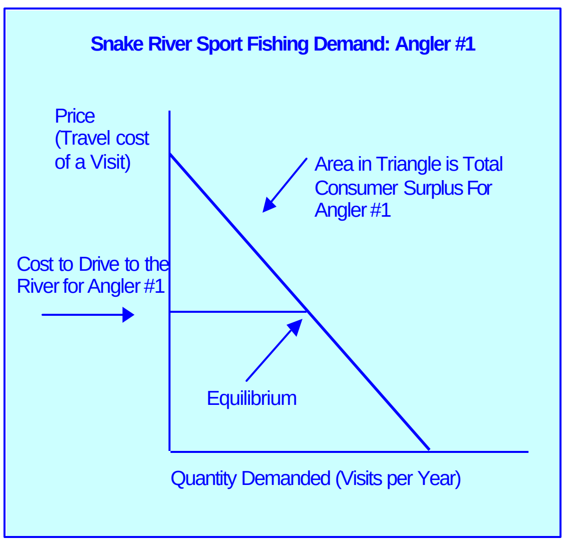

Figure 2 Fishing demand for angler #1

Each angler has a unique demand curve reflecting how much satisfaction they gain from sportfishing at the river, their free time available for sportfishing, the distance to alternate comparable sportfishing sites, and other factors that determine their likes and dislikes. Each angler also has a unique horizontal supply curve; at a level determined by the distance from their home to the fishing site of their choice, the fuel efficiency of their vehicle, access fees (if any), etc.

The critical exogenous variable in the travel cost model is the cost of travel from home to the sportfishing site. Each angler has a different travel cost (price) for a sportfishing trip from home to the river. Variation among anglers in travel cost from home to sportfishing site (i.e., price variation) creates the Snake River Basin site-demand data shown in Figure 5. The statistical demand curve is fitted to the data in Figure 5 using regression analysis.[2] Non monetary factors, such as available free time and relative enjoyment for

[2]It is possible that some anglers might select a residence location close to the reservoirs to minimize cost of travel (Parsons 1991). The travel cost model assumes that this doesn’t happen. If anglers locate their residence to minimize distance to the reservoir fishing site then the assumption that travel cost is exogenous is invalid and a simultaneous equation estimation technique would be required.

sportfishing, will also affect the number of river visits per year. The statistical demand curve should incorporate all the factors which affect the publics' willingness-to-pay for sportfishing at the river. It is the task of the Snake River Basin sportfishing survey to include questions that elicit information about anglers that explains their unique willingness-to-pay for sportfishing.

The goal of the travel cost demand analysis is to empirically measure the triangular area in Figure 2 which is the net dollar value of satisfaction received or angler willingness-to-pay in excess of the costs of the sportfishing trips. The triangular area is summed for the 257 anglers in our sample and divided by their average number of trips per year (which, for anglers in our sample was 5.78 trips per year). This is the estimated consumer surplus per sportfishing trip or, i.e., net economic value per trip. The estimated average net economic value per trip (consumer surplus per trip), derived from the travel cost model, can be multiplied times the total angler trips from home to the river in a year to find annual net benefits of the Snake River Basin in central Idaho for sportfishing.

Figure 5 shows unadjusted sample data relating sportfishing trips from home to site per year and dollars of travel expense per trip at the river for 257 respondents. Figure 6 shows the sample data relating sportfishing trips per year to the hours required to travel between home and the river fishing site. The data shown in both graphs reveal an inverse relationship between money or time required for a sportfishing trip to the river and trips demanded per year. Both out-of-pocket cost per trip and hours per trip act as prices for a sportfishing trip. Even before adjustment for differences among anglers' available free time, sportfishing experience, and other factors affecting angler behavior, it is clearly shown by Figures 5 and 6 that anglers with high travel costs or high travel time per trip take fewer sportfishing trips per year. Therefore, observations across the sample of 257 anglers can reveal a sportfishing demand relationship. Each price level along a down-sloping demand curve shows the marginal benefit or angler willingness-to-pay for that corresponding output level (number of sportfishing trips consumed). The gross economic value (total willingness-to-pay) for the sportfishing public good is shown by the area under the statistical demand function. The annual net economic value of sportfishing is found by subtracting the sum of the participants access (travel) costs from the sum of their benefit estimates. This is equivalent to summing the consumer surplus triangles for all anglers at the river.

Figure 3 Study region for Central Idaho

The Study Area

The mail surveys were distributed using names and addresses collected from anglers by clerks in central Idaho or reported by guides in the Snake River Basin in Central Idaho. Figures 3 and 4 locate the study region in central Idaho.

The Snake River Basin Demand and Spending Surveys

The Snake River Basin expanded demand survey included detailed socio-economic information about anglers and data on money and physical time costs of travel, sportfishing, and other activities both on and off river fishing sites. Trout was the primary fish caught. Anglers (sample of 372 anglers) listed rainbow trout (69.6%), other fish (47.3%), steel head (38.4%), smallmouth bass (16.4%), sturgeon (5.4%) and bull trout (3.8%) among the species caught. The questionnaire used for the mail survey is shown in Appendix II and is similar to the sportfishing questionnaire used on the lower Snake River reservoirs (Normandeau Associates et al. 1998b) and on the free flowing Snake River above Lewiston (Normandeau Associates et al. 1998d). The questionnaire used in this study is also similar to those used previously to study sportfishing demand on the Cache la Poudre River in northern Colorado and for Blue Mesa Reservoir in southern Colorado (Johnson 1989; McKean et al. 1995; McKean et al. 1996). Both of the latter surveys were by personal interview while the Snake River Basin survey was by mail.[3]

Anglers were contacted at fishing sites over the period from April 15, 1998 through November 30, 1998 and requested to take part in the sportfishing spending mail survey. Most persons contacted on-site were agreeable to receiving a mail questionnaire and provided their name and mailing address. Persons on guided tours or guided rafting trips were not directly accessible and tour guides mailed or handed out surveys to their clients.

The spending survey provided a list of potential spending choices and requested the amount spent and the location for each of the spending categories. Separate forms were provided for spending during travel to the site, spending while at the site, and spending on the trip home. The sportfishing spending survey resulted in a sample of 259 completely useable responses. Because of the varied ways in which surveys were distributed it was not possible to calculate a response rate. The sportfishing spending survey data are expanded to show the direct economic effects on spending, earnings, and employment in central Idaho.

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[3] The personal interview surveys had sample sizes of 200 and 150 while this survey had 257 useable responses. Sample size has varied widely in published water-based recreation studies. Ward (1989) used a sample of 60 mail surveys to estimate multi-site demand for water recreation on four reservoirs in New Mexico; Whitehead (1991-92) used a personal interview sample of 47 boat anglers for his fishing demand study on the Tar-Pamlico River in North Carolina; Laymen, et al. (1996) used a sample of 343 mail surveys to estimate angler demand for chinook salmon in Alaska.

