OUTDOOR RECREATION DEMAND AND EXPENDITURES:
LOWER SNAKE RIVER RESERVOIRS

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EXECUTIVE SUMMARY

Two surveys were conducted on recreationists at the Lower Snake River reservoirs for the purposes of: (1) measuring willingness-to-pay for outdoor recreation trips and, (2) measuring expenditures by recreationists. The recreation survey was focused on persons that did not list fishing as their primary activity. Anglers were surveyed in a separate study.

The surveys were conducted by a single mailing using a list of names and addresses collected from recreationists at the reservoirs during May through October, 1997. The outdoor recreation travel cost demand survey resulted in 408 usable responses and the outdoor recreation input-output spending survey received 367 usable responses. The response rate for the complex travel cost questionnaire was about 65 percent. The response rate on the detailed input-output survey was 64 percent. The high useable response rate is thought to be a result of the excellent impression made by the initial on-site contacts by University of Idaho students, the return address for the questionnaire to the University of Idaho, and a two dollar bill included as incentive.

The outdoor recreation demand analysis used a model that assumed recreationists did not (or could not) give up earnings in exchange for more free time for outdoor recreation. This model requires extensive data on recreationist time and money constraints, time and money spent traveling to the reservoir outdoor recreation sites, and time and money spent during the outdoor recreation trip for a variety of possible activities. The travel cost demand model related outdoor recreation trips (from home to site) per year by groups of recreationists (average about 8.364 trips per year) 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 average observed (in-sample) cost of $0.202/mile for a car divided by the average party size (4.87) yielded 4.12 cents per mile per recreationist.

The primary objective of the demand analysis was to estimate willingness-to-pay per trip for outdoor recreation at the reservoirs. Consumer surplus (the amount by which total consumer willingness-to-pay exceeds the costs of production) was estimated at $71 per person per trip. The average number of outdoor recreation trips per year from home to the Lower Snake River Reservoirs was 8.364 resulting in an average annual willingness-to-pay of $596 per person per year. Total annual willingness-to-pay by recreationists at the reservoirs, was estimated at $31,578,464 (see pages 37-41).

The outdoor recreationist input-output spending survey collected detailed information on the types of purchases and the place the purchase occurred. Separate data were collected for the trip to the reservoirs, while on-site at the reservoirs, and on the trip home. Expenditure data for some 26 seller categories were obtained. The data allow measuring the average expenditure by type of purchase for various distances from the reservoirs. The name of the town nearest where each purchase occurred was collected allowing estimation of average purchases for each of the seller categories for a large number of towns and counties.

Average group expenditures were $524 per trip and the group size was 4.87 persons. Recreationist spending per person per trip was nearly $108 ($524/4.87). Recreationists in the input-output survey averaged 10.74 trips per year (compared to 8.364 trips in the travel cost demand analysis survey). Thus, average annual spending on trips to the reservoirs per recreationist was $1,156. Recreationist spending that occurred during the Lower Snake River reservoir outdoor recreation trips excluded spending made while traveling to other outdoor recreation sites and excluded major purchases of boats or other gear, maintenance, storage, insurance and other non-trip related outdoor recreation costs. Recreationist trip expenditures included any non-outdoor recreation related purchases made during the trip. Total annual spending by recreationists was estimated at $61,249,504 per year.

The outdoor recreation "demand" and "spending" surveys provided detailed information on samples of individuals who participated in outdoor recreation on the four Lower Snake River reservoirs. The information provided by these samples was used to infer the spending behavior of recreationists on the Lower Snake River reservoirs. 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 outdoor recreation. Estimation of the marginal benefits (demand) function allowed calculation of "net economic value" per outdoor recreation trip. The outdoor recreationist spending survey showed spending patterns useful in estimating the stimulus to jobs and business sales in the region created by recreationists attracted to the reservoirs. The total economic effects of sportfishing include both the initial spending stimulus on sales, employment, and personal income and the indirect economic effects as the initial spending effects spread throughout the local economy. This study estimates the initial economic effects which will be used in a separate economic multiplier study that estimates the total economic effects. The surveys also provided information on transportation, lodging, and other outdoor recreation activities enjoyed by outdoor recreationists while at the reservoirs.

