**US Army Corps of Engineers**
**Walla Walla District**

# FINAL DRAFT
# Willingness-To-Pay and Expenditures by Anglers In the Snake River Basin in Central Idaho

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## Executive Summary

Two surveys were conducted on sportfishers 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 sportfishers. 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 usable responses.

In comparison to the lower Snake River reservoir surveys and surveys in the unimpounded reach upstream of Lewiston, 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. Also, the inclusion of a two dollar bill as an incentive payment 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 sportfishers 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.[1]

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 species caught with 70.8 percent of anglers including trout in their catch. The fishing value for recovered sea run salmon would be an additional $11.4 million.

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 by expenditure survey respondents (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 in central Idaho.

## PURPOSES OF THE SPORTFISHING DEMAND AND SPENDING SURVEYS

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 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. Figure 1 locates the study region in central Idaho relative to other states and towns. The principal areas within central Idaho where respondents were contacted were centered in the towns of Salmon, Riggins, and Orofino. These towns were the focus of recreation on the upper Salmon River, main fork of the Salmon River and the Little Salmon River, and the Clearwater and Lochsa rivers, respectively.


Figure 1. Locator map for the study region in Central Idaho

## MEASUREMENT OF ECONOMIC VALUE

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 a government agency is involved. Because of the size of the project, 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 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.[2] 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.

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 sportfishers 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).[3] "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 2 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 sportfishers 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 sportfishers 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 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.

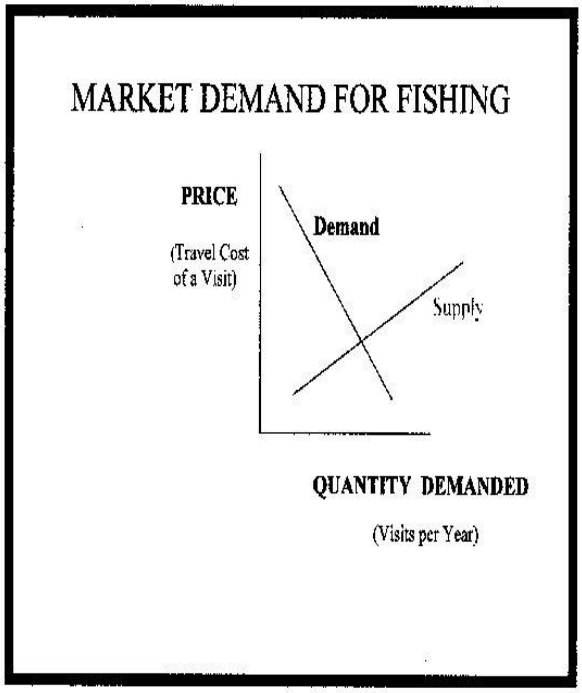


Figure 2. Market Demand for Fishing

Figure 3 describes the demand by a typical angler for sportfishing at the Snake River Basin in central Idaho. Angler demand is negatively sloped indicating, as before, 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 fishing site per year would not influence the cost per trip.

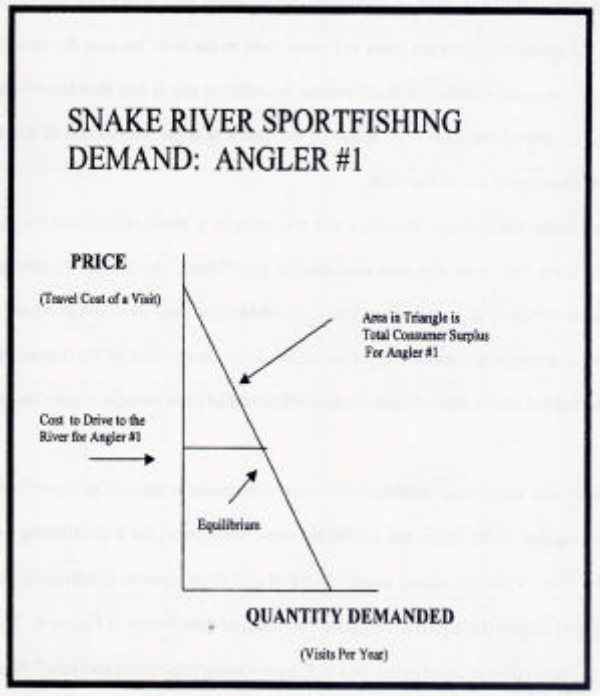


Figure 3. Sportfishing Demand for an Individual

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 sportfisher 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.

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 4. The statistical demand curve is fitted to the data in Figure 4 using regression analysis.[4] Non monetary factors, such as available free time and relative enjoyment for 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.