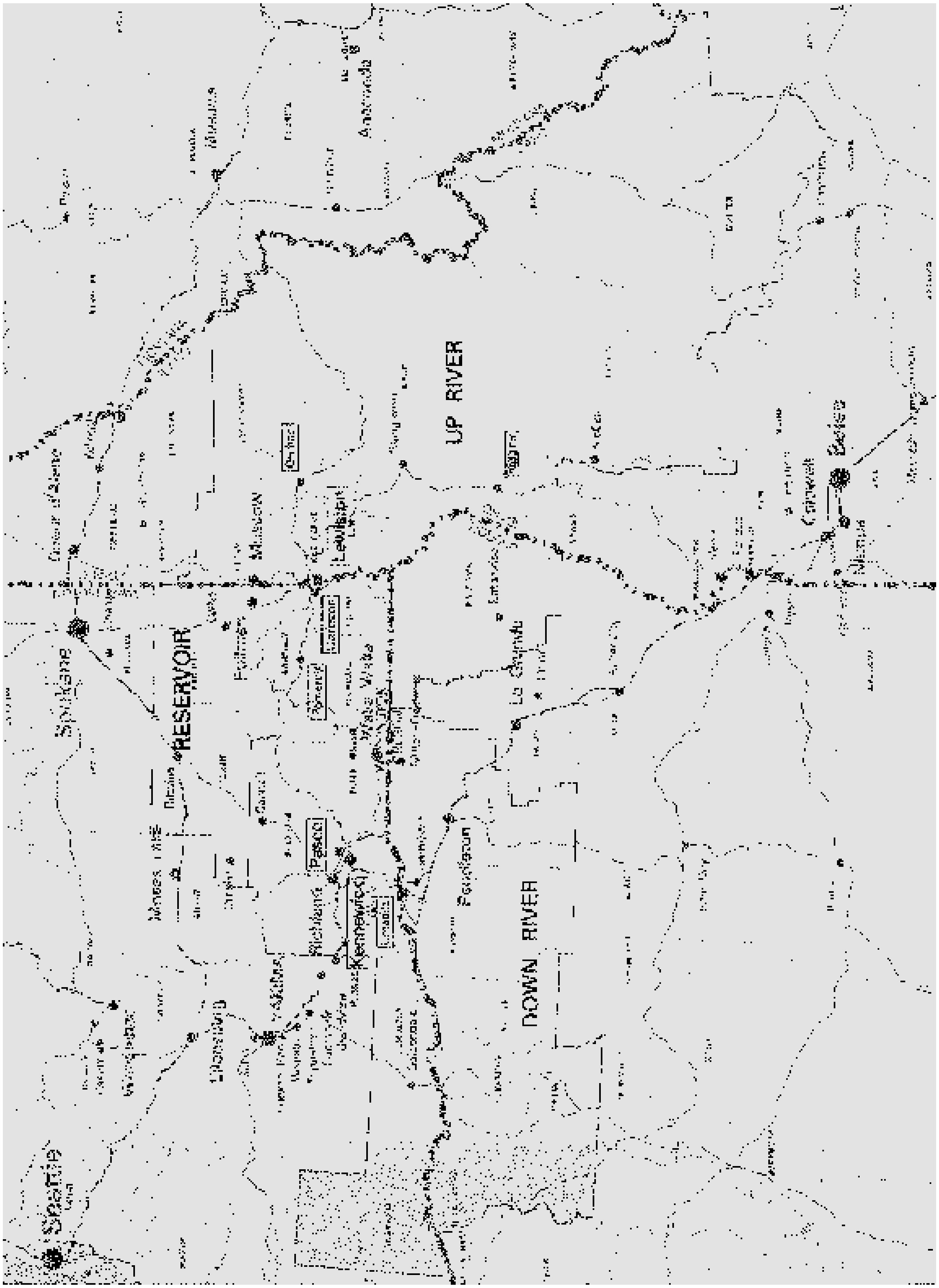

Figure 4 The four subregions

Avoiding Travel Time Valuation

There has been disagreement among practitioners in the design of the travel cost model, thus wide variations in estimated values have occurred (Parsons 1991). Researchers have come to realize that nonmarket values measured by the traditional travel cost model are flawed. In most applications, the opportunity time cost of travel has been assumed to be a proportion of money income based on the equilibrium labor market assumption. Disagreements among practitioners have existed on the “correct” income proportion and thus wide variations in estimated values have occurred.

The conventional travel cost models assume labor market equilibrium (Becker 1965) so that the opportunity cost of time used in travel is given by the wage rate (see a following section). However, much dissatisfaction has been expressed over measurement and modeling of opportunity time values. McConnell and Strand (1981) conclude, "The opportunity cost of time is determined by an exceedingly complex array of institutional, social, and economic relationships, and yet its value is crucial in the choice of the types and quantities of recreational experiences." The opportunity time value methodology has been criticized and modified by Bishop and Heberlein (1979), Wilman (1980), McConnell and Strand (1981), Ward (1983, 1984), Johnson (1983), Wilman and Pauls (1987), Bockstael et al. (1987), Walsh et al., (1989), Walsh et al. (1990a), Shaw (1992), Larson (1993), and McKean et al. (1995, 1996).

The consensus is that the opportunity time cost component of travel cost has been its weakest part, both empirically and theoretically. “Site values may vary fourfold, depending on the value of time.” (Fletcher et al. 1990). “... the cost of travel time remains an empirical mystery.” (Randall 1994).

Disequilibrium in labor markets may render wage rates irrelevant as a measure of opportunity time cost for many anglers. For example, Bockstael et al. (1987) found a money/time tradeoff of $60/hour for individuals with fixed work hours and only $17/hour with flexible work hours.

The results from our previous studies and this study on the Snake River Basin in central Idaho suggest using a model specifically designed to help overcome disagreements and criticisms of the opportunity time value component of travel cost. We use a model that eliminates the difficult-to-measure marginal value of income from the time cost value. Instead of attempting to estimate a “money value of time” for each individual in the sample we simply enter the actual time required for travel to the fishing site as first suggested by Brown and Nawas (1973), and Gum and Martin (1975) and applied by Ward (1983,1989). The annual income variable is retained as an income constraint.[4]

[4] An added advantage of not using income to measure opportunity time value is that colinearity between the time value component of travel cost and the income constraint should be greatly reduced.

The Disequilibrium Labor Market Model

The travel cost model used in this statistical analysis assumes that site visits are priced by both (1) out-of-pocket travel expenses, and (2) opportunity time costs of travel to and from the site. Opportunity time cost has been conventionally defined in economic models as money income foregone (Becker 1965; Water Resources Council 1983). However, a person's consideration of their limited time resources may outweigh money income foregone given labor market disequilibrium and institutional considerations. Persons who actually could substitute time for money income at the margin represent a small part of the population, especially the population of anglers. Retirees, students, and unemployed persons do not exchange time for income at the margin. Many workers are not allowed by their employment contracts to make this exchange. Weekends and paid vacations of prescribed length are often the norm. Thus, the equilibrium labor market model may apply to certain self-employed persons, e.g., dentists or high level sales occupations, where individuals, (1) have discretionary work schedules and, (2) can expect that their earnings will decline in proportion to the time spent recreating. (Many professionals can take time off without foregoing any income). The equilibrium labor market subgroup of the population is very small. According to U.S. Bureau of Labor Statistics and National Election Studies (U.S. Bureau of the Census 1993), only 5.4 percent of voting age persons in the U.S. were classified as self-employed in the United States in 1992. The labor market equilibrium model applies to less than 5.4 percent of anglers who are over-represented by retirees and students.

Bockstael et al. (1987), hereafter B-S-H, provide an alternate model in which time and income are not substituted at the margin. B-S-H show that the time and money constraints cannot be collapsed into one when individuals cannot marginally substitute work time for leisure. Thus, <u>physical travel time</u> and <u>money cost</u> per trip from home to site enter as separate price variables in the demand function. (Figures 5 and 6 show actual money cost and time cost plotted against fishing trips demanded per year). <u>Discretionary time</u> and income enter as separate constraint variables. Money cost and physical time per trip also enter as separate price variables for closely related time-consuming goods such as alternate sportfishing sites. The B-S-H travel cost model can be estimated as,

$$r = b_0 + b_1 c_0 + b_2 t_0 + b_3 c_a + b_4 t_a + b_5 INC + b_6 DT \qquad \textbf{(1)}$$

where the subscripts o and a refer to own site prices and alternate site prices respectively, c is out-of-pocket travel cost per trip, t is physical travel time per trip, INC is money income, and DT is available discretionary time.

Differences Between Disequilibrium and Equilibrium Labor Market Models

The equilibrium labor market model makes the explicit assumption that opportunity time value rises directly with income. Thus, the methodology that we have rejected assumes perfect substitution between work and leisure. McConnell and Strand

