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Willingness to Pay for Non Angler Recreation at the Lower Snake River Reservoirs

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This study applied the travel cost method to estimate demand for non angler recreation at the impounded Snake River in eastern Washington. Net value per person per recreation trip is estimated for the full non angler sample and separately for camping, boating, water-skiing, and swimming/picnicking. Certain recreation activities would be reduced or eliminated and new activities would be added if the dams were breached to protect endangered salmon and steelhead. The effect of breaching on non angling benefits was found by subtracting our benefits estimate from the projected non angling benefits with breaching. Major issues in demand model specification and definition of the price variables are discussed. The estimation method selected was truncated negative binomial regression with adjustment for self selection bias.

KEYWORDS: *Travel cost model, non angler recreation, lower Snake River, dam breaching, two-step decision model.*

Dam breaching on the lower Snake River to save endangered salmon and steelhead would eliminate more than 33 thousand acres of flat water extending nearly 140 miles.[1] The site currently contains 26 thousand acres

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[1]Under the endangered species act, National Marine Fisheries Service listed the Snake River sockeye salmon as endangered in 1991, in 1992, Snake River spring/summer chinook and Snake River fall chinook salmon were listed as threatened. The lower Snake River steelhead were listed as threatened in 1997. Historically, the runs have been affected by overfishing, poor ocean conditions, reduced spawning grounds, dams and reservoirs (Federal and non-Federal), and general habitat degradation. Several of these conditions continue today, along with predation, estuary destruction, and competition from hatchery fish and non-native fish. (USACE, 2002).

of land area of which half is designated as wildlife habitat. Because of past failures, new measures to protect the endangered fish have been mandated. The National Marine Fisheries Service 2000 Biological Opinion (NMFS, 2000) specifies that the "action agencies" could request authority from Congress for breaching if mitigation goals are not met according to their designated 10-year timetable.[2] The U.S. Army Corps of Engineers (USACE, 2002) feasibility study of juvenile salmon migration chose further "system upgrades" over breaching, but they state that their selected alternative is consistent with breaching as a final solution. With breaching, flat water used for swimming, water-skiing, propeller-driven boating, and sailing would be mainly replaced with white water and rapids suitable for kayaking, rafting, and jet boating. Also, much additional land area would exist for picnicking, camping, hiking, biking, wildlife viewing, hunting, and other land-based activities. The willingness-to-pay for current non angling recreation activities measures part of the costs of dam breaching, including loss of power generation, barge transport, and a small amount of irrigation. Our benefits estimate for non angling recreation (net consumer value) is subtracted from projected non angling recreation benefits with breaching (Loomis, 2002) to find the effect of dam breaching on non angling benefits. Loomis predicted that non angling recreation benefits with dam breaching would be $192.7 to $310.7 million per year. (His forecast can vary depending on the treatment of non responders and other factors.)

This study uses the travel cost method (TCM) to estimate the net value for non angler recreation at the lower Snake River reservoirs in eastern Washington. We examine existing reservoir recreation with different models and in more detail than was done for the USACE feasibility study. Activities studied include camping, boating, water-skiing, and swimming/picnicking. Estimation of benefits by type of activity allowed us to adjust our survey results to more closely match long-run visitation by activity type. Derivation of benefits by type of recreation activity also is beneficial because they are widely used by federal and state resource managers when local estimates are unavailable (Rosenberger & Loomis, 2000; Rosenberger & Loomis, 2001; Shrestha & Loomis, 2001; Walsh, Johnson & McKean, 1992). Additional activities in the sample (in small numbers) included sailing, wildlife viewing, hunting, and other unspecified activities.

A travel cost demand model relates the number of annual recreation trips to a site to the price of a trip. The traditional approach assumes that the price of a trip is the sum of imputed opportunity time value and pecuniary travel costs (Becker, 1965). The traditional approach can be inappropriate if either, (1) institutional factors make opportunity time value difficult or impossible to monetize, or (2) consumer behavior is different from that assumed by the traditional model. The two-step consumer decision model,

[2]The Biological Opinion was ruled inadequate by the U.S. District Court in 2003 and the NMFS was given one year to improve it.

discussed below, provides an alternate to the traditional model. Both of the conditions which invalidate the traditional approach are likely to apply to the consumers in our data set. Most respondents indicated they did not have any foregone income while recreating and experimental modeling showed that when actual recreation participation decisions were made, consumer behavior was not influenced by opportunity time cost. Appending imputed opportunity time cost to pecuniary travel cost actually reduced the goodness of fit (discussed in a later section). Thus, the traditional model, which combines an imputed opportunity time cost with pecuniary travel cost, was not appropriate for this sample. The alternate two-step consumer decision model, which is discussed below, includes pecuniary outlay and physical time outlay as separate trip price variables and both money income and available free time are included as separate constraint variables which can limit trips demanded.