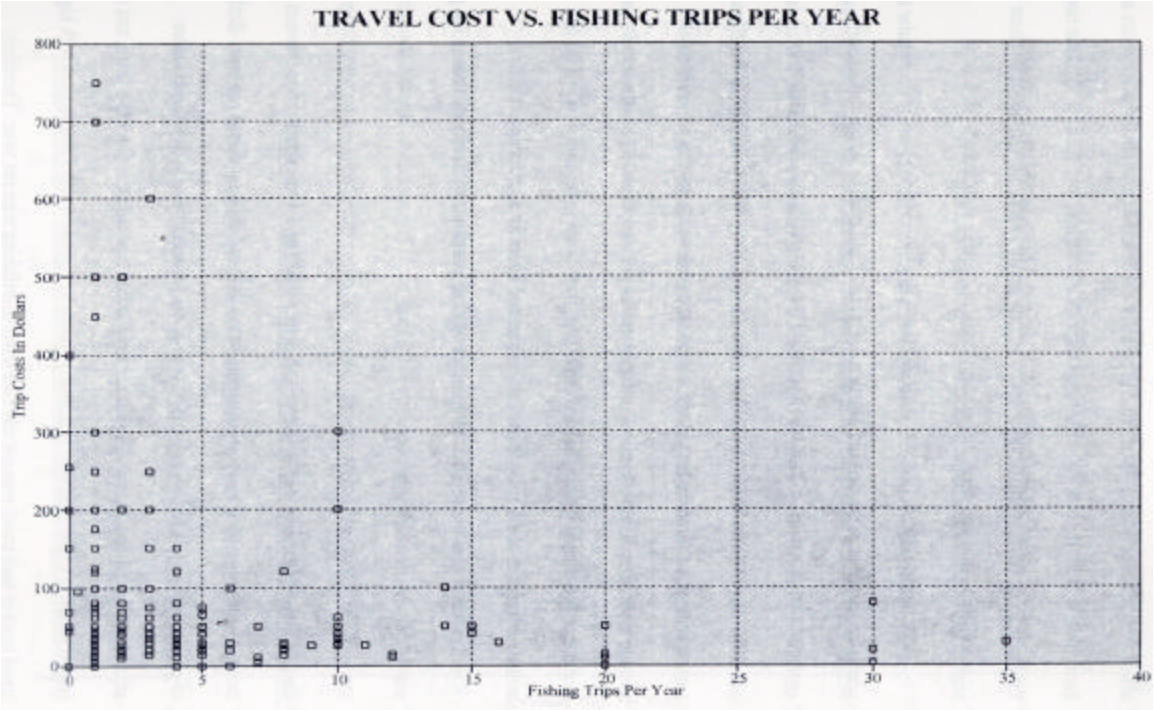


Figure 4 - Travel cost versus fishing trips per year

The goal of the travel cost demand analysis is to empirically measure the triangular area in Figure 3 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 demand sample and divided by their average number of trips per

year. This is the estimated consumer surplus per sportfishing trip or 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 4 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 5 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 4 and 5 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.

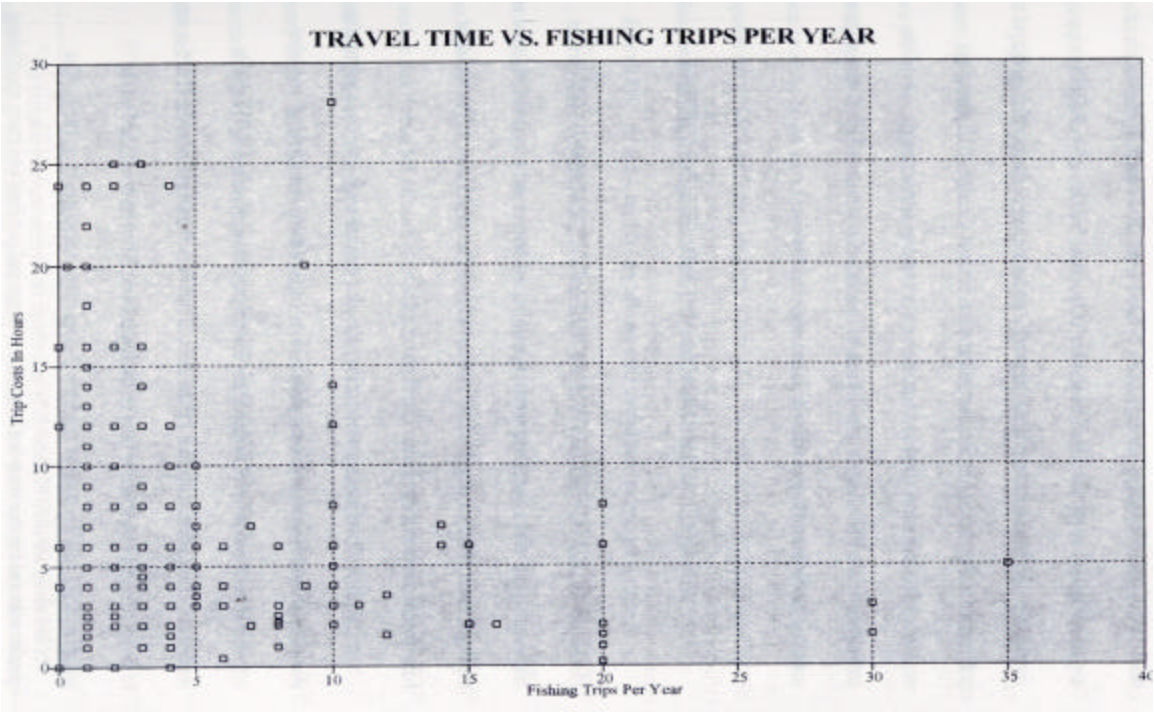


Figure 5. Travel time versus fishing trips per year

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) of the sportfishing output of a public good is shown by the area under the statistical demand function. The annual net economic value (consumer surplus) 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.

## THE SNAKE RIVER BASIN DEMAND AND SPENDING SURVEYS

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

The Snake River Basin 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. The demand survey resulted in 257 usable responses. The questionnaire used for the demand survey is shown in Appendix II and is similar to the sportfishing questionnaire used on the lower Snake River reservoirs and on the unimpounded Snake River above Lewiston (Normandeau Associates *et al.*, 1999). 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.[5]

The spending survey provided a list of potential spending choices and requested the amount spent and the location for each of the spending categories (Appendix II). 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 usable responses. Because of the varied ways in which surveys were distributed it was not possible to calculate response rates. The sportfishing spending survey data are expanded to show the direct economic effects on spending, earnings, and employment in central Idaho.

## THE IMPORTANCE OF 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.[6]

## 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 (*i.e.*, 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, physical travel time and money cost per trip from home to site enter as separate price variables in the demand function. (Figures 4 and 5 show actual money cost and time cost plotted against fishing trips demanded per year). Discretionary time 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 shown in the following equation:

$$r = b_0 + b_1 c_o + b_2 t_o + b_3 c_a + b_4 t_a + b_5 INC + b_6 DT$$

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

$$r = f[c + (t)g'(w)]$$

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 (?f/?c) to be equal in magnitude to a change in the opportunity time cost ?f/?[(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.[7] 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 must be 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 complementarity 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 travelling 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 onsite and for side trips. Furthermore, both trips and onsite 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), onsite 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 underspecification bias if the prices of closely related goods were omitted.[8] 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.