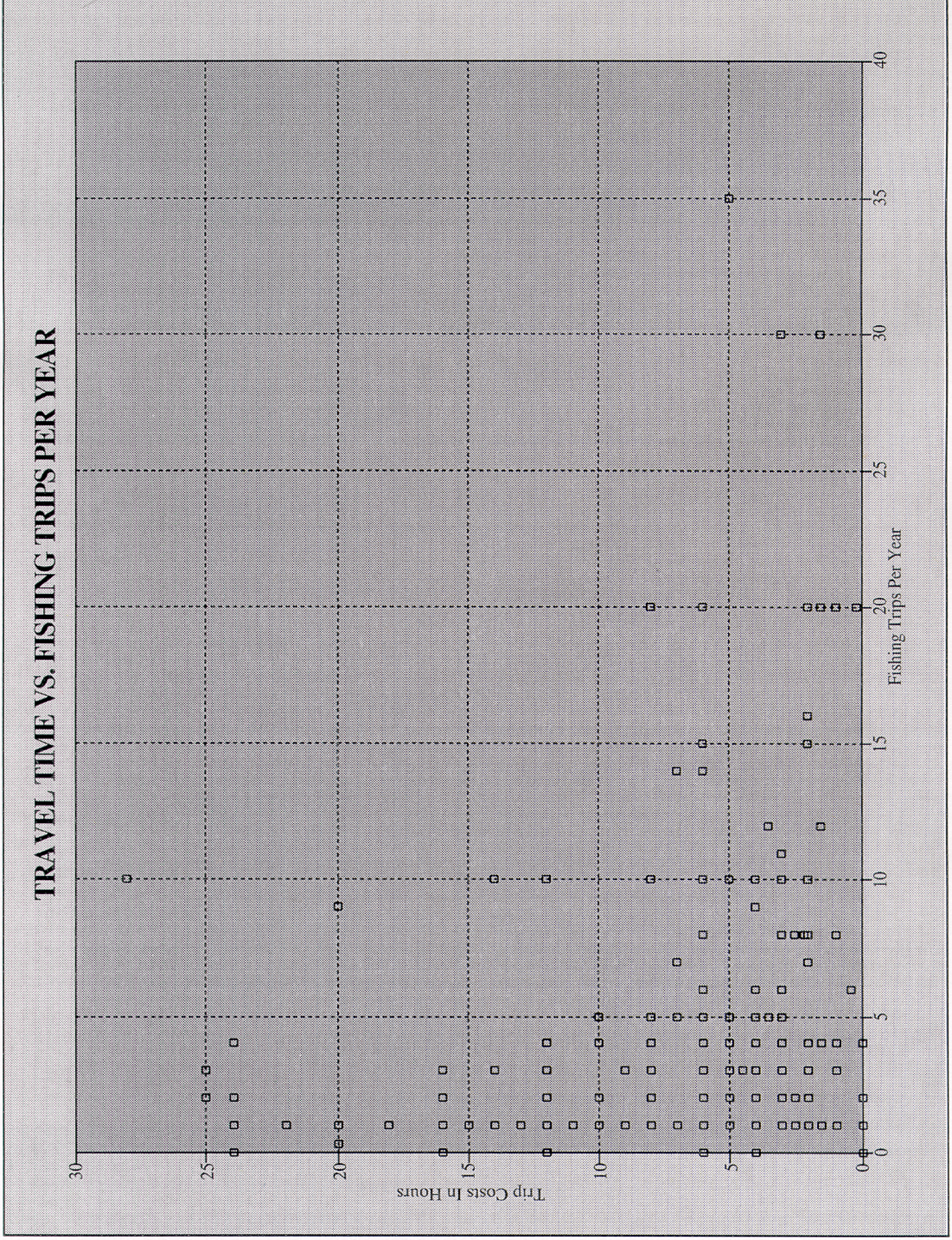

Figure 5. Travel time versus fishing trips per year

(1981, 1983) (M-S) specify price in their travel cost demand model as the argument in the right hand side of equation two:

$$r = f\left[c + (t)\, g'(w) \right] \tag{2}$$

where, as before, r is trips from home to site per year, c is out-of-pocket costs per trip, and t is travel time per trip. The term g'(w) is the marginal income foregone per unit time. It is assumed in the M-S model that any increase of travel cost, whether it is out-of-pocket spending or the money value of travel time expended, has an equal marginal effect on visits per year. The term [c + (t)g'(w)] imposed this restriction because it forces the partial effect of a change in out-of-pocket cost ($\partial f/\partial c$) to be equal in magnitude to a change in the opportunity time cost $\partial f/\partial[(t)g'(w)]$. An important distinction in model specification is demonstrated by M-S. The equilibrium labor market model requires that out-of-pocket and opportunity time value costs be added together to force an identical coefficient on both costs.[5] In contrast, the B-S-H disequilibrium labor market model requires separate coefficients to be estimated for out-of-pocket costs and opportunity time value costs.

Problems With Foregone Income Measurement

Measurement and statistical problems often beset the full price variable in empirical applications. Even for those self-employed persons who are in labor market equilibrium, measuring marginal income is difficult. Simple income questions are unlikely to elicit true marginal opportunity time cost. Only after-tax earned income should be used when measuring opportunity time cost. Thus, opportunity cost may be overstated for the wealthy whose income may require little of their time. Conversely, students who are investing in education and have little market income will have their true opportunity time costs understated. In practice, marginal income specified by theory is usually replaced with a more easily observable measure consisting of average family income per unit time. Unfortunately, marginal and average values of income are unlikely to be the same.

The Importance of Including All Closely Related Goods Prices

Ward (1983,1984) proposed that the "correct" measure of price in the travel cost model is the minimum expenditure required to travel from home to fishing site and return since any excess of that amount is a purchase of other goods and is not a relevant part of the price of a trip to the site. This own-price definition suggests that the other (excess) spending during the trip is associated with some of the closely related goods whose prices are likely to be important in the demand specification. For example, time-on-site can be an important good and it is often ignored in the specification of the TCM. Yet time-on-site <u>must be</u> a closely related good since the weak complementarity principle upon which measurement of benefits from the TCM is founded implies that time-on-site is essential. Weak

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[5] Although the equilibrium labor market model requires that the marginal effects of out-of-pocket cost and income foregone on quantity demanded be equal, empirical results often fail to support the model if the two components of price are entered separately in a regression.

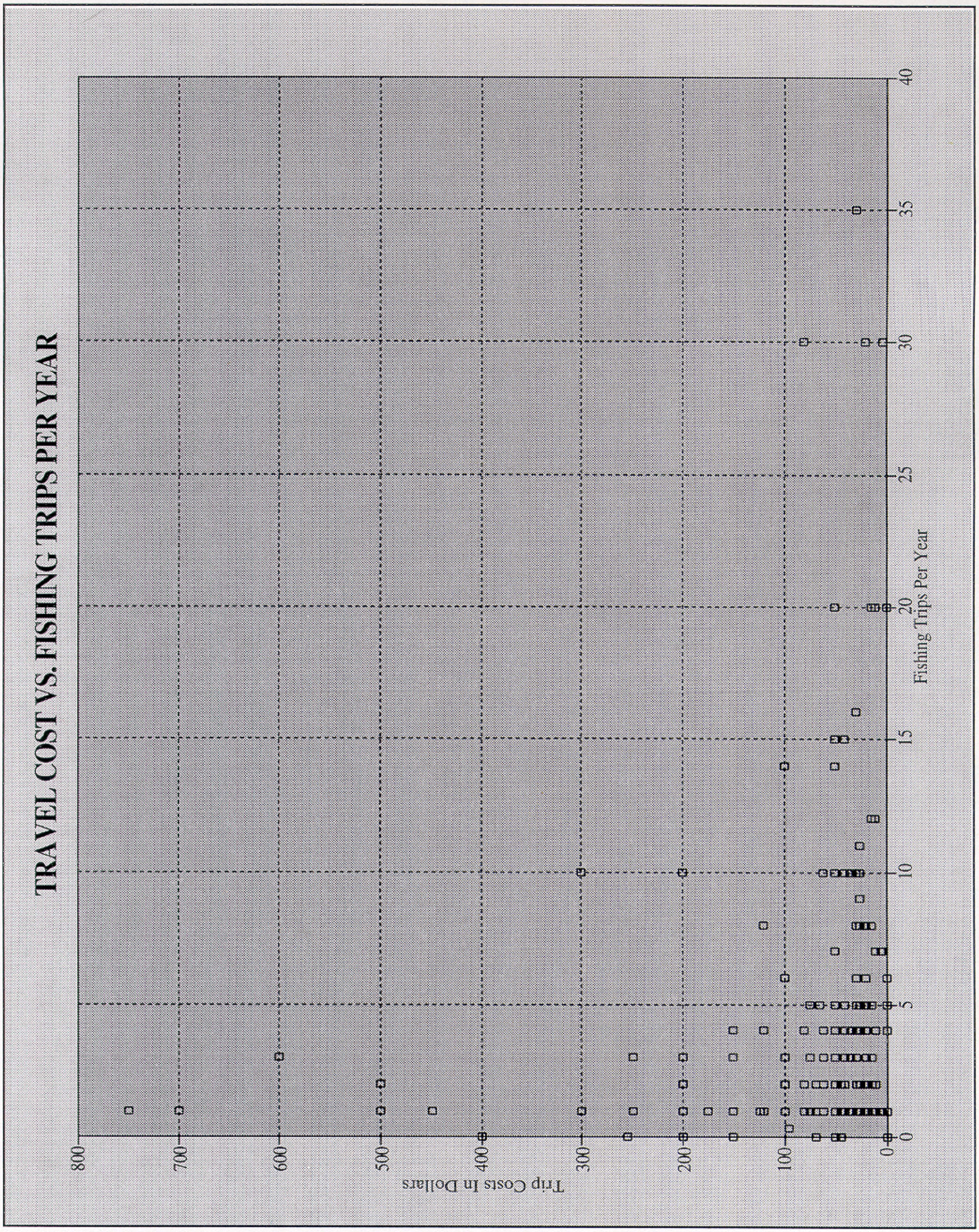

Figure 5 Travel cost vs. fishing trips per year

complementary was the term used to connect enjoyment of a recreation site to the travel cost to reach it (Maler 1974). It is assumed that a travel cost must be paid in order to enjoy time spent at the recreation site. Without traveling to the site, the site has no recreation value to the consumer and without the ability to spend time at the site the consumer has no reason to pay for the travel. With these assumptions, the cost of travel from home to site can be used as the price associated with a particular recreation site (Loomis et al. 1986).

The sign of the coefficient relating trips demanded to particular time "expenditures" associated with the trip is an empirical question. For example, time-on-site or time used for other activities on the trip have prices which include both the opportunity time cost of the individual and a charge against the fixed discretionary time budget. Spending more time-on-site could increase the value of the trip leading to increased trips, but time-on-site could also be substituted for trips. Spending during a trip for goods, both on and off the site, consist of closely related goods which are expected to be complements for trips to the site. Finally, spending for extra travel, either for its own sake, or to visit other sites, can be a substitute or a complement to the site consumption. For example, persons might visit site "a" more often if site "b" could also be visited with a relatively small added time and/or money cost. If the price of "b" rises, then visits to "a" might decrease since the trip to "a" now excludes "b". Conversely, persons might travel more often to "a" since it is now relatively less expensive compared to attaining "b" (McKean et al. 1996).