The Non-Equilibrating Labor Market

The wage rate (usually with some downward adjustment) is used to monetize travel time in the traditional model but wages measure the value of time only with equilibrating labor markets. A non-equilibrating labor market includes (1) persons who are not in the labor market because they are in school, unemployed, not in the correct age range for employment, independently wealthy, retired, or disabled, and (2) persons who are employed by firms with market power that fix work hours and pay rates. Lack of participation in a free competitive labor market means either that the wage rate does not exist or does not represent the true opportunity time value. The individual will allocate their scarce time in terms of alternative activities sacrificed but they have no meaningful measure of money opportunity time cost. Modeling recreation demand with non-equilibrating labor markets has been proposed by Brown and Nawas (1973), Gum and Martin (1975), Larson (1993a, 1993b), McConnell (1999), Ward and Beal (2000), Ward and Loomis (1986), and applied by Bockstael, Strand, and Hanemann (1987), Larson (1993b), Loomis (2002, 2003), McKean, Johnson, and Taylor (2003), McKean, Johnson, and Walsh (1995), McKean, Walsh, and Johnson (1996), Shaw and Feather (1999), and Ward (1983, 1984, 1989).

More than 87% of the persons in our sample did not give up income to participate in recreation at the reservoirs. Clearly, this sample is dominated by persons for whom foregone income is irrelevant. That they do not consider foregone income as part of the price of a recreation trip is shown below in our empirical test of the traditional model. (One possible opportunity time cost which we did not measure in our survey was the expenditure for taking care of the house or yard while on vacation. This cost would not depend on the recreationist's value of time but rather on the replacement cost for unpaid household services by the recreationist. We doubt that replacement cost for household services would be important for the relatively short time period of the recreation trips in this particular study.)

The Two-Step Decision Model

The two-step decision model of consumer behavior first considers "long run" life-changing decisions (Bockstael et al., 1987; Larson, 1993b; McKean et al., 2003; Shaw & Feather, 1999). Thus, for persons of working age, specification of a two-step decision model begins with consideration of the labor market.[3] Variables related to the labor market are designated as step one variables while a consumer's selection of each consumer good is relegated to step two. Step one decisions can involve, work time versus non work or consumption time, choice of occupation, industry of employment, investment in education or skills, attributes of the region of residence, choice of residence location relative to work versus recreation sites, and other long-run factors affecting quality of life. The first step in the decision process determines total free time which can be used for consumption but does not attempt to decide among individual goods. In contrast, the traditional model assumes that *all* decisions are made in a single step. Thus, each time a consumer considers the purchase of a time-consuming good they would need to reevaluate the effect on their income and negotiate with their employer or change employers in order to jointly maximize satisfaction from earned income and consumption. Such behavior seems impractical or impossible in many cases. The two-step decision model assumes that the less important and often trivial short-run consumption decisions do not involve a reassessment of work hours, income, or employment. Recreation choices are short-run decisions "conditioned on longer-run labor choices" (Bockstael et al., 1987). If consumers pre-allocate time for work and consumption, then work time is not a consumer choice variable in step two and the wage rate is irrelevant as a measure of their time value in step two. Thus, step two is, in effect, a non-equilibrating labor market. It is this consumer decision to pre-allocate labor time versus leisure and consumption time in step one that determines the nature (variable specification) of their recreation demand curve specification in step two.