## THE TRAVEL COST DEMAND VARIABLES AND ANGLER CHARACTERISTICS

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. 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%), steelhead (38.4%), smallmouth bass (16.4%), white 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.

| Table 1<br>Definition of Variables[9] | |
|---|---|
| $r$ | Annual trips from home to the Snake River Basin fishing site (dependent variable) |
| $c_o$ | The angler's out-of-pocket round trip travel cost to the Snake River fishing site, in dollars |
| L($t_o$) | Round trip travel time to the fishing site, in hours |
| $t_{or}$ | Time spent on other recreation while at the fishing site |
| L($c_{as}$) | The angler's purchases made during the trip at an alternate 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 year, in days |
| L(*EXP*) | The angler's total sportfishing experience in the Snake River Basin, in years |

### The Prices of a Trip From Home to Site

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 (Normandeau Associates *et al.*, 1999). 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).

The physical time price for each individual in the B-S-H model (disequilibrium labor market) is measured by to 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.

## Closely Related Goods Prices

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 multidestination 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 onsite 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 nonsignificant.

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 nonsignificant. Anglers with a boat did not visit the fishing site any more often than shore anglers.

## ESTIMATED 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.[10] 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.[11]

**Table 2**
**Snake River Basin Demand**
**Travel Cost Per Mile Per Angler Assumed to be $0.076**

**Truncated Negative Binomial Regression[12], 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).**

| 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 |

**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% |
| Angler's Total Years of Fishing Experience (years) | 1.19% |

### Price Elasticity of Demand

Price elasticity with respect to out-of-pocket travel cost is -0.7579. A 10 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 10 percent, trips would decrease by 2.84 percent.

### 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 10 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 10 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 10 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 10 percent increase in years visited the river results in a 1.19 percent in annual trips to the river.

**Tests of Statistical Significance**

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 overdispersion (Cameron and Trivedi, 1990; Greene, 1992) for the Poisson regression were negative. Thus, unlike the data sets for the lower Snake River reservoirs and the unimpounded survey reach 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.

## ESTIMATING CONSUMERS 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)/(-β), where β is the estimated slope on price and E(r) is average annual visits. Consumers surplus per trip from home to site is 1/(-β). (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 From Home to Site Assuming Travel Cost of 7.6 cents per Mile per Angler

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.*, 1999).[13]

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. 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 steelhead licenses sold and the sample share of steelhead anglers to total anglers in central Idaho. The study area (upriver economic subregion) includes all Idaho rivers and streams that are accessible to the ocean. Thus, it is assumed that the 40,300 steelhead licenses[14] sold in Idaho in 1998 is the number of unique steelhead anglers in the Snake River Basin. In comparison, the U.S. Fish and Wildlife Service publication, *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, reported 47,000 steelhead anglers for Idaho. Total anglers in the Snake River Basin is estimated by the ratio of steelhead angler numbers to the proportion of steelhead anglers in our sample (38.4%, see page 26), 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 Service. 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 anglers in central Idaho.[15] U.S. Fish and Wildlife Service regions 2 and 6 in Idaho are slightly larger than the study area in the Snake River Basin.

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 the Snake River Basin in Idaho in 1998. Steelhead fishing would account for 21.25% of total annual consumer surplus from fishing, or about $4,861,716 per year.

**The Sportfishing Value of Returning Salmon Fishing in Central Idaho to the Levels of 1950-1960**

Reading (*The Economic Impact of Steelhead 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.[16] The *1996 National Survey* shows 23,000 salmon anglers in Idaho fishing 162,000 days mainly for landlocked planted salmon. (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). In 1991, the *National Survey* showed 30,300 salmon anglers fishing 175,600 days in Idaho. However, in 1985, the *National Survey* showed a huge 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 (1996) angler days estimate, we have annual consumer surplus equal to annual sportfishing value (consumer surplus) 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 equal to annual sportfishing value times number of anglers or $218 x 52,200 = $11,379,000.

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 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 much 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-reported travel costs for salmon anglers their annual value estimate increased to $397 per year.[17]

## 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 overdispersion 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 steelhead and salmon fishing in the Columbia River Basin including the lower Columbia River. Their estimate is $90 per person per trip for steelhead. The average trip length was about two days with 0.68 steelhead 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, and the $35.71 we estimated for anglers on the unimpounded 30-mile reach of the Snake River above Lewiston (Normandeau Associates et al. 1999).[18]

## THE SPORTFISHER SPENDING SURVEY

### Geographic Location of Recreation Economic Impacts

Table 4 shows that relatively few anglers (12.2 percent of the 246 usable responses to this question), lived within a 50 mile radius of their fishing site.[19] The number of visitors living between 50 and 100 miles from the fishing site represented 15.4 percent of those responding. About 61 percent of the 246 anglers lived within 200 miles of the central Idaho recreation site. Nine respondents (3.6%) traveled 1,000 miles or more to fish in central Idaho.

**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 | 0 |

**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 through 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.

**Table 5**
**Expenditures Made By Anglers Traveling to Central Idaho**

| Type of Purchase | Average Expenditures 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 and 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 Expenditures 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 and 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 Expenditures 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 and Car Wash | $0.04 |
| Auto Repair | $0.60 |
| Other Repair | $0.00 |
| Entertainment | $0.00 |
| Health Services | $0.10 |
| All Other Purchases | $0.00 |

In comparison, average angler spending estimates for Idaho determined by the U.S. Fish and Wildlife Service are much smaller.[20] 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, which 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, onsite, or return trip. Towns where sportfisher spending occurred are identified in the database. These detailed spending data are used in the regional economic impact analyses.