Many recreational trips combine sightseeing and the use of various capital and service items with both travel and the site visit, and include side trips (Walsh et al. 1990b). Recreation trips are seldom single-purpose and travel is sometimes pleasurable and sometimes not. The effect of these "other activities" on the trip-travel cost relationship can be statistically adjusted for through the inclusion of the relevant prices paid during travel or on-site and for side trips. Furthermore, both trips and on-site recreation are required to exist simultaneously to generate satisfaction or the weak complementarity conditions would be violated (McConnell 1992). A relation between trips and site experiences is indicated such that marginal satisfaction of a trip depends on the corresponding site experiences. Therefore, the demand relationship should contain site quality variables, time-on-site, and goods used on-site, as well as other site conditions. Exclusion of these variables would violate the specification required for the weak complementarity condition which allows use of the TCM to measure benefits.

In this study of fishing in the Snake River Basin, an expanded TCM survey was designed to include money and time costs of on-site time (McConnell 1992), on-site purchases, and the money and time cost of other activities on the trip. These vacation-enhancing closely related goods prices are added to the specification of the conventional TCM demand model. Empirical estimates of partial equilibrium demand could suffer under specification bias if the prices of closely related goods were omitted.[6] Traditional TCM demand models seemingly ignore this well known rule of econometrics and exclude the prices of on-site time, purchases, and other trip activities which are likely to be the principal closely related goods consumed by anglers.

RESULTS

The definitions for the variables in the disequilibrium and equilibrium travel cost models are shown in Table 1. The dependent variable for the travel cost model is (r), annual reported trips from home to the sportfishing site. Annual sportfishing trips from home to the Snake River Basin fishing site is the quantity demanded. The average angler took 5.78 trips from home to the fishing site in the Snake River Basin during the period April 15, 1998 - November 30, 1998.

The t-ratios for all important variables to estimate the value of sportfishing are statistically significant from zero at the 5 percent level of significance or better. The tests for over dispersion (Cameron and Trivedi 1990; Greene 1992) for the Poisson regression were negative. Thus, unlike the data sets for the Lower Snake River Reservoirs and upstream of Lewiston, Poisson regression was appropriate. However, truncated negative binomial regression is reported. The estimated coefficients for Poisson and negative binomial regression are identical in all cases except on income. A conservative approach uses the negative binomial model to eliminate any possible overstatement of the t-ratios that might occur with the Poisson regression. In fact, the t-ratios were somewhat higher for the Poisson regression (not shown) than for the negative binomial regression.

Trip Prices

The money price variable in the B-S-H model is c_r, which is the out-of-pocket travel costs to the sportfishing site. Our mail survey obtained travel costs for most of those surveyed. Reported one-way travel distance for each party was multiplied times two and times $0.076 to obtain money cost of travel per person per trip. Cost per mile was based on average cost collected from the much larger Lower Snake River Reservoirs survey. Angler-perceived cost was used rather than costs constructed from Department of Transportation or American Automobile Association data. Anglers' perceived price is the relevant variable when they decide how many sportfishing trips to take (Donnelly et al. 1985).

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[6] Bias in the consumer surplus estimate, created by exclusion of important closely related goods prices, depends on the sign of the coefficient on the excluded variable, and the distribution of trip distances (McKean and Revier 1990). Exclusion of the price of a closely related good will bias the estimate of both the intercept and the demand slope estimate (Kmenta 1971). Both these effects bias consumer surplus. Since the expression for consumer surplus generally is nonlinear, the expected consumer surplus is not properly measured by simply taking the area under the demand curve. The distribution of trips along the demand function can affect the bias in consumers surplus, depending on the combination of intercept and slope bias created by the under specification of the travel cost demand. Both intercept and slope biases <u>and</u> the trip distribution must be known in order to predict the effect of exclusion of the price of a related good on the consumer surplus estimate.

The physical time price for each individual in the B-S-H model (disequilibrium labor market) is measured by t_o which is round trip driving time in hours. Average round trip driving time was about 15 hours with an average round trip distance of 376 miles. Thus, average speed was only 25 miles per hour.

Prices of Closely Related Goods

The B-S-H model calls for the inclusion of t_a, round trip driving time from home to an alternate sportfishing site, as the physical time price of an alternate sportfishing site. This variable was not significant and appeared to be highly correlated with the monetary cost of travel. Another alternate site price variable is c_a, which is the out-of-pocket travel costs to the most preferred alternate sportfishing site from the anglers home. This substitute price variable also was not significant.

A price variable, c_{md}, measuring money travel cost for the second leg of the trip for anglers visiting a second fishing site was included. This variable would indicate if the number of trips to the fishing site was influenced by the cost of going from the first river fishing site to the second site for those with multi destination trips. This variable was not significant.

The variable to measure available free time is *DT*. The discretionary time constraint variable is required for persons in a disequilibrium labor market who cannot substitute time for income at the margin. Restrictions on free time are likely to reduce the number of sportfishing trips taken. The discretionary time variable has been positive and highly significant in previous disequilibrium labor market recreation demand studies and was highly significant in this study (Bockstael et al. 1987; McKean et al. 1995, 1996). The average number of days that anglers in the survey were "free from other obligations" was 91 days per year.

The income constraint variable (*INC*) is defined as average annual family income resulting from wage earnings. The relation of quantity demanded to income indicates differences in tastes among income groups. Although restrictions on income should reduce overall purchases, it may also cause a shift to low cost types of consumer goods such as fishing. Thus, the sign on the income coefficient conceptually can be either positive or negative. The estimated coefficient on income was negative for this data set.

Four other closely related goods prices were tested in the model: t_{os}, time spent at the primary fishing site at the river, c_{os} money purchases at the primary fishing site at the river, c_{as}, money spent during the trip at alternate sportfishing sites in central Idaho during the fishing trip ($27 per trip), and other recreation time spent at the primary fishing site (5.5 hours), t_{or}. Only the latter two variables were significant in this data set. The presence of alternate site spending during the trip tended to increase the number of trips taken. Anglers that spent more time on-site recreating, rather than fishing, tended to take fewer trips.

Other Exogenous Variables

The expected sportfishing success rate variable, *E(Catch)* is the individual's previous average catch per day in the Snake River Basin. Anglers average catch was reported at 8 fish per trip and varied from 2 to 70. Trips from home to site per year were hypothesized to relate positively to expected sportfishing success based on the individuals past experience fishing in the Snake River Basin. However, the expected catch variable was not significant for this data set.

The strength of an angler's preferences for sportfishing over other activities should positively influence the number of sportfishing trips taken per year. The variable, *TASTE*, is defined as the number of hours fished per 24 hour day. The average hours fished per day was 6.72 hours. A second indicator of taste related particularly to the study region is the number of years that the angler has visited the Snake River basin in central Idaho. The variable *EXP* measures this second aspect of taste. Anglers had an average of 10.24 years experience fishing in the Snake River Basin. The estimated coefficients on both taste variables were significant and had the expected positive signs.

Age has often been found to influence the demand for various types of sportfishing activity. The average age of anglers in the survey was 49.4 years. Age of the angler was tested in the statistical demand model and found non-significant.

About 38.5% of the anglers in the survey used a boat at least part of the time. However, a dummy variable (*BOAT*) that identified anglers that used a boat for fishing either all or part of the time was found non-significant. Anglers with a boat did not visit the fishing site any more often than shore anglers.

Demand Elasticities

The estimated regression coefficients and elasticities from the truncated negative binomial regression estimation for the Snake River Basin sportfishing demand models are reported in Tables 2 and 3.[7] Several of the exogenous variables in the truncated negative binomial regressions were log transforms. When the independent variables are log transforms the estimated slope coefficients directly reveal the elasticities. When the independent variables are linear the elasticities are found by multiplying the coefficient times the mean of the independent variable. Elasticity with respect to dummy variables could be estimated for at least three situations, the dummy variable is zero, the dummy variable is one, or the average value of the dummy variable. Given a log transform of the dependent variable, elasticity for a dummy variable is zero if the dummy is zero, the estimated slope coefficient if the dummy is one, and the slope coefficient times the E(dummy) if the average value of the dummy is used. We will report the elasticity for the case where the dummy is one.[8]

Price Elasticity of Demand

Price elasticity with respect to out-of-pocket travel cost is -0.7579. A ten percent increase in travel costs would reduce participation by 7.58 percent.

The elasticity with respect to physical travel time for anglers was -0.2842. If the time cost of travel required to reach the site increased by ten percent, trips would decrease by 2.84 percent.

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[7] Elasticity refers to the percentage change in the dependent variable (trips) caused by a one percent change in the independent variable (unless otherwise noted).