The two-step model overcomes theoretical problems which have not been successfully addressed by the conventional travel cost model. First, there is the assumption by the conventional model that income is exogenous. The basis for this assumption is missing in the conventional model (Shaw & Feather, 1999). Theoretically, income may be endogenous in the traditional model leading to simultaneity bias. The two-step model determines equilibrium values for both income and free time in step one so that they are properly exogenous in the consumer goods demand functions in step two. A second deficiency in the conventional model concerns the price variable. The location of residence could be selected to minimize the cost of recrea-

[3]Early two step decision models assumed that consumers first partitioned spending among major product groups and in the second stage allocated spending within the subgroups to individual goods (Strotz, 1957, 1959; Pollak, 1969; George & King, 1971; Browning & Meghir, 1991; Alderman & Sahn, 1993).

tion travel, making recreation price (travel cost) endogenous (Parsons, 1991). The traditional travel cost model is theoretically subject to simultaneity bias if residence location is endogenous. The two-step model removes this simultaneity flaw because the selection of a residence is part of the long-run decisions made in step one. Thus, recreation demand in step two is free of price simultaneity.

The wage rate is no longer a relevant measure of the opportunity cost of time because work time and leisure time are intentionally pre-allocated by the consumer in step one and thus there can be no substitution of time from consumption to work in step two. The important effect is that the *full price* (pecuniary plus foregone income) for the aggregate of all time-consuming goods which can exist in step one, is inoperable in step two for individual goods. Physical time prices and money prices are separate entities in the individual consumer demand functions. There can be substitution of time among different goods but not between goods and work. The conditional recreation demand function will contain, *Ptravel, Ttravel, Tavail,* and *INC.* (The term conditional denotes preallocation of labor versus leisure.) Conditional recreation demand is shown in [1]:

$$Q_s = f(Ptravel, Ttravel, Tavail, INC, O) \qquad [1]$$

where vectors *Ptravel* and *Ttravel* are out-of-pocket and physical time prices to access the primary recreation site and prices for closely related goods including other sites. The variables, *Tavail* and *INC,* are available time and money income constraints, and vector *O* includes all other demand shift variables. Equation [1] is the basis for the empirical estimates which follow.

This two-step decision model is used in place of the traditional model to measure the value of reservoir recreation on the lower Snake River in eastern Washington. The model applies if recreationists either pre-allocate their time for work, and leisure prior to deciding among consumer goods (the two-step decision model), or employers set work hours, and/or the recreationists are not in the labor force (disequilibrium labor market). Any of these conditions create a situation where money and time variables cannot be collapsed into a single variable. Thus, recreationists must consider income and time separately which results in separate pecuniary and physical time prices for a trip and separate income and physical time constraint variables.

Specification of Closely Related Goods Prices

Definition of the pecuniary travel cost is critical to the accurate measurement of benefits (Randall, 1994). The minimum expenditure required to travel from home to the recreation site and return (Ward, 1984) is adopted here as the appropriate measure because any excess of that amount is for other goods. Non transport spending of money and time during the trip is often associated with closely related goods which enhance the recreation experience (McKean et al., 1996; Parsons & Wilson, 1997; Rosenthal, 1987). For example, time-on-site must be a closely related good because of the weak complementarity principle (Maler, 1974) upon which measurement of benefits from the TCM is founded. (e.g., a travel cost must be paid in order to benefit from the recreation site and the site has no recreation value to the consumer without spending time at the site.) The sign of the coefficient relating trips demanded to particular time and money "expenditures" made during the trip reflects whether the purchase is a complement or substitute good. The effect of these "related activities" on site demand can be statistically adjusted for through the inclusion of the relevant prices paid during travel or on-site and for side trips. Travel cost models often exclude the prices of on-site time, purchases, and other trip activities which are likely to be the principal closely related goods consumed by recreationists. Exclusion of these variables is very likely to create underspecification bias.

The Survey

In this study, an expanded TCM survey was designed to include money and time costs of on-site time, on-site purchases, the money and time cost of other activities on the trip, and available free time and income. An important question asked if income was foregone while traveling or recreating (Johnson, 1989). Most travel cost surveys omit this important question.

Recreationists were first contacted at the reservoirs and requested to take part in the outdoor recreation demand mail survey. The sample list was collected by University of Idaho students who lived in trailers at the reservoirs throughout the recreation season and who had university vehicles to traverse the 140-mile long reservoir to sample names and addresses. A total of 627 surveys was mailed out with 417 useable returns yielding an overall response rate of 66.5% for the non angler recreation demand questionnaire. This survey was limited to persons previously contacted at the site who indicated non angler recreation was preferred to other recreation activities such as fishing. (A survey designed specifically for anglers was sent to those who indicated fishing was their primary interest.) However, some respondents still indicated a high preference for fishing when the questionnaire was returned. The sample was further reduced when those ranking fishing first on a scale of 1 to 10 were deleted from the sample. The final sample size was 332 non angler recreation groups.