## Angler Lodging

Questions about angler lodging were only asked in the travel cost survey, but are reported herein. About 330 of 371 (89%) anglers in the travel cost demand survey[21] stayed overnight during fishing trips in central Idaho. Table 8 shows that, of those anglers that stayed overnight, 71 (21.5%) stayed at motels or commercial campgrounds. About 78.5 percent of the overnighters stayed with friends, or in campers, trailers, mobile homes, tents, or in other accommodations. Table 6 shows that reported lodging expenditures were second only to guide services for anglers staying in central Idaho.

**Table 8**
**Overnight Lodging**
**By 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 | 83.3 |
| 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?"

**Table 10**
**Importance of Recreation Activities During Fishing Trip**

| Type of Recreation Activity While On Fishing Trip | Number of Anglers Responding To Question Out of 259 Surveyed | Average Rating To Group (1 = Most Important, 5 = Least Important) Nonresponses Excluded |
|---|---|---|
| Steelhead 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 |
| Jetboating | 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 |

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. Five recreation categories drew a response from more than half the anglers: trout fishing, steelhead fishing, camping, nature viewing, and wildlife watching. However, trout fishing (2.74) received the only rating less than 3.0 among all possible activities. Thus, few of the recreation categories listed other than fishing for trout or steelhead seemed very important to the anglers.

**REFERENCES**

Adamowicz, W.L., J.J. Fletcher, and T. Graham-Tomasi. 1989.

*Functional Form and the Statistical Properties of Welfare Measures.* American Journal of Agricultural Economics 71:414-420.

Becker G.S., 1965.

*A Theory of the Allocation of Time.* Economic Journal 75:493-517.

Binkley, D., and T.C. Brown. 1993.

*Management Impacts on Water Quality of Forests and Rangelands.* USDA Forest Service. GT Report RM-239. Rocky Mountain Forest and Range Experiment Station:Fort Collins.

Bishop, R.C., and T.A. Heberlein. 1979.

*Measuring Values of Extra-Market Goods: Are Indirect Measures Biased?* American Journal of Agricultural Economics 61(5):926-932.

Bockstael, N.E., and K.E. McConnell. 1981.

*Theory and Estimation of the Household Production Function for Wildlife Recreation.* Journal of Environmental Economics and Management 8:199-214.

Bockstael, N.E., Strand, I.E., and W.M. Hanemann. 1987.

*Time and the Recreational Demand Model.* American Journal of Agricultural Economics 69:293-302.

Brown, W.G., and F. Nawas. 1973.

*Impact of Aggregation on the Estimation of Sportfishing Demand Functions.* American Journal of Agricultural Economics 55:246-49.

Cameron, A., and P. Trivedi. 1990.

*Regression Based Tests for Overdispersion in the Poisson Model.* Journal of Econometrics 46:347-364.

Cameron, T.A., W.D. Shaw, S.E. Ragland, J. Callaway, and S. Keefe. 1996.

*Using Actual and Contingent Behavior Data with Differing Levels of Time Aggregation to Model Recreation Demand.* Journal of Agricultural and Resource Economics 21(1):130-149.

Caulkins, P.P., R.C. Bishop, and N.W. Bouwes. 1985.

*Omitted Cross-Price Variable Biases in the Linear Travel Cost Model: Correcting Common Misperceptions.* Land Economics 61:182-87.

Clawson, M. and J.L. Knetsch. 1966.

*Economics of Sportfishing.* Johns Hopkins University Press: Baltimore.

Cramer, J.S. 1986.

*Econometric Applications of Maximum Likelihood Methods.* Cambridge University Press: Cambridge. 208pp.

Creel, M.D., and J.B. Loomis. 1990.

*Theoretical and Empirical Advantages of Truncated Count Data Estimators for Analysis of Deer Hunting in California.* American Journal of Agricultural Economics 72:434-41.

Creel, M.D., and J.B. Loomis. 1991.

*Confidence Intervals for Welfare Measures with Application to a Problem of Truncated Counts.* The Review of Economics and Statistics 73:370-373.

Crow, E.L., F.A. Davis, and M.W. Maxfield. Undated.

*Statistics Manual.* Research Department, U.S. Naval Ordnance Test Station. Dover Publications, Inc: New York.

Dhrymes, P.J. 1978.

*Introductory Econometrics.* Springer-Verlag: New York. 288pp.

Donnelly, D.M., J.B. Loomis, C.F. Sorg, and L.J. Nelson. 1983.

*Net Economic Value of Recreational Steelhead Sportfishing in Idaho.* Resource Bulletin RM-9. Rocky Mountain Forest and Range Experiment Station. USDA Forest Service. Fort Collins, Colorado.

Englin, J., and J.S. Shonkwiler. 1995.

*Estimating Social Welfare Using Count Data Models: An Application to Long-Run Recreation Demand Under Conditions of Endogenous Stratification and Truncation.* The Review of Economics and Statistics :104-112.

Englin, J., D. Lambert, and W.D. Shaw. 1997.

*A Structural Equations Approach to Modeling Consumptive Recreation Demand.* Journal of Environmental Economics and Management 33:33-43.

Fiore, J., and F.A. Ward. 1987.

*Managing Recreational Water Resources to Increase Economic Benefits to Recreationists in the Arid Southwest.* Agricultural Experiment Station. Report No. 609. New Mexico State University, New Mexico.

Fletcher, J.J., W.L. Adamowicz, and T. Graham-Tomasi. 1990.

*The Travel Cost Model of Recreation Demand: Theoretical and Empirical Issues.* Leisure Sciences 12:119-147.

Greene, W.H. 1992.

*LIMDEP, Version 6.* Econometric Software, Inc.: Bellport, New York.

Greene, W.H. 1981.

*On the Asymptotic Bias of Ordinary Least Squares Estimator of the Tobit Model.* Econometrica 49:505-13.

Gum, R., and W.E. Martin. 1975.

*Problems and Solutions in Estimating The Demand for the Value of Rural Sportfishing.* American Journal of Agricultural Economics 57:558-66.