[8] Let the regression equation be $\ln(r) = \alpha_1 + \alpha_2 D + \alpha_3 \ln(Z)$ where Z represents all the continuous independent variables. The equation can be written as $r = e^{(\alpha_1 + \alpha_2 D)} Z^{(\alpha_3)}$. Elasticity of r with respect to D is defined as ε = (% change in r) / (% change in D) = $(\partial r/\partial D)(D/r)$. $\partial r/\partial D = \alpha_2 e^{(\alpha_1 + \alpha_2 D)} Z^{(\alpha_3)}$; D can be 0, 1, or E(D); and r is defined above. Elasticity reduces to $\varepsilon = \alpha_2 D$. Thus, ε becomes zero if D is zero and ε takes the value α_2 if D is one.

Price Elasticity of Closely Related Goods

Money spent during the trip at alternate sportfishing sites in the Snake River basin, c_{as}, has a price elasticity of 0.0647. Thus, increases in the amount of purchased inputs at alternative fishing sites during the trip tends to increase the number of trips. The purchased inputs act as complementary goods to the overall fishing trip experience in central Idaho.

Time spent during the trip on other recreation, t_{or}, had a price elasticity of -0.01804. Persons who engaged in the most non-fishing recreation during the trip tended to take fewer fishing trips.

Elasticity for Income and Time Constraints

Income elasticity was highly significant for this data set. Quantity demanded (sportfishing trips from home to the Snake River per year) was lower for high income anglers. The elasticity of -0.3289 indicates that a person with a ten percent higher income level will take 3.29 percent less trips. It is not unusual to find that outdoor recreation is negatively related to income.

Elasticity with respect to discretionary time is 0.1084 As in past studies, the discretionary time was positive and highly significant. A ten percent increase in free time results in a 1.08 percent increase in sportfishing trips to the Snake River Basin. As expected, available free time acts as an important constraint on the number of sportfishing trips taken per year.

Elasticity With Respect to Other Variables

Elasticity with respect to *TASTE* for fishing was positive showing that anglers who fished longer hours per day were likely to take more sportfishing trips per year to the Snake River. Those who fished ten percent longer per day would tend to take 5.44 percent more sportfishing trips per year to the Snake River.

The sportfishing experience variable showed that those who have fished the Snake River in central Idaho over a long period of time tend to make more sportfishing trips to the river. A ten percent increase in years visited the river results in a 1.19 percent in annual trips to the river.

Estimating Consumer Surplus per Trip from Home to Site

Consumers' surplus was estimated using the result shown in Hellerstein and Mendelsohn (1993) for consumer utility (satisfaction) maximization subject to an income constraint, and where trips are a nonnegative integer. They show that the conventional formula to find consumer surplus for a semilog model also holds for the case of the integer constrained quantity demanded variable. The Poisson and negative binomial regressions, with a linear relation on the explanatory own monetary price variable are equivalent to a semilog functional form. Adamowicz et al. (1989) show that the annual consumers surplus estimate for demand with continuous variables is E(r)/(-ß), where ß is the estimated slope on price and E(r) is average annual visits. Consumers surplus per trip from home to site is 1/(-ß). (Also note that the estimate of consumers surplus is invariant to the distribution of trips along the demand curve when surplus is a linear function of Q. Thus, it is not necessary to numerically calculate surplus for each data point and sum as would be the case if the surplus function was nonlinear.)

Consumers Surplus Per Trip

Estimated coefficients for the travel cost model with labor market disequilibrium, and assuming travel cost per mile of 7.6 cents per mile per person are shown in Table 2. The assumption of 7.6 cents per mile per person is identical with that used in the fishing demand model estimated for the four reservoirs on the Lower Snake River (Normandeau Associates et al. 1998b).[9]

Application of truncated negative binomial regression, and using angler-reported travel distance times $0.076 per mile per person to estimate out-of-pocket travel costs, results in an estimated coefficient of -0.026538 on out-of-pocket travel cost. Consumers surplus per angler per trip is the reciprocal or $37.68. Average angler trips per year in our sample was 5.78. Total surplus per angler per year is average annual trips x surplus per trip or 5.78 x $37.68 = $218 per year.

Total Annual Consumers Surplus for Sportfishing in the Snake River Basin

An important objective of the demand analysis was to estimate total annual willingness-to-pay for fishing in the Snake River Basin. As discussed above, consumer surplus was estimated at $37.68 per person per travel cost trip. The average number of sportfishing trips per year from home to the Snake River Basin was 5.78 resulting in an average annual willingness-to-pay of $218 per year per angler. The annual value of the sport fishery or willingness-to-pay by our sample of 257 anglers is 257 x $218 = $56,026.

The total annual willingness-to-pay for all anglers requires knowledge of the total population of anglers which fish in the Snake River Basin. The number of anglers can be inferred from Steel head licenses sold and the sample share of steel head to total anglers in central Idaho. The central Idaho region includes all Idaho rivers and streams that are accessible to the ocean. Thus, it is assumed that the 40,300 steel head licenses[10] sold in Idaho in 1998 is the number of unique steel head anglers in central Idaho. In comparison, the U.S. Fish and Wildlife publication, *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, reported 47,000 steel head anglers for Idaho. According to our survey, trout was the primary fish caught in central Idaho. Anglers (sample of 372 anglers) listed rainbow trout (69.6%), other fish (47.3%), steel head (38.4%), smallmouth bass (16.4%), sturgeon (5.4%) and bull trout (3.8%) among the species caught. The percentages sum to more than 100% because some anglers caught several of the species. Total anglers for central Idaho is estimated by the ratio of steel head angler numbers to its share, or 40,300/0.384 = 104,948 total anglers. In comparison, total anglers in the State of Idaho in 1996 is reported to be 474,000 by the U.S. Fish and Wildlife. The 1985 National Survey of Fishing, Hunting and Wildlife-Associated Recreation shows 44,000 anglers in region 2 and 128,100 anglers in region 6 for a total of 172,100

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[9] This assumes that anglers in the Snake River Basin and anglers on the four reservoirs on the Lower Snake River use vehicles having similar fuel efficiency. Money travel cost per mile for a vehicle is based on the much larger sample (537 observations versus 257 observations) collected for the reservoirs.

[10] Includes season licenses and 3-day permits.

anglers.[11] U.S. Fish and Wildlife Service regions 2 and 6 are slightly larger than the area covered by the study region in central Idaho.

Multiplying annual value per angler times the number of unique anglers yields total annual willingness-to-pay of $218 x 104,948 = $22,878,664 per year for anglers in central Idaho in 1998. Steel head fishing would account for 21.25% of total annual consumer surplus from fishing in central Idaho or about $4,861,716 per year.[12]

Value of Salmon Fishing in Central Idaho at 1950-1960 Levels

Reading (*The Economic Impact of Steel head Fishing and the Return of Salmon Fishing In Idaho*, September 1996) estimates 150,000 days annually of salmon fishing effort (for sea- run salmon) in the 1950's and 1960's.[13] (Using the *National Survey* ratio of anglers to fishing days implies that Reading’s 150,000 salmon fishing days is equivalent to 21,300 salmon anglers). However, in 1985, the *National Survey* showed a much larger 75,200 salmon anglers fishing 746,300 days in Idaho.

The $218 annual consumer surplus per angler for all species is a very conservative (low) estimate of the value for sea run salmon. If we apply that value to recovered salmon runs, using the angler total based partly on the Reading angler days estimate, we have annual consumer surplus is annual sportfishing value times number of anglers or $218 x 21,300 = $4,643,000.

If we take the *National Survey* data for 1985 and adjust it downward to exclude anglers fishing for land-locked salmon (based on current land-locked salmon angler data) we have 75,200 - 23,000 = 52,200 anglers fishing for sea-run salmon. Consumer surplus is annual sportfishing value times number of anglers or $218 x 52,200 = $11,379,000. The wide range in the estimates of possible value of a recovered Idaho sea-run salmon fishery reflects uncertainty about the accuracy of the data used to expand the sample.

These estimates of total annual value for recovered salmon fishing do not take into account the part of the Snake River Basin that extends into northeast Oregon. Added annual benefits to salmon sportfishing would be created in the State of Oregon (which is part of the Snake River drainage) if sea run chinook salmon fishing was restored in northeast Oregon.

Note however, that the annual value per angler ($218) is based on the average for all species of fish in central Idaho. The annual value per angler of fishing in Idaho for sea run salmon could be higher than for resident fish. Layman, et al. (1996) estimated value per season of $223 for chinook salmon fishing in Alaska using travel cost per mile reported by an automobile association. If they used self-

[11] 1985 is the last year for which the U.S. Fish and Wildlife Service reported data by regions within States.

[12] The share attributed to steel head is based on survey results for type of fish caught adjusted to sum to one hundred percent.