The average non angler recreationist had visited the lower Snake River reservoirs for 12.1 years and traveled 246 miles (round trip) from home to recreation site. Travel distance varied by activity which indicates differences in perceived value of the activities. Distance traveled by persons primarily interested in boating (146 miles) was less than for other activities, such as camping (383 miles). Time-on-site for activities such as swimming (28 hours) and picnicking (29 hours) was small in comparison to other reservoir activities such as boating (46 hours) and camping (55 hours). The full sample of non angler recreationists averaged 39.5 hours on-site per trip.

The sub-samples of recreationists who preferred swimming also included many who liked camping. The same was true for the picnicking sub-sample.

Thus, the value for these subsets really reflected a composite of camping and swimming or picnicking. Limiting the swimming/picnicking sample to those who did not stay overnight reduced time on site to 6.5 hours for this sub-sample. Day trips are thought to be more typical for swimming or picnicking.

Another concern was multiple destination trips. Some 12.6 percent of the full sample visited a second recreation site away from the reservoirs for at least three hours during the trip. For this sub-sample of visitors the recreation value measured per trip includes some value received from visiting the second recreation site. However, when these recreationists were removed from the sample the estimated net value per trip and trips per year both increased. Overstatement of benefits did not occur with the inclusion of multiple site visitors. Instead of reducing benefits, exclusion of multiple site trips would increase total benefits by about 19 percent.

Definition of Demand Variables

The definitions for the variables in the estimated travel cost models are shown in Table 1. The dependent variable for the travel cost model is Q_s, annual reported trips from home to the outdoor recreation site. Quantity demanded is defined as the number of annual outdoor recreation trips from home to the lower Snake River reservoirs.

The money price variable is *Ptravel*, which is the pecuniary travel cost to the outdoor recreation site. Accurate estimation of cost per mile is important because the estimated benefits in the travel cost model used here vary directly with the assumed cost per mile. The average reported travel cost was 19.67 cents per mile per vehicle.[4] In comparison, the average full cost, including fixed ownership costs, estimated by the American Automobile Association (AAA), was 46.1 cents per mile. However, AAA found direct oper-

TABLE 1
Definition of Variables

Q_s	Annual trips from home to the Lower Snake River reservoir outdoor recreation site (dependent variable).
Ptravel	The recreator's out-of-pocket round trip travel cost to the outdoor recreation site, in dollars.
Ttravel	The recreator's round trip travel time to the outdoor recreation site, in hours.
Pon-site	The recreator's on-site out-of-pocket costs at the reservoirs on outdoor recreation during the trip, in dollars.
Tavail	The recreators discretionary time available per year, in days.
Tother activity	The time spent on other non-recreation activities during the trip.
EXP	The recreator's total outdoor recreation experience at the reservoirs, in years.
BOAT	A dummy variable, one for persons who had a boat and zero otherwise.

[4]A concurrent survey of 537 anglers resulted in travel costs of 19 cents per mile per group (Agricultural Enterprises, Inc. & University of Idaho, 1999).

ating costs were less than 10 cents per mile. Inclusion of much of the fixed ownership costs may be inappropriate when making recreation travel decisions unless the vehicle was purchased only for recreational use. Operating costs for vehicles in our sample are likely to be higher than the national average because of the larger share with campers or trailers. The average party size per vehicle was 2.21 (USACE survey, 1994) resulting in a travel cost of 8.9 cents per mile per recreationist. The money cost of travel per person per trip was the product of round trip distance for each party and cost per mile per recreationist. Cost per mile was based on average recreationist-reported cost rather than costs based on AAA data. Recreationists' perceived price was judged the relevant variable for decisions on the number of outdoor recreation trips to take (Donnelly, Loomis, Sorg, & Nelson, 1983). The physical time price for each individual was measured by *Ttravel* which is reported round trip driving time in hours. Both pecuniary travel cost and the physical time cost of travel were highly significant in most demand functions.

Closely Related Goods Prices

Prices must include separate pecuniary costs and physical time costs. The model calls for the inclusion of round trip driving time from home to an alternate outdoor recreation site, as the physical time price of an alternate outdoor recreation site. Driving time to an alternate site was not significant. The remaining alternate site price variable is the out-of-pocket travel cost to the most preferred alternate outdoor recreation site. The substitute price variable also was not significant.