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SECTION ONE - OUTDOOR RECREATION DEMAND

A public enterprise like the Lower Snake River reservoirs differs in two significant ways from a competitive firm. First, the public project is very large relative to the market that it serves; this is one of the reasons that a public agency is involved. Because of the size of the project, as output (outdoor recreation 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 project has no equilibrium market price that can easily be observed to indicate value or, i.e., marginal benefit.

If output for outdoor recreation at the reservoirs was supplied by many competitive firms, market equilibrium would occur where the declining market demand curve intersected the rising market supply curve. The competitive market equilibrium is economically "efficient" because total consumer benefits are maximized where marginal cost equals marginal benefits. If marginal costs exceed marginal benefits in a given market "rational" consumers will divert their spending to other markets. A competitive market price would indicate the marginal benefit to consumers of an added unit of outdoor 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 (outdoor recreation) of a public project also can be found by estimating the consumer demand curve for that output. The economic value of outdoor recreation on the four reservoirs can be determined if a statistical demand function showing consumer willingness-to-pay for various amounts of outdoor recreation is estimated. Because market prices cannot be observed, (outdoor recreation is a non-market good), a *surrogate price* must be used to model consumer behavior toward outdoor recreation (U.S. Army Corps of Engineers 1995; Herfindahl and Kneese 1974; McKean and Walsh 1986; Peterson et al. 1992).

The outdoor recreation demand survey collected information on individuals at the reservoirs showing their number of reservoir outdoor recreation trips per year and their cost of traveling to the reservoirs. The price faced by recreationists is the cost of access to the reservoirs (mainly the time and money costs of travel from home to site), and the quantity demanded per year is the number of outdoor recreation trips they make to the reservoirs. A demand relationship will show that fewer trips to the reservoirs are made by people who face a larger travel cost to reach the reservoirs from their homes (Clawson and Knetsch 1966).

" The Travel cost method (TCM) has been preferred by most economists, as it is based on observed market behavior of a cross-section of users in response to direct out-of-pocket and time cost of travel."

(Loomis 1997)[1] "The basic premise of the travel cost method (TCM) is that per capita use of a recreation site will decrease if the out-of-pocket and time costs of traveling from place of origin to the site increase, other things remaining equal." (Water Resources Council 1983, Appendix 1 to Section VIII).

Figure 1 shows a market for outdoor recreation. (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 outdoor recreation shows the economic factors affecting all recreationists in a region. The demand by recreationists for outdoor recreation trips is negatively sloped, showing that if the money cost of a trip rises recreationists will take fewer trips per year. Examples of how money trip costs might rise include: increased automobile fuel prices, outdoor recreation 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 outdoor recreation. The supply of outdoor recreation opportunities is upward sloping. The upward slope of outdoor recreation supply is caused by the need to travel ever further from home to obtain quality outdoor recreation if more people enter the "regional outdoor recreation market". Increased outdoor recreation-trips in the region can occur when a larger percentage of the population becomes interested in outdoor recreation, when more non-local recreationists travel to the region to obtain quality outdoor recreation, or if the local population expands over time. The market demand/supply graph is useful for describing the aggregate economic relationships affecting recreationist behavior but a "site-demand" model is used to place a value on a specific outdoor recreation site (such as the Lower Snake River reservoirs.)

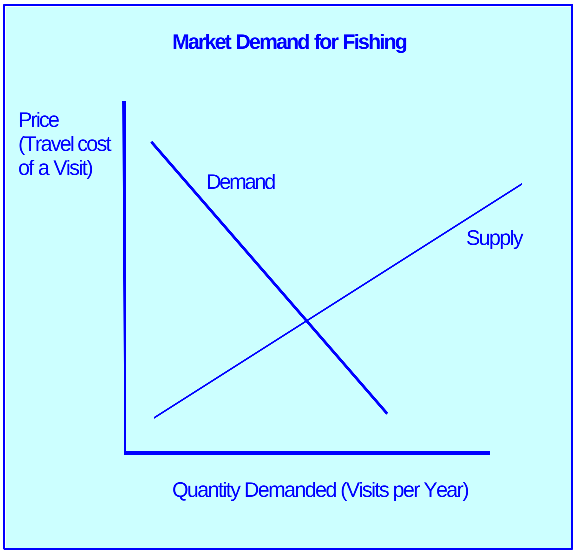

Figure 1 Market demand for recreation

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

The vertical distance between the recreationist's demand for outdoor recreation and the