[13] Based on 23,000 fish caught per year and 6.5 fishing days per fish caught.

reported travel costs for salmon anglers their annual value estimate increased to $397 per year.[14]

Comparison of Willingness-To-Pay With Other Studies

Comparisons of net benefits for fishing among demand studies is difficult because of differences in the units of measurement of consumption or output. Comparisons of value per person trip are flawed unless all studies compared have similar length of stays. Comparisons of value per person per day are difficult because some sites and fish species are fishable all day (or even at night) and others only at certain hours. Conversion problems for sportfishing consumption data makes exact comparison among studies impossible. Many studies are quite old and the purchasing power of the dollar has declined over time. Adjustment of values found in older studies to current purchasing power can be attempted using the consumer price index. Another problem with older studies is the changes in both economic and statistical models used to measure value. Adjustment for different travel cost model methodologies, as well as contingent value methodologies, and inflation, is shown in Walsh et al. (1988a; 1988b; 1990a). Some of the more recent studies used higher cost per mile than we did for travel and also used income rate as opportunity time cost that was added to the monetary costs of travel. If these outmoded methods resulted in an overstatement of travel cost, a near proportional overstatement of estimated consumer surplus will occur. In addition, some of the studies used Poisson regression and obtained extremely large t-values. Although no test for over dispersion was mentioned, the very high t-values suggest that the requirement of Poisson regression that the mean and variance of trips per year be equal was violated. If that is the case, the Poisson regressions are inappropriate and should have been replaced with negative binomial regression.

Olsen et al. (1991) used a contingent value survey to obtain estimates for steel head and salmon fishing in the Columbia River Basin including the lower Columbia River. Their estimate is $90 per person per trip for steel head. The average trip length was about two days with 0.68 steel head caught on average during the trip.

Willingness-to-pay per travel cost trip from home to site in the present study was estimated to be $37.68. This result is higher than our estimates for reservoir fishing on the Lower Snake River of some $32 (Normandeau Associates et al. 1998b), and the $35.71 we estimated for anglers on the free flowing Snake River above Lewiston (Normandeau Associates et al. 1998d).[15]

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[14] The annual value estimate increase if foregone income is added to the travel cost. No justification is provided for the amount of income given up while traveling however.

[15] The difference in the value of fishing is believed reliable because the same economic model and estimation techniques were applied to the reservoirs and the free-flowing Snake River.

Table 1 Definition of variables[16]

r =	annual trips from home to the free flowing Snake River fishing site (dependent variable
c_0 =	the angler’s out-of-pocket round trip travel cost to the sport-fishing site, in dollars
$L(t_0)$ =	round trip travel time to the sport-fishing site, in hours
t_{or} =	time spent on other recreation while at the fishing site
$L(C_{as})$ =	the anglers purchases made during the trip at an alternative fishing site in the Snake River Basin, in dollars.
INC =	annual family earned and unearned income, in dollars
L(DT) =	the angler’s discretionary time available per year, in days
L(TASTE) =	the angler’s hours fished per 24 hour day
L(EXP) =	the angler’s total sportfishing experience in the Snake River Basin, in years

[16]L in front of the variable indicates a log transformation

Table 2 Snake River Basin demand travel.

Variable	**Coefficient**	**t-ratio**	**Mean of Variable**	**Elasticity**
Constant	0.5442	3.72	na	na
c_o	-0.026538	-8.26	28.56	-0.76
$L(t_o)$	-0.2842	-3.65	15.07	-0.28
t_{or}	-0.0189	-2.15	5.50	-0.10
$L(c_{as})$	0.0647	1.55	27.04	0.06
INC	-0.0000046	-2.56	71782.00	-0.33
L(*DT*)	0.1084	2.82	91.16	0.11
L(*TASTE*)	0.5442	3.72	6.73	0.54
L(*EXP*)	0.1192	2.04	10.24	0.12

Cost per mile per angler assumed to be $0.076. Truncated negative binomial regression[17], r = trips per year to the river (r = dependent variable), mean r= 5.78. $R^2 = 0.30$ (Estimated by a regression of the predicted values of trips from the truncated negative binomial model on the actual values.)

[17] See Appendix I for a discussion of the statistical methodology.

Table 3 Effects of exogenous variables on an anglers trips per year

Exogenous Variable	Effect on Trips/Year of a +10% Change
Angler’s Money Cost of Round Trip (dollars/trip)	-7.58%
Angler’s Round Trip Travel Time (hours/trip)	-2.84%
Angler Time Spent on Other Recreation at Fishing Site	-0.99%
Angler’s Purchases During the Trip While Fishing Away From the Primary Fishing Site (dollars)	0.65%
Annual Family Income (dollars/year)	-3.29%
Angler’s Discretionary Time Available (days/year)	1.08%
Angler’s Hours per 24 Hour Day Spent on Fishing	5.44%
Anglers’s Total Years of Fishing Experience (years)	1.19%

SPORT-FISHING SPENDING

Anglers were contacted on-site over the period from April 15, 1998 through November 30, 1998 and requested to take part in the sportfishing spending mail survey (AEI 1998). Most persons contacted on-site were agreeable to receiving a mail questionnaire and provided their name and mailing address. Persons on guided tours or guided rafting trips were not directly accessible and tour guides mailed or handed out surveys to their clients. The sportfishing spending survey data are expanded to show the direct economic effects on spending, earnings, and employment in central Idaho.

The spending survey provided a list of potential spending choices and requested the amount spent and the location for each of the spending categories. Separate forms were provided for spending during travel to the site, spending while at the site, and spending on the trip home. A copy of the questionnaire is shown in Appendix II. The sportfishing spending survey resulted in a sample of 259 useable responses. Because of the varied ways in which surveys were distributed it was not possible to calculate a response rate.

Geographic Location of Sportfishing Economic Impacts

Table 4 is based on the sport-fisher spending survey that contained 259 observations. The table shows that 30 anglers, or about 12.2 percent of the 246 responses to this question, lived within a fifty mile radius of their fishing site.[18] The number of visitors living between 50 and 100 miles from the fishing site was 38 which was 15.4 percent of those responding.

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[18] In contrast, most anglers at the four reservoirs on the lower Snake River lived nearby their fishing site. The travel cost demand survey found that 70 percent of the anglers at the lower Snake River reservoirs lived within 50 miles of their fishing site.

Table 4 Anglers and recreationists by distance traveled

Miles One Way	Anglers
50	30
100	38
150	52
200	31
250	19
300	14
350	14
400	14
450	8
500	4
550	3
600	6
650	1
700	0
750	0
800	1
850	1
900	1
950	0
1000	1
1050	0
1100	0
1150	0
1200	1
1250	1
1300	0
1350	0
1400	0
1450	0
>1450	6

Table 5 Expenditures made by anglers traveling to Central Idaho

Type of Purchase	Average Expenditure per Fishing Party
County Government	$5.17
State Government	$19.76
Federal Government	$3.33
Bus/Taxi	$7.63
Tour Boat	$9.19
Airline	$43.85
Auto/Truck/RV Rental	$8.90
Service Station #1	$29.62
Service Station #2	$9.68
Grocery Store	$37.09
Auto Dealer	$117.30
Clothing Store	$6.47
Boat/Marine Store	$3.02
Sporting Goods Store	$15.92
Hardware Store	$1.56
Restaurant	$26.91
Department Store	$10.60
Other Retail	$1.61
Lodging	$25.55
Guide Services	$67.97
Equipment Rental	$2.36
Parking & Car Wash	$4.61
Auto Repair	$8.88
Other Repair	$0.42
Entertainment	$4.03
Health Services	$0.98
All Other Purchases	$11.01

Table 6. Expenditures made by anglers while staying in Central Idaho.

Type of Purchase	Average Expenditure per Fishing Party
County Government	$1.17
State Government	$9.75
Federal Government	$1.57
Bus/Taxi	$0.00
Tour Boat	$2.93
Airline	$7.93
Auto/Truck/RV Rental	$0.21
Service Station #1	$9.43
Service Station #2	$3.24
Grocery Store	$15.71
Auto Dealer	$0.89
Clothing Store	$1.65
Boat/Marine Store	$1.06
Sporting Goods Store	$8.27
Hardware Store	$1.86
Restaurant	$21.49
Department Store	$1.77
Other Retail	$1.25
Lodging	$49.16
Guide Services	$51.68
Equipment Rental	$1.96
Parking & Car Wash	$0.05
Auto Repair	$0.00
Other Repair	$0.58
Entertainment	$2.10
Health Services	$3.22
All Other Purchases	$2.24

Table 7 Expenditures made by anglers returning from Central Idaho.