The variable to measure available free time is *Tavailable*. Restrictions on free time are likely to reduce the number of outdoor recreation trips taken. The coefficient on the discretionary time variable has been positive and highly significant in previous disequilibrium labor market recreation demand studies (Bockstael et al., 1987; Loomis, 2002, 2003; McKean et al., 1995, 1996, 2003). Free time was highly significant in most of the estimated demand functions with the expected positive coefficient. The income constraint variable (*INC*) is defined as average annual family earned and unearned income. The relation of quantity demanded to income may indicate differences in tastes among income groups. Although restrictions on income should reduce overall purchases, it may also cause a shift to "inferior" types of consumer goods. Thus, the sign on the income coefficient conceptually can be either positive or negative. Income was not significant for this sample. Time-on-site at the four reservoirs was not significant but money spent on-site, *Pon-site*, was significant. As expected, the sign was negative indicating that on-site cost was for complementary goods used for recreation at the reservoirs.

Other Exogenous Variables

The strength of a recreationist's preferences for outdoor recreation over alternate activities should positively influence the number of outdoor recreation trips taken to the reservoirs per year. An indicator of taste related particularly to the study site is the number of years that the recreationist has visited the reservoirs. The variable *EXP* measures this aspect of taste. The variable was highly significant in all of the models. A dummy variable, *BOAT*, which identified recreationists that had a boat was included in the model. Possession of a boat increased visit rates and 72.6% of the sample of non angler recreationists had boats at the site. The variable *Tother activity*, the time spent on non-recreational activities during the trip, was not significant for some of the sub-samples but was significant in the full sample. It adjusted for time spent on non-recreational activities during the trip which tended to reduce quantity demanded (number of visits per year). Age has been found to influence certain types of outdoor recreation activity. In this sample, age was significant with a negative affect only for the water-skiing activity. However, colinearity prevented the inclusion of the age and boat variables together. Age showed no relationship for the remaining recreation activities and was excluded from all the regressions.

Some 40% of the groups in the full sample recreated at Lower Granite reservoir which adjoins Lewiston, Idaho. This is the only section of the reservoirs that adjoins a major town. However, tests using both intercept and slope dummy variables could not detect a demand shift or slope change for those recreating at the reservoir adjoining Lewiston. Other variables tested and found unimportant included: money or time spent at other recreation sites, money or time spent during the trip away from the reservoirs, and money spent on non recreation activities during the trip

Methods

Statistical Concerns for Demand Curve Estimation

The dependent variable is a count of recreation trips to the study site taken over the year and the data are based on a mail survey of recreationists contacted on-site. Thus, the chosen estimator must account for the fact that the dependent variable is a nonnegative integer from a truncated endogenously stratified sample and where the data also were found to exhibit overdispersion.

Because the data for the dependent variable (visits per year) are positive integers, truncated below one visit per year, equation estimation by ordinary least squares regression is inappropriate. Truncation occurs when part of the data are excluded from the sample. The on-site survey sample excluded persons who did not recreate at the study site. Maddala (1983) shows that conventional least squares regression slopes will be biased toward zero when the dependent variable data are truncated from below. Therefore, an estimation method is required which accounts for a dependent variable that is truncated and a nonnegative integer. Both truncated Poisson and truncated negative binomial regression are appropriate for dependent variables that are nonnegative count data (Greene, 1981, 2002; Hellerstein & Mendelsohn, 1993).

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. Tests developed by Cameron and Trivedi (1990), and shown in Greene (2002), indicated that overdispersion was present in the Poisson model. Moreover, the *t*-values appeared inflated in the Poisson regressions compared to the negative binomial regressions. Another test is available by actually running the negative binomial regression. The model has an overdispersion rate shown by $var(Q_s)/E(Q_s) = 1 + \alpha E(Q_s)$. When the truncated negative binomial regression with adjustment for endogenous stratification was estimated, the coefficient on the overdispersion parameter, alpha, was not significant in most of the estimated demand models. However, much of the evidence indicated that $Var(Q_s)/E(Q_s) = 1$ was violated. Therefore, the truncated negative binomial regression technique (Haab & McConnell, 2002) was used in place of truncated Poisson regression.