Hellerstein, D.M. 1991.

*Using Count Data Models in Travel Cost Analysis with Aggregate Data.* American Journal of Agricultural Economics 73:860-67.

Hellerstein, D.M., and R. Mendelsohn. 1993.

*A Theoretical Foundation for Count Data Models.* American Journal of Agricultural Economics 75:604-611.

Herfindahl, O.C., and A.V. Kneese. 1974.

*Economic Theory of Natural Resources.* Charles E. Merril Publishing Co.:Columbus, Ohio. 405pp.

Johnson, D.M. 1989.

*Economic Benefits of Alternative Fishery Management Programs.* Ph.D. Dissertation. Colorado State University. Fort Collins, Colorado.

Johnson, T.G. 1983.

*Measuring the Cost of Time in Recreation Demand: Comment.* American Journal of Agricultural Economics 65:169-171.

Kmenta, J., 1971.

*Elements of Econometrics.* The MacMillan Company: New York. 391-396

Larson, D.M. 1993.

*Joint Recreation Choices and Implied Values of Time.* Land Economics 69(3):270-86.

Layman, R.C., J.R. Boyce, and K.R. Criddle. 1996.

*Economic Valuation of the Chinook Salmon Sport Fishery of the Gulkana River, Alaska, Under Current and Alternate Management Plans.* Land Economics 72(1):113-28.

Loomis, J.B. 1997.

*Recreation Economic Decisions: Comparing Benefits and Costs, Second Edition.* With Richard Walsh. Venture Publishing, Inc.: State College, PA.

Loomis, J.B., Sorg, C.F., and D.M. Donnelly. 1986.

*Evaluating Regional Demand Models for Estimating Recreation Use and Economic Benefits: A Case Study.* Water Resources Research 22:431-38.

Loomis, J.B., B. Roach, F.A. Ward, and R. Ready. 1993.

*Reservoir Recreation Demand and Benefits Transfers: Preliminary Results.* Western Regional Research Publication. W-133 Benefits and Costs Transfer in Natural Resource Planning.

Maddala, G.S. 1983.

*Limited Dependent and Qualitative Variables in Econometrics.* Cambridge University Press: Cambridge.

Maddala, G.S. 1977.

*Econometrics.* International Student Edition. McGraw-Hill Book Company: Singapore.

Maler, K.G. 1974.

*Environmental Economics: A Theoretical Inquiry.* Johns Hopkins University: Baltimore.

McConnell, K.E. and I.E. Strand. 1981.

*Measuring the Cost of Time In Recreational Demand Analysis: An Application to Sportfishing.* American Journal of Agricultural Economics 63:153-56.

McConnell, K.E. and I. Strand. 1983.

*Measuring the Cost of Time in Recreation Demand Analysis: Reply.* American Journal of Agricultural Economics 65:172-74.

McConnell, K.E. 1992.

*On-Site Time in Recreation Demand.* American Journal of Agricultural Economics 74:918-25.

McKean, J.R., and D.M. Johnson. 1998.

*Experiments with Equilibrium and Disequilibrium Labor Market Travel Cost Models.* In Review. 34pp.

McKean, J.R., R.G. Taylor, G. Alward, and R.A. Young. Forthcoming 1998.

*Adapting Synthesized Input-Output Models for Small Natural Resource-Based Regions: A Case Study.* Society and Natural Resources, An International Journal.

McKean, J.R., and R.G. Walsh. 1986.

*Neoclassical Foundations for Nonmarket Benefits Estimation.* Natural Resource Modeling 1:153-170.

McKean, J.R., and C. Revier. 1990.

*An Extension of 'Omitted Cross-Price Variable Biases in the Linear Travel Cost Model: Correcting Common Misperceptions.* Land Economics 66:162-82.

McKean, J.R., D.M. Johnson, and R.G. Walsh. 1995.

*Valuing Time in Travel Cost Demand Analysis: An Empirical Investigation.* Land Economics 71:96-105.

McKean, J.R., R.G. Walsh, and D.M. Johnson. 1996.

*Closely Related Good Prices in the Travel Cost Model.* American Journal of Agricultural Economics 78:640-646.

McKean, J.R., and K.C. Nobe. 1983.

*Sportsmen Expenditures for Hunting and Sportfishing in Colorado - 1981.* Technical Report No. 39. Colorado Water Resources Research Institute, Colorado State University and Colorado Division of Wildlife.

McKean, J.R., and K.C. Nobe. 1984.

*Direct and Indirect Economic Effects of Hunting and Sportfishing in Colorado - 1981.* Technical Report No. 45. Colorado Water Resources Research Institute, Colorado State University and Colorado Division of Wildlife. Fort Collins, Colorado.

Mendelsohn, R., J. Hof, and G.L. Peterson. 1992.

*Measuring Recreation Values with Multiple-Destination Trips.* American Journal of Agricultural Economics 74:926-33.

Mullahy, R. 1986.

*Specification and Testing of Some Modified Count Data Models.* Journal of Econometrics 33:341-365.

Normandeau Associates, University of Idaho, and Agricultural Enterprises, Inc. 1999.

*Sport Fishery Use and Value on Lower Snake River Reservoirs.* Contract No. DACW68-D-0003. US Army Corps of Engineers, Walla Walla District, Walla Walla, Washington.

Olsen, D., J. Richards, and R.D. Scott. 1991.

*Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs.* Rivers 2(1):44-56.

Oster, J.M., D.T. Taylor, J.J. Jacobs, and E.B. Bradley. 1987.

*Reservoir Entrophication and the Value of Recreation Activities: A Case Study of Flaming Gorge Reservoir.* Department of Agricultural Economics and Wyoming Water Research Center. University of Wyoming. Laramie, Wyoming.

Palm, R.C., and S. P. Malvestuto. 1983.

*Relationships Between Economic Benefit and Sport-Sportfishing Effort on West Point Reservoir, Alabama-Georgia.* Transactions of the American Fisheries Society. Page 112.