Type of Purchase	Average Expenditure per Fishing Party
County Government	$0.10
State Government	$0.00
Federal Government	$0.00
Bus/Taxi	$0.00
Tour Boat	$0.00
Airline	$0.46
Auto/Truck/RV Rental	$0.00
Service Station #1	$13.68
Service Station #2	$2.84
Grocery Store	$2.92
Auto Dealer	$0.21
Clothing Store	$0.00
Boat/Marine Store	$121.62
Sporting Goods Store	$0.54
Hardware Store	$0.41
Restaurant	$8.23
Department Store	$0.00
Other Retail	$0.48
Lodging	$3.58
Guide Services	$0.00
Equipment Rental	$0.00
Parking & Car Wash	$0.04
Auto Repair	$0.60
Other Repair	$0.00
Entertainment	$0.00
Health Services	$0.10
All Other Purchases	$0.00

About 86 percent of the 246 anglers lived within 400 miles of the central Idaho recreation site.

Expenditure per Angler, per Trip From Home to Site, and per Year

Summing the detailed expenditures collected in the spending survey and shown in Tables 5 - 7 results in a spending total of $840.40 x 259 = $217,664 for the 259 angler groups in the survey. Average group size was 3.51 persons. Average group expenditures for the sample were $840.40 per fishing round trip or $840.40/3.51 = $239.43 per angler per trip. Multiplying cost per angler per trip times the number of trips per year (6.48) results in an annual fishing trip-related cost of $1,551.51 per year per angler.

Total annual spending by anglers is found by multiplying annual spending per angler per year ($1,551.51) times the number of unique anglers (104,948) or $1,551.51 x 104,948 = $162,827,871 total angler spending per year in Central Idaho.

In comparison, average angler spending estimates for Idaho State from the U.S. Fish and Wildlife Service are much smaller.[19] The *National Survey* (1996) shows average annual trip-related and equipment expenditures for anglers in the State of Idaho in 1991 were $573 per angler per year. Annual fishing expenditures per angler were $109 for food and lodging, $107 for transportation, $57 for other trip costs (boat or equipment rental, guides, charter boats, land use, boating costs, bait, ice, heating and cooking fuel), $57 for fishing equipment, $16 for auxiliary equipment, $112 for special equipment, $1 for magazines and books, and $113 for licenses, stamps, tags, permits, land leasing and ownership. It appears that the U.S. Fish and Wildlife Service data exclude spending by anglers that is not directly trip-related. That was not the goal of this study. It was intended to measure spending that occurred as a result of the fishing trips whether the spending was for fishing activities or not.

Sportfishing Expenditure Rates by Town

The database collected by the sportfishing spending survey will allow detailed measurement of spending by community, by type of purchase, and by travel to site, on-site, or return trip. Towns where sport-fishing spending occurred are identified in the database. These detailed spending data are used in the regional economic impact analyses.

Angler Lodging

About 330 of the 371 anglers in the travel cost demand survey[20] stayed overnight in central Idaho. Table 8 shows that, of those anglers that stay overnight, 62 stayed at motels or commercial campgrounds. About 81 percent of the overnighters stay with friends, or in campers, trailers, mobile homes, tents, or in other accommodations.

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[19] The U.S. Fish and Wildlife Service estimates of fishing and hunting expenditures also were much lower than were found in our survey of 3,500 anglers and hunters in Colorado (McKean and Nobe 1983, 1984).

[20]A travel cost demand survey in central Idaho was conducted by AEI concurrently with the spending survey.

Table 8 Overnight lodging by anglers

Type of Lodging	Number of Anglers
Camper	46
Trailer	31
Commercial Campground	9
Motel	62
With Friends	18
Public Campground	73
Didn't Stay Overnight	41
Other Lodging	91

Angler Mode of Transportation

Method of travel used by the 259 anglers in the spending survey sample was classified into eight categories as shown in Table 9. As expected, personal car/van/truck dominated the transport method. Personal camper or RV was second most likely to be used for transport.

Table 9 Type of transportation used by anglers 1/

Mode of Transport	Percent of Sample
Personal Car/Van/Truck	83.33
Rented Car/Van/Truck	3.49
Personal Camper/RV	16.28
Rented Camper/Mobile Home/RV	0.39
Airplane	8.53
Bus	0.00
Tour Bus	0.39
Tour Boat	0.00
Other	6.59

1/ Total percent exceeds 100 because some anglers used more than one transportation type.

Importance of Recreation Activities During the Fishing Trip

Anglers were asked to rate 17 recreation activities using a scale from one to five where one was most important and five was least important. The results of this survey question are shown in Table 10. The question was phrased, "what recreation activities were important to you and your group on this trip?"

Average group size for the 259 anglers in this survey was 3.51 persons. Table 10 also shows the number of anglers responding for each recreation category. Many persons did not rate all of the types of recreation on the questionnaire. For example, only 51 persons out of 259 responded to the "other" category. Evidently anglers avoided rating recreation activities that were undefined or irrelevant to them. Many anglers simply marked the categories they liked without including a rating number. It was assumed that anglers had the lowest rating on the categories of recreation that they left blank and thus the averages are generally low. However, the response rate itself may be an indicator of angler interest in the various types of recreation. Only two recreation categories drew a response from more than half the anglers: trout fishing, and steel head fishing.

None of the recreation categories except for trout fishing (rated 2.74) and steel head fishing (rated 3.08) seemed very important to the anglers. It is clear from the responses shown in Table 10, that the angler group of outdoor recreationists in central Idaho are primarily interested in trout fishing, steel head fishing, camping, wildlife watching, and nature viewing.

Table 10 Importance of recreation activities during fishing trip

Type of Recreation Activity While on Fishing Trip	Number of Anglers Respondin g to Question out of 259 Surveyed	Average Rating to Group (1 = most important, 5 = least important) Nonresponses Excluded
Steel head Fishing	173	3.08
Smallmouth Bass Fishing	107	4.60
Trout Fishing	181	2.74
Sturgeon Fishing	98	4.72
Bull Trout Fishing	95	4.73
Jet boating	112	4.46
Camping	152	3.44
Other	51	4.51
Rafting	110	4.38
Kayaking	91	4.81
Canoeing	92	4.86
Hiking	122	4.09
Bird Watching	109	4.29
Wildlife Watching	142	3.67
Sightseeing	128	3.81
Biking	95	4.78
Nature Viewing	142	3.53

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APPENDIX I - Statistical Concerns for Demand Curve Estimation

Truncated Poisson or truncated negative binomial regression is appropriate for dependent variables with count data (integer), and truncated negative binomial regression is used in this study (Greene 1981; Creel and Loomis 1990, 1991; Hellerstein and Mendelsohn 1993).[21] Because the data for the dependent variable (visits per year), are integers, truncated below one visit per year, equation estimation by ordinary least squares regression (OLS) is inappropriate. Truncation occurs when part of the data are excluded from the sample. The on-site survey excluded persons not consuming recreation at the study site. Maddala (1983) shows that the regression slopes estimated by OLS will be biased toward zero when the dependent variable data are truncated. The result is that the least squares method understates price elasticity and overstates consumers' surplus.[22]

Poisson and negative binomial regression functional form is mathematically equivalent to a logarithmic transformation of the dependent variable. Most of the independent variables are log transformed. The resulting functional form for these variables in the demand equation is double log. Out-of-pocket travel cost is not transformed resulting in a semi-log functional form.

The significance of the coefficients in a Poisson regression can be greatly overstated if the variance of the dependent variable is not equal to its mean (overdispersion). The negative binomial regression does not have this shortcoming but the iterative solution process sometimes fails to converge.[23] Convergence was not a problem for this data set. Tests for overdispersion in the truncated Poisson regressions were positive. Tests developed by Cameron and Trivedi (1990), and shown in Greene (1992), were conducted. These tests indicated that overdispersion was present in the Poisson regression models. Also, the t-values appeared inflated in the Poisson regressions. A second test is available by actually running the negative binomial regression. When the truncated negative binomial regression was estimated, the coefficient on the overdispersion parameter, ", was 0.6083 with a t-value of 5.19. This result provided strong evidence of overdispersion because the negative binomial model implies:

$$var(r) / E(r) = \{1 + a\, E(r)\} = \{1 + 0.6083\, E(r)\}$$

and our sample estimate of E(r) was 5.78 sportfishing trips from home to the river per year. The Poisson model assumption that var(r)/E(r) = 1 is clearly violated. The t-values found in the truncated negative binomial model were smaller than in the truncated Poisson model. That result was further evidence that Poisson model had overdispersion. Therefore, the truncated negative binomial regression technique was used in place of truncated Poisson regression.

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[21] An alternate approach is to separate the decision process into two parts. The potential visitor first decides whether or not to visit the site. For those who decide to visit the site a second decision is made on the number of visits per year. Two stage estimation techniques such as Tobit, Heckman, and Cragg models do not account for the integer nature of the recreation trips variable resulting in significant error (Mullahy 1986).

[22] Price elasticity is defined as the percentage change in quantity demanded (trips) caused by a one percent change in money trip price (out-of-pocket cost of a trip).

[23] The distinguishing characteristic of many recent non-linear econometric estimation techniques is that the have no explicit analytical solution. In such cases an iterative numerical calculation approach is used (Cramer 1986).