Self selection effects are of concern when site samples are utilized. Loomis (2003) measured the extreme bias in estimated net benefits which can occur because of self selection. The truncation adjustment accounts for exclusion of zero values but it does not adjust for the possibility that frequent visitors are more likely to be in the sample than are less frequent visitors. Although Englin and Shonkwiler (1995) provide a simple technique to adjust Poisson regression for endogenous stratification, an adjustment for negative binomial regression did not exist. William H. Greene (Econometric Software, Inc., personal communications, 2001) provided new code for the Limdep 7 (or later) program which can be used to obtain full information maximum likelihood estimates of truncated negative binomial regression adjusted for endogenous stratification. The new Limdep control statements are shown in McKean et al. (2003).

Results

The estimated regression coefficients from the truncated negative binomial regressions adjusted for endogenous stratification are reported in Table 2. Poisson and negative binomial regressions, with a linear relation on the explanatory own price variable are equivalent to a semilog functional form. Adamowicz, Fletcher, and Graham-Tomasi (1989), show the annual consumers surplus estimate for the semilog function as $CS_{st} = -Q^*/\beta$, where β is the estimated slope on price (pecuniary travel cost) and Q^* is average annual visits. Consumers surplus per trip from home to site is $-1/\beta$. The estimate of consumers surplus is invariant to the distribution of trips along the demand curve. 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.

The full sample of non angler recreators was broken into five recreation categories (see Table 2) by selecting those who ranked a given activity 1 or 2 on a scale of 1 to 10 (3 was included for swimming). Respondents often preferred more than one activity. For example, the sample for camping demand also included 4.4% who also liked swimming, 5.6% who liked picnicking, 13.8% who liked water-skiing, 16.9% who liked boating and very small

TABLE 2
Non Angler Recreation Demand Functions, Two-Step Decision Model

Activity	Full Sample (*n* = 332)	Camping[2] (*n* = 160)	Boating (*n* = 132)	Water Ski (*n* = 97)	Swimming (*n* = 77)	Picnicking (*n* = 107)
Demand Variable	Coefficient & *t*-Ratio	Coefficient & *t*-Ratio	Coefficient & *t*-Ratio	Coefficient & *t*-Ratio	Coefficient & *t*-Ratio	Coefficient & *t*-Ratio
Constant	−0.9352	−2.4342	−0.0264	−1.4072	−0.6639	−0.3831
	−1.97	−0.73	−0.05	−1.24	−0.87	−0.67
Ptravel	−0.0406	−0.0286	−0.0551	−0.0514	−0.0232	−0.0266
	−6.90	−3.06	−6.37	−5.32	−1.83	−2.43
L(*Ttravel*)[1]	−0.1735	−0.2724	−0.2285	−0.1343	−0.3163	−0.0877
	−2.75	−1.71	−2.30	−1.79	−2.28	−0.69
Pon-site	−0.0022	−0.0026	−0.0028	−0.0026	−0.0029	−0.0040
	−3.53	−1.89	−2.16	−4.28	−1.34	−2.13
L(*EXP*)[1]	0.2468	0.4100	0.2284	0.2349	0.3144	0.2349
	3.72	3.57	2.30	2.48	2.49	2.45
BOAT	1.1435	0.70	1.1317	2.8929	1.3638	1.0548
	7.33	3.63	3.27	2.67	3.76	4.39
Tavailable	0.0067	0.0025	0.0003	0.0051	0.0032	0.0036
	4.55	1.87	0.14	1.87	1.59	2.43
Tother activity	−0.0730		−0.0336	0.0829	−0.2712	−0.1599
	−2.06		−1.09	1.01	−1.36	−2.09
Adjusted R^2	0.56	0.60	0.58	0.58	0.68	0.62
Net Value per Person per Trip	$24.65	$34.96	$18.16	$19.46	$43.13 ($7.26)	$37.58 ($7.26)
Avg. Annual Visits by Person	7.36	4.09	9.87	9.43	7.92 (11.56)	6.04 (11.56)
Net Value per Person per Year	$181.42	$142.99	$179.24	$183.51	$341.59 ($83.92)	$185.25 ($83.92)
Estimated Persons per Year	24,963	2,756 (30,777)	8,192	1,420	5,580	7,015
Total Net Value per Year	$4.53 million	$0.394 (4.400) million	$1.468 million	$0.261 million	$1.906 ($0.468) million	$1.300 ($0.589) million

[1]L( ) denotes the variable is a log transform.
[2]Limdep estimators were singular when *Tother* was included.