Parsons, G.R. 1991.

*A Note on Choice of Residential Location in Travel Cost Demand Models.* Land Economics 67(3):360-64.

Peterson, G.L., C.S. Swanson, D.W. McCollum, and M.H. Thomas, Eds. 1992.

*Valuing Wildlife Resources in Alaska.* Westview Press: Boulder, CO. 357pp.

Randall, A. 1994.

*A Difficulty with the Travel Cost Method.* Land Economics 70(1):88-96.

Reading, Don. 1996.

*The Economic Impact of Steelhead Fishing and the Return of Salmon Fishing in Idaho.* Ben Johnson Associates. For the Idaho Fish and Wildlife Foundation.

Reading, Don. 1999.

*The Economic Impact of A Restored Salmon Fishery in Idaho.* Ben Johnson Associates. For the Idaho Fish and Wildlife Foundation.

Rosenthal, D.H. 1987.

*The Necessity for Substitute Prices in Recreation Demand Analyses.* American Journal of Agricultural Economics 69:828-37.

Shaw, W.D. 1992.

*Searching for the Opportunity Cost of an Individual's Time.* Land Economics 68:107-15.

Shaw, D. 1988.

*On-Site Samples' Regression Problems of Non-Negative Integers, Truncation and Endogenous Stratification.* Journal of Econometrics 37:211-223.

U.S. Army Corps of Engineers. 1995.

*Columbia River System Operation Review, Final Environmental Impact Statement, Appendix O, Economic and Social Impact.*

U.S. Army Corps of Engineers. 1995.

*Columbia River System Operation Review, Final Environmental Impact Statement, Appendix J-1, Recreation Demand Model & Simulation Results.*

U.S. Army Corps of Engineers. 1995.

*Columbia River System Operation Review, Final Environmental Impact Statement, Appendix J, Recreation.*

U.S. Water Resources Council. 1983.

*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.* U.S. Government Printing Office.

Wade, W.W., G.M. McColister, R.J. McCann, and G.M. Johns. 1988.

*Estimating Recreation Benefits for Instream and Diverted Users of Waterflows of the Sacramento-San Joaquin Rivers Watershed.* Presented at the W-133 Meeting. Monterey, California.

Walsh, R.G., D.M. Johnson, and J.R. McKean. 1988.

*Review of Sportfishing Economic Demand Studies with Nonmarket Benefit Estimates 1978-1988.* Colorado Water Resources Research Institute. Technical Report No. 54. Colorado State University, Fort Collins, Colorado.

Walsh, R.G., J.R. McKean, and D.M. Johnson. 1988.

*Benefit Transfer of Sportfishing Demand Studies, 1968-88.* Water Resources Research 28(3):707-713.

Walsh, R.G., G.L. Peterson, and J.R. McKean. 1989.

*Distribution and Efficiency Effects of Alternative Recreation Funding Methods.* Journal of Leisure Research 21:327-47.

Walsh, R.G., J.R. McKean, and D.M. Johnson. 1990a.

*Nonmarket Values from Two Decades of Research on Recreation Demand.* In Advances in Applied Microeconomics, Vol. V. V.K. Smith and A.N. Link Eds. JAI Press, Inc.: Greenwich, Conn. Pp. 167-194.

Walsh, R.G., L.D. Sanders, and J.R. McKean. 1990b.

*The Consumptive Value of Travel Time on Recreation Trips.* Journal of Travel Research 29:17-24.

Ward, F.A. 1983.

*Measuring the Cost of Time in Recreation Demand Analysis: Comment.* American Journal of Agricultural Economics 65:167-68.

Ward, F.A. 1989.

*Efficiently Managing Spatially Competing Water Uses: New Evidence from a Regional Recreation Demand Model.* Journal of Regional Science 29(2):229-46.

Ward, F.A. 1984.

*Specification Considerations for the Price Variable in Travel Cost Demand Models.* Land Economics 60:301-5.

Whitehead, J.C. 1991-92.

*Benefits of Quality Changes in Recreational Sportfishing: A Single-Site Travel Cost Approach.* Journal of Environmental Systems 21(4):357-64.

Wilman, E.A. 1980.

*The Value of Time in Recreation Benefit Studies.* Journal of Environmental Economics and Management 7:272-86.

Wilman, E.A., and R.J. Pauls. 1987.

*Sensitivity of Consumers' Surplus Estimates to Variation in the Parameters of the Travel Cost Model.* Canadian Journal of Agricultural Economics 35:197-211.

## 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).[22] 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 onsite 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.[23]

Poisson and negative binomial regression functional form is mathematically equivalent to a logarithmic transformation of the dependent variable. Some 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 and several other independent variables are 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.[24] Convergence was not a problem for this data set. Tests for overdispersion in the truncated Poisson regressions were conflicting. Tests developed by Cameron and Trivedi (1990), and shown in Greene (1992), were conducted. These tests did not indicate that overdispersion was present in the Poisson models estimated for this study. However, 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, α, was 0.86 with a t-value of 11.15. This result provided strong evidence of overdispersion because the negative binomial model implies var(r)/E(r) = {1 + α E(r)} = {1 + 0.86 E(r)} and our sample estimate of E(r) was 20.255 fishing trips from home to the reservoirs 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 much 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.