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

horizontal supply (cost) of a outdoor recreation trip is the net benefit or consumer surplus obtained from a outdoor recreation trip. The demand curve shows what the recreationist would be willing-to-pay for various amounts of outdoor recreation trips and the horizontal line is their actual cost of a trip. As more outdoor recreation 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 recreationist does not make any more visits to the reservoirs because the money value to this recreationist of the added satisfaction from another outdoor recreation trip is less than the trip cost. The equilibrium number of visits per year chosen by the recreationist is at the intersection of the demand curve and the horizontal travel cost line.

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

The critical exogenous variable in the travel cost model is the cost of travel from home to the outdoor recreation site. Each recreationist has a different travel cost (price) for a outdoor recreation trip from home to the reservoirs. Variation among recreationists in travel cost from home to outdoor recreation site (i.e., price variation) creates the Lower Snake River reservoirs site-demand data shown in Figure 3. The statistical demand curve is fitted to the data in Figure 3 using regression analysis.[2] Non-monetary factors, such as available free time and relative enjoyment for outdoor recreation, will also affect the number of reservoir visits per year. The statistical demand curve should incorporate all the factors which affect the publics' willingness-to-pay for outdoor recreation at the reservoirs. It is the task of the Lower Snake River Reservoirs Recreation Survey to include questions that elicit information about recreationists that explains their unique willingness-to-pay for outdoor recreation.

The goal of the travel cost demand analysis is to empirically measure the triangular area in Figure 2 which is the net dollar value of satisfaction received or recreationist willingness-to-pay in excess of the costs of the outdoor recreation trips. The triangular area is summed for the 407 recreationists in our sample and divided by their average number of trips per year (which, for

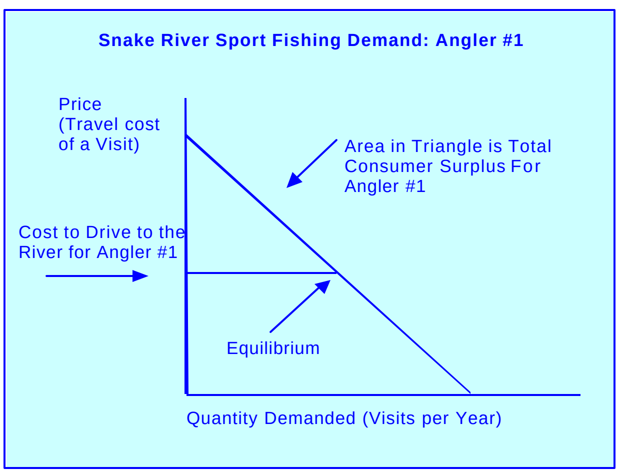

Figure 2 Recreation demand for an individual

[2] It is possible that some visitors 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 visitors locate their residence to minimize distance to the reservoir recreation site then the assumption that travel cost is exogenous is invalid and a simultaneous equation estimation technique would be required.

recreationists in our sample was 8.364 trips per year). This is the estimated consumer surplus per outdoor recreation trip or, i.e., net economic value per trip. The estimated average net economic value per trip (consumer surplus per trip), derived from the travel cost model, can be multiplied times the total recreationist trips from home to the reservoirs in a year to find annual net benefits of the Lower Snake River reservoirs for outdoor recreation.

Figure 3 shows the sample data relating outdoor recreation trips per year to the hours required to travel between home and the reservoir outdoor recreation site. Figure 4 shows unadjusted sample data relating outdoor recreation trips from home to site per year and dollars of travel expense per trip at the reservoirs for all respondents. The data shown in both graphs reveal the expected inverse relationship between money or time required for a outdoor recreation trip to the reservoirs and trips demanded per year. Both out-of-pocket cost per trip and hours per trip act as prices for an outdoor recreation trip. Even before adjustment for differences among recreationists' available free time, outdoor recreation experience, and other factors affecting recreationist behavior, it is clearly shown by Figures 3 and 4 that recreationists with high travel costs or high travel time per trip take fewer outdoor recreation trips per year. Therefore, observations across the sample of 407 recreationists can reveal an outdoor recreation demand relationship.