Appendix II - Questionnaire

FIELD(FirstName) FIELD(LastName)
FIELD(Address)
FIELD(City), FIELD(State) FIELD(PostalCode)

Dear FIELD(FirstName) FIELD(LastName),

Recently you helped the University of Idaho by participating in a use survey at FIELD(Where Contacted) on the Snake River. It is our understanding that you, or a household member who was present on the first survey, would be willing to assist this project by completing the attached "Follow-up" survey for a more in-depth view of the Snake River. The information you supply concerning the money you or your party spent in going to the recreation site, at the site, and returning home is of high importance for this study.

Please find enclosed a stamped pre-addressed envelope for mailing to the project home office.

All information will be confidential and will be used only as totals with no individual names or information released to any person or agency.

Thank you for your assistance in completing the survey forms.

Sincerely,

Project Consultant

SPORTFISHER SURVEY   SNAKE RIVER BASIN
(OMB #0710-000 Expires September 30, 1998)

Thank you for agreeing to participate in this sportfisher survey. This questionnaire pertains to central Idaho, near where you were surveyed.

1. Circle one ... **{mainly fish from boat}** **{mainly fish from bank}** **{equal amount from boat and bank}**

2. Circle one ... stayed in: **{camper}** **{trailer}** **{commercial campground}** **{motel}** **{with friends}** **{public campground}** **{didn't stay overnight}** **{other, describe: ____ }**

3. How many hours per 24 hour day do you fish on average? **_________ hours per day**

4. Typically, how many days per year are you on fishing trips to the river where you were surveyed? **_________ days per year**

5. Typically, how many days per year are you on fishing trips to places other than the river where you were surveyed? **_________ days per year**

6. How many fish of all kinds do you typically catch per day at the river where you were surveyed? **________ fish per day**

7. Circle all that apply ... What kind of fish do you typically catch? **{steelhead}** **{rainbow trout}** **{bull trout}** **{sturgeon}** **{smallmouth bass}** **{other, describe other_______________________________}**

8. How many miles (one-way) is it from your home to the river where you were surveyed? _________ **miles one-way**

9. Circle all that apply ... How did you travel to the Snake River fishing site upstream of Lewiston? **{pickup truck}** **{car}** **{boat}** **{bus}** **{plane}** **{other, describe other____}**

10. How many years have you fished in the Snake River Basin? **_______ years**

11. How many days per year are you free from other obligations so that you could go fishing or undertake other recreation? **______ days per year**

12. What is your total time (hours) away from home on a typical trip to the river where you were surveyed? **______ hours**

13. What is the typical total cost to you of a trip to the river where you were surveyed including round trip transportation, equipment, supplies, food, accommodations, entertainment, etc.? **$ ______ cost to you.**

14. Please enter your typical hours away from home and typical trip cost (answered above) in the last row of the table below.

Column 2: please allocate hours away from home across the trip activities listed on the left.

Column 3: please allocate trip cost across the activities listed on the left.

(1) TRIP ACTIVITY	(2) HOURS AWAY FROM HOME	(3) TRIP COSTS IN DOLLARS
Fishing at the river		
Fishing at other sites in central Idaho during the trip		
Travel to and from the fishing site from your home		
Other recreation activities at the river		
Recreation at other places than the river during the trip		
Other Activities on Trip (explain below)*		
	TOTAL HOURS =	**TOTAL DOLLARS =**

* Please describe other activities on trip____

15. What is your occupation? Describe type of employment, or student, housewife, retired, unemployed, school teacher, truck driver, etc.___________________________________

16. How many days of vacation, excluding weekends, do you typically take each year? ______ **days per year**

17. What is the one-way distance from your home to your most preferred alternative fishing site if you didn't fish at this site? **_____ miles one-way**

18. What is the name & location of your most preferred alternative fishing site?
____

19. Circle one ... Will you typically leave the site where you were surveyed for alternative reservoirs, lakes, or streams, if fishing conditions are bad here?
{yes} {no}

20. If the answer to question 19 above is yes, what is the distance one-way from the site where you were surveyed to the alternate site? **______ miles one-way**

21. For the kind of fishing you like to do, how many other sites besides the river where you were surveyed are available to you? **______ other sites**

22. Typically, how many fishing trips per year do you take to the river where you were surveyed? **______ trips per year**

23. What is your age? Circle one ... **{less than 20} {20-25} {25-30} {30-35} {35-40} {40-45} {45-50} {50-55} {55-60} {60-65} {65-70} {70-75} {75-80}**

24. Circle one ... Do you give up wage or salary income (i.e. non-paid vacation) when traveling to this site or while fishing at the site? {yes} {no}

25. If the answer is yes to question 24 above, how much income do you give up for a typical fishing trip to the river where you were surveyed? **$_____________**

26. What is your current wage or salary income in $ per year? Circle one ...
{0-10,000} {10,000-20,000} {20,000-30,000} {30,000-40,000} {40,000-50,000} {50,000-60,000} {60,000-70,000} {70,000-80,000} {over 80,000}

27. What is your current pension, interest income, etc., in $ per year? Circle one ...
{0-10,000} {10,000-20,000} {20,000-30,000} {30,000-40,000} {40,000-50,000} {50,000-60,000} {60,000-70,000} {70,000-80,000} {over 80,000}

Lower Snake River OMB # 0710-0001
SPORTFISHING TRAVEL SURVEY **Expires 9-30-199**

1. What is your ZIP code? ________

2. How many fishing trips to the Lower Snake River region did you take in the last 12 months? _______ trips

3. What was your method of travel to the Lower Snake River? (Please check as many as apply)

< > Personal car/van/truck
< > Rented car/van/truck
< > Personal Camper/RV
< > Rented Camper/Mobile Home/RV
< > Bus
< > Tour Bus
< > Tour Boat
< > Other, (describe)
____

4. How many nights were you away from home on this trip? ______ nights

5. When you left home what was your primary destination? ___________________
____

6. How many miles did you travel (one-way) from your home to your fishing site on the Lower Snake River? _______ miles

7. How many people were in your travel group? _______ persons

8. What recreation activities were important to you and your group on this trip?
Please <u>rank each activity</u> 1 to 5, where 1 is very important and 5 is not important.

< > lake fishing
< > river fishing
< > boating
< > water skiing
< > swimming
< > other water sports
< > camping
< > other, describe
____
< > bird hunting
< > small game hunting
< > big game hunting
< > hiking
< > bird watching
< > wildlife watching
< > sightseeing
< > biking
< > nature viewing

9. Expenditures made by your group while **traveling to the Lower Snake River fishing site**.

Type of Business	Dollar Amount	Name of Town or Nearest Major Town
County Government permits/licenses/fees		
State Government permits/licenses/fees		
Federal Government permits/licenses/fees		
Bus or Taxi Service		
Tour Boat		
Airline		
Car, P.U. or RV Rental		
Service Station (1)		
Service Station (2)		
Food Store		
Auto Dealer		
Clothing Store		
Boat/Marine Store		
Sporting Goods Store		
Hardware Store		
Restaurant		
Dept. Store		
Other Retail (describe)		
Motels & Lodging		
Guide Services		
Equipment Rental		
Parking and Car Wash		
Auto Repair		
Other Repair (describe)		
Entertainment		
Health Services		
Other (describe)		
Other (describe)		

Please make your best estimate for each category, enter zero if no expenditure.

10. Expenditures made by your group while **at the Lower Snake River fishing site**.

Type of Business	Dollar Amount	Name of Town or Nearest Major Town
County Government permits/licenses/fees		
State Government permits/licenses/fees		
Federal Government permits/licenses/fees		
Bus or Taxi Service		
Tour Boat		
Airline		
Car, P.U. or RV Rental		
Service Station (1)		
Service Station (2)		
Food Store		
Auto Dealer		
Clothing Store		
Boat/Marine Store		
Sporting Goods Store		
Hardware Store		
Restaurant		
Dept. Store		
Other Retail (describe)		
Motels & Lodging		
Guide Services		
Equipment Rental		
Parking and Car Wash		
Auto Repair		
Other Repair (describe)		
Entertainment		
Health Services		
Other (describe)		
Other (describe)		

Please make your best estimate for each category, enter zero if no expenditure.

11. Expenditures made by your group **on the return trip back home**.

Type of Business	Dollar Amount	Name of Town or Nearest Major Town
County Government permits/licenses/fees		
State Government permits/licenses/fees		
Federal Government permits/licenses/fees		
Bus or Taxi Service		
Tour Boat		
Airline		
Car, P.U. or RV Rental		
Service Station (1)		
Service Station (2)		
Food Store		
Auto Dealer		
Clothing Store		
Boat/Marine Store		
Sporting Goods Store		
Hardware Store		
Restaurant		
Dept. Store		
Other Retail (describe)		
Motels & Lodging		
Guide Services		
Equipment Rental		
Parking and Car Wash		
Auto Repair		
Other Repair (describe)		
Entertainment		
Health Services		
Other (describe)		
Other (describe)		

Please make your best estimate for each category, enter zero if no expenditure.