percentages for sailing, wildlife viewing, hunting, and other non specified activities. The swimming and picnicking activities had very large percentages who liked camping. Time on-site for the swimming and picnicking subsamples showed that many respondents must have stayed overnight which implies camping probably occurred. Thus, the swimming and picnicking estimates show the net value of a trip for campers who also like swimming and picnicking and do not represent the typical visitor. A regression estimated on swimmers and picnickers who did not stay overnight resulted in sample of 75 visitors with an estimated net value per person per visit of only $7.26 compared with $43.13 for swimming and $37.58 for picnicking when overnight stays were included (see Table 2). Both values are shown on Table 2 but the much smaller $7.26 value is used for estimating total benefits. The reduced value per visit was partially offset by the increase in visits per year when the swimming/picnicking sample was restricted to day visits (see Table 2).

The estimated coefficient on travel cost for the full sample using the truncated negative binomial regression adjusted for endogenous stratification was −0.04056. Consumers surplus per recreationist per trip is the reciprocal or $24.65. Average recreationist trips per year in the full sample was 7.36. Total surplus is the product of average annual trips and surplus per trip or $181.42 per recreationist per year. It was estimated that 52,984 unique non angler recreationists visit the reservoirs per year (Normandeau Associates, University of Idaho, & Agricultural Enterprises, Inc., 1999). If we apply our estimated consumer surplus per person per year to all non angler recreationists, total annual benefits would be $181.42 × 52,984 = $9.61 million. ($11.45 million if visitors making visits to more than one site are excluded from the regression.) However, our sample under represented demand for over half of the visitors whom the USACE's annual entrance surveys placed in the "other unspecified recreation" and "sight seeing" categories.[5] Thus, our full sample applies most directly to 24,963 visitors, as shown in Table 2. The resulting value for these visitors would be $4.53 million based on the demand function estimated for our full sample. If the total net value received by the same (reduced) number of visitors was based on the separate demand functions for each recreation activity, the total net value would be only $3.18 million. The difference can be explained by our faulty full sample which overweighted the high value campers who also liked swimming and picnicking relative to the low value day trip swimming and picnicking, as discussed earlier.

Net Non Angling Benefits with Breaching

The net effect of breaching on non angling benefits is found by subtracting our benefit estimate from the Loomis (2002) projected benefits with dam breaching. The benefit estimates based on our sample exclude sightseeing and other which account for 52.44% of total visits measured by the USACE. More than 75% of the sight seeing and other sub-sample were also included in the camping sub-sample. Thus, the respondents in the sight seeing and other categories are assumed to have the camping valuation for visits. With this assumption, total annual benefits from camping increases

[5]The USACE entrance survey results (excluding fishing) were, camping 5.2%, picnicking 13.24%, boating 15.46%, hunting 0.41%, water skiing 2.68%, swimming 10.53%, sightseeing 14.11%, and other unspecified activities 38.33%.

from $0.394 million (shown in Table 2) to $4.367 million. Adding the benefits measured for the other activities shown in Table 2 results in total non angler benefits without breaching of about $7.2 million per year. Subtraction of the current non angling recreation benefits ($7.2 million) from the benefits with breaching ($192.7 to $310.7 million) yields $185.5 to $303.5 million of net non angling recreation benefits with breaching.

A Test of the Traditional Travel Cost Model

In the traditional travel cost model, the opportunity time cost of travel is usually assumed to be a proportion of reported money income based on the equilibrium labor market assumption (Cesario, 1976; McConnell & Strand, 1981). A downward adjustment of reported income is supposed to account for differing shares of employed persons per group, reduced pay for moonlighting, the part of travel time that could have been worked, and other factors. Little is known about these adjustment factors and the income adjustment is often based on "custom."