## APPENDIX II - QUESTIONNAIRES

FIELD(Date)

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(WhereContacted) 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 rank each activity 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.**

## APPENDIX III - CODE FORMS FOR SPREADSHEET DATA FILES

### Snake River Sport Fishing Travel Cost
### Code Page for Entry Into Microsoft Excel

| For Column | Corresponding Question or Data From Survey |
|---|---|
| A | Control Number |
| | Mainly fish from... |
| B | 1) Boat<br>2) Bank<br>3) Equal boat and bank |
| | Stayed in... |
| C | 1) Camper<br>2) Trailer<br>3) Commercial Camp<br>4) Motel<br>5) With Friends<br>6) Public Camp<br>7) Didn't stay over<br>8) Other |
| D | How many hours per day do you fish on average? |
| E | How many days per year are you on fishing trips to the river where surveyed? |
| F | How many days per year are you on fishing trips to places other than the river? |
| G | How many fish of all kinds do you typically catch per day at the survey location? |
| | What kinds of fish do you typically catch (1=indicated, 0=not indicated) |
| H | Steelhead |
| I | Rainbow Trout |
| J | Northern pikeminnow |
| K | Channel Catfish |
| L | Smallmouth Bass |

| | |
|---|---|
| M | Other |
| N | How many miles (one-way) to river where surveyed? |
| | How did you travel to the fishing site?<br>(Where 1 = circled and 0 = not circled) |
| O | Pickup Truck |
| P | Car |
| Q | Boat |
| R | Bus |
| S | Plane |
| T | Other |
| U | How many years have you fished on the lower Snake River? |
| V | How many days per year are you free from other obligations? |
| W | What is your total time (hours) away from home on a typical trip to the river? |
| X | What is the typical cost to you of a trip to the river where surveyed? |
| Y | 14a1 Hours Away: Fishing at the river |
| Z | 14a2 Dollars of Trip Costs: Fishing at the river |
| AA | 14b1 Hours Away: Fishing at other sites than the river |
| AB | 14b2 Dollars of Trip Costs: Fishing at other sites than the river |
| AC | 14c1 Hours Away: Travel to and from the lower Snake region |
| AD | 14c2 Dollars of Trip Costs: Travel to and from lower Snake region |
| AE | 14d1 Hours Away: Other recreation at the river |
| AF | 14d2 Dollars of Trip Costs: Other recreation at the river |
| AG | 14e1 Hours Away: Recreation at other places than the river |
| AH | 14e2 Dollars of Trip Costs: Recreation at other places than the river |
| AI | 14f1 Total Hours |
| AJ | 14f2 Total Dollars |

| | |
|---|---|
| AK | Occupation<br><br>1) Retired<br>2) Student<br>3) Unemployed<br>4) Self-employed<br>5) Hourly wage earner<br>6) Professional<br>7) Housewife<br>8) Other |
| AL | How many days of vacation do you take each year? |
| AM | What is the one-way distance from home to most preferred alternative site?/TD |
| AN | Will you typically leave the site if fishing is bad?<br><br>1) Yes<br>2) No |
| AO | If the answer is yes, what is the distance one-way from the river to the alternate? |
| AP | For the kind of fishing you like, how many other sites are available to you? |
| AQ | How many fishing trips per year do you take to the river where surveyed? |
| AR | What is your age?<br><br>0) less than 20<br>1) 20-25<br>2) 25-30<br>3) 30-35<br>4) 35-40<br>5) 40-45<br>6) 45-50<br>7) 50-55<br>8) 55-60<br>9) 60-65<br>10) 65-70<br>11) 70-75<br>12) 75-80 |

Do you give up wage or salary income?

AS

1) Yes
2) No

AT If yes, how much?

What is your current wage or salary income?

AU

0) 0-10,000
1) 10,000-20,000
2) 20,000-30,000
3) 30,000-40,000
4) 40,000-50,000
5) 50,000-60,000
6) 60,000-70,000
7) 70,000-80,000
8) Over 80,000

What is your current pension or interest income?

AV

0) 0-10,000
1) 10,000-20,000
2) 20,000-30,000
3) 30,000-40,000
4) 40,000-50,000
5) 50,000-60,000
6) 60,000-70,000
7) 70,000-80,000
8) Over 80,000

**Snake River Outdoor Recreation Input-Output**
**Code Page for Entry Into Microsoft Excel**

| For Column | Corresponding Question or Data From Survey |
|---|---|
| A | Control Number |
| B | Zip Code |
| C | How many outdoor recreation trips to the Central Idaho region? |
| | What was your method of travel?<br>(Where 0 = not marked and 1 = marked) |
| D | Personal Car/Van/Truck |
| E | Rented Car/Van/Truck |
| F | Personal Camper/RV |
| G | Rented Camper/Mobile Home/RV |
| H | Airplane |
| I | Bus |
| J | Tour Bus |
| K | Tour Boat |
| L | Other |
| M | How many nights away from home on this trip? |
| N | Travel destination (1 = Central Idaho region, 2 = another destination) |
| O | How many miles one way? |
| P | How many people in group? |
| | Importance of recreation activities<br>[where 0 = only checked (without numerical value),<br>scale from 1 = very important to 5 = not important] |
| Q | steelhead fishing |
| R | smallmouth bass fishing |

| | |
|---|---|
| S | trout fishing |
| T | sturgeon fishing |
| U | bull trout fishing |
| V | jetboating |
| W | camping |
| X | other |
| Y | rafting |
| Z | kayaking |
| AA | canoeing |
| AB | hiking |
| AC | bird watching |
| AD | wildlife watching |
| AE | sightseeing |
| AF | biking |
| AG | nature viewing |

## Expenditures Traveling *To* Central Idaho

| | |
|---|---|
| AH | county government |
| AI | nearest town |
| AJ | state government |
| AK | nearest town |
| AL | federal government |
| AM | nearest town |
| AN | bus or taxi service |
| AO | nearest town |
| AP | tour boat |
| AQ | nearest town |
| AR | airline |
| AS | nearest town |
| AT | car, pickup, or RV rental |
| AU | nearest town |
| AV | service station (1) |
| AW | nearest town |
| AX | service station (2) |
| AY | nearest town |
| AZ | food store |
| BA | nearest town |
| BB | auto dealer |
| BC | nearest town |
| BD | clothing store |
| BE | nearest town |
| BF | boat/marine store |

| | |
|---|---|
| BG | nearest town |
| BH | sporting goods store |
| BI | nearest town |
| BJ | hardware store |
| BK | nearest town |
| BL | restaurant |
| BM | nearest town |
| BN | department store |
| BO | nearest town |
| BP | other retail |
| BQ | nearest town |
| BR | motels and lodging |
| BS | nearest town |
| BT | guide services |
| BU | nearest town |
| BV | equipment rental |
| BW | nearest town |
| BX | parking and car wash |
| BY | nearest town |
| BZ | auto repair |
| CA | nearest town |
| CB | other repair |
| CC | nearest town |
| CD | entertainment |
| CE | nearest town |
| CF | health services |
| CG | nearest town |

| | |
|---|---|
| CH | other |
| CI | nearest town |
| CJ | other |
| CK | nearest town |

**Expenditures While in Central Idaho**

| | |
|---|---|
| CL | county government |
| CM | nearest town |
| CN | state government |
| CO | nearest town |
| CP | federal government |
| CQ | nearest town |
| CR | bus or taxi service |
| CS | nearest town |
| CT | tour boat |
| CU | nearest town |
| CV | airline |
| CW | nearest town |
| CX | car, pickup, or RV rental |
| CY | nearest town |
| CZ | service station (1) |
| DA | nearest town |
| DB | service station (2) |
| DC | nearest town |
| DD | food store |
| DE | nearest town |
| DF | auto dealer |
| DG | nearest town |
| DH | clothing store |
| DI | nearest town |
| DJ | boat/marine store |

| | |
|---|---|
| DK | nearest town |
| DL | sporting goods store |
| DM | nearest town |
| DN | hardware store |
| DO | nearest town |
| DP | restaurant |
| DQ | nearest town |
| DR | department store |
| DS | nearest town |
| DT | other retail |
| DU | nearest town |
| DV | motels and lodging |
| DW | nearest town |
| DX | guide services |
| DY | nearest town |
| DZ | equipment rental |
| EA | nearest town |
| EB | parking and car wash |
| EC | nearest town |
| ED | auto repair |
| EE | nearest town |
| EF | other repair |
| EG | nearest town |
| EH | entertainment |
| EI | nearest town |
| EJ | health services |
| EK | nearest town |

| | |
|---|---|
| EL | other |
| EM | nearest town |
| EN | other |
| EO | nearest town |

**Expenditures on *return trip***

| | |
|---|---|
| EP | county government |
| EQ | nearest town |
| ER | state government |
| ES | nearest town |
| ET | federal government |
| EU | nearest town |
| EV | bus or taxi service |
| EW | nearest town |
| EX | tour boat |
| EY | nearest town |
| EZ | airline |
| FA | nearest town |
| FB | car, pickup, or RV rental |
| FC | nearest town |
| FD | service station (1) |
| FE | nearest town |
| FF | service station (2) |
| FG | nearest town |
| FH | food store |
| FI | nearest town |
| FJ | auto dealer |
| FK | nearest town |
| FL | clothing store |
| FM | nearest town |
| FN | boat/marine store |

| | |
|---|---|
| FO | nearest town |
| FP | sporting goods store |
| FQ | nearest town |
| FR | hardware store |
| FS | nearest town |
| FT | restaurant |
| FU | nfiearest town |
| FV | department store |
| FW | nearest town |
| FX | other retail |
| FY | nearest town |
| FZ | motels and lodging |
| GA | nearest town |
| GB | guide services |
| GC | nearest town |
| GD | equipment rental |
| GE | nearest town |
| GF | parking and car wash |
| GG | nearest town |
| GH | auto repair |
| GI | nearest town |
| GJ | other repair |
| GK | nearest town |
| GL | entertainment |
| GM | nearest town |
| GN | health services |
| GO | nearest town |

| | |
|---|---|
| GP | other |
| GQ | nearest town |
| GR | other |
| GS | nearest town |

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[1]Cost per person per mile was based on the much larger lower Snake River reservoirs sample.
[2]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.
[3]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.
[4]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.
[5]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-Pimlico River in North Carolina; and Laymen *et al.* (1996), used a sample of 343 mail surveys to estimate angler demand for chinook salmon in Alaska.
[6]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.
[7]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.
[8]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 consumer surplus, depending on the combination of intercept and slope bias created by the underspecification of the travel cost demand. Both intercept and slope biases and 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.
[9]L in front of the variable indicates a log transformation.
[10]Elasticity refers to the percentage change in the dependent variable (trips) caused by a 1-percent change in the independent variable (unless otherwise noted).
[11]Let the regression equation be 1n(r) = α$_1$ + α$_2$D + α$_3$ 1n(Z), where Z represents all the continuous independent variables. The equation can be written as r = $e^{(\α_1 + \α_{2D})} Z^{(\α_3)}$. Elasticity of r with respect to D is defined as Ω = (% change in r)/(% change in D) = (δr/δD)(D/r). δr/δD = α$_2 e^{(\α_1 + \α_{2D})} Z^{(\α_3)}$; D can be 0, 1, or E(D); and r is defined above. Elasticity reduces to Ω = α$_2$D. Thus, Ω becomes zero if D is zero, and Ω takes the value α$_2$ if D is one.
[12]See Appendix 1 for a discussion of the statistical methodology.
[13]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.
[14]Includes season and 3-day permits.
[15]1985 is the last year for which the US Fish and Wildlife Service reported data by regions within States.
[16]Based on 23,000 fish caught per year, and 6.5 fishing days per fish caught.
[17]The annual value estimate increases if foregone income is added to the travel cost. No justification is provided for the amount of income given up while traveling, however.
[18]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.
[19]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.
[20]The US 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).
[21]A travel cost demand survey in central Idaho was conducted by AEI concurrently with the spending survey.
[22]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).

[23]Price elasticity is defined as the percentage change in quantity demanded (trips) caused by a 1-percent change in money trip price (out-of-pocket cost of a trip).
[24]The distinguishing characteristic of many recent non-linear econometric estimation techniques is that they have no explicit analytical solution. In such cases, an iterative numerical calculation approach is used (Cramer, 1986).