For comparison purposes, a traditional travel cost model was formulated for the boating sub-sample (see Table 4). As is common practice, all visitors were assumed to have opportunity time cost based on foregone income even though most reported none. Estimated opportunity time cost was the product of annual earned income converted to hourly (division by 2,000) and round trip travel distance converted to hours (division by 50 mph). Physical time variables were excluded from the model. The truncated negative binomial regression technique adjusted for endogenous stratification was applied. The result was a consumer surplus estimate of $161.09 per person per trip and the model had a *t*-value on the travel cost coefficient of −8.19. A second regression was estimated where only pecuniary travel cost was entered as price. The consumer surplus per person per trip fell to $14.03 but the *t*-value on the travel cost coefficient increased in absolute value to −9.20. Consumer surplus estimates for other assumed fractions of imputed opportunity time cost are shown in Table 3. Table 3 shows that the *t*-value on the

TABLE 3

Goodness of Fit versus Share of Imputed Income Foregone in the Traditional Travel Cost Model[1]

Fraction of Imputed Income Assumed Foregone	*t*-Value on Price Coefficient	Net Value per Person per Trip
1.00	−8.19	$161.09
0.35	−8.75	$61.94
0.25	−8.94	$47.39
0.15	−9.15	$33.20
0.05	−9.30	$20.02
0.00	−9.20	$14.03

[1]The boating recreation demand model.

TABLE 4
The Traditional Travel Cost Model Applied to the Demand for Boating Recreation

Truncated negative binomial regression with adjustment for endogenous stratification, Q_s = dependent variable, trips per year to the four reservoirs

Variable	Coefficient	*t*-Value
Constant	−0.7465	−0.77
FULL PRICE[1]	−0.0211	−8.94
L(*EXP*)[2]	0.2844	2.94
BOAT	0.9572	2.92
Pon-site	−0.0036	−2.71

[1]Assumes 25% of imputed income is foregone.
[2]L( ) denotes the variable is a log transform.
Adjusted R^2 = 0.49

travel cost coefficient reaches a maximum as imputed opportunity time cost approaches close to zero. Also, it is clear that the magnitude of the estimated consumer surplus in the traditional model is critically dependent on the assumed share of earnings that are foregone during the trip. However, increasing the share of foregone earnings that was added to pecuniary travel cost above 5% reduced the fit of the model. For most boat recreationists, it was travel distance, not money opportunity time cost, which "explained" trips demanded per year. (Similar results were found for the full sample but Limdep could not find a solution when the imputed income share was small.)

Replacement of the traditional imputed money time value with physical time in the two-step decision model does not mean that time has no money value. Rather, most consumers did not need and/or desire to use a money value for their time when making recreation consumption decisions. An average money value for time is implicit in a model which incorporates physical time (Ward, 1983; McKean, et al., 1995). For example, a traditional boating demand model with slightly less than 5% of imputed foregone income added to pecuniary travel cost (see Table 3) would result in about the same net value per person per trip ($18.36) as was found by the two-step decision model ($18.16). This suggests that, for our sample, the average money value of time used for boating recreation is less than 5% of the imputed wage rate.

Summary Remarks

A mail survey was conducted on recreationists at the lower Snake River reservoirs in eastern Washington for the purposes of measuring willingness-to-pay for non angler reservoir recreation. This study used data from a sample list collected on-site which attempted to exclude anglers. The study sample was further reduced by removing respondents who indicated that fishing was their favorite activity at the reservoirs. The demand for several types of non angler recreation at the reservoirs was estimated using a travel cost model. The recreation demand analysis was based on a two-step decision model which assumes persons did not (or could not) give up earnings in exchange for more free time for recreation. This model requires extensive data on a recreationist's time and money constraints, time and money spent traveling to the recreation sites, and time and money spent at the recreation site. The demand equations were estimated using truncated negative binomial regression which incorporated an adjustment for endogenous stratification. Comparison of results for the two-step decision model with the traditional model suggests that the average implicit value of time foregone while recreating (boating sub-sample) was less than 5% of income.

Our full sample did not accurately reflect the recreation activity shares found in the USACE entrance surveys. Thus, our estimated value for each separate activity was combined using the USACE activity share estimates to find total annual benefits lost with breaching. The value of the sight seeing and other unspecified recreation activities could not be estimated because few persons (29) were included in our sample. However, 3/4 of those giving top rating to sight seeing and other also gave top rating to camping. Thus, the high value per visit camper sub-sample was expanded to include sightseeing and other. The result was an upper bound estimate of total non angler benefits without breaching of nearly $7.2 million per year. Non angler recreation at the study site with white water was much more valuable than with the reservoirs. Subtraction of the upper bound current recreation benefits ($7.2 million) from the benefits with breaching ($192.7 to $310.7 million) yielded at least $185.5 to $303.5 million of annual net non angling recreation benefits with breaching. The large increase in site value with breaching suggests that white water non angling recreation sites are much more scarce relative to demand than flat water sites in the Pacific Northwest.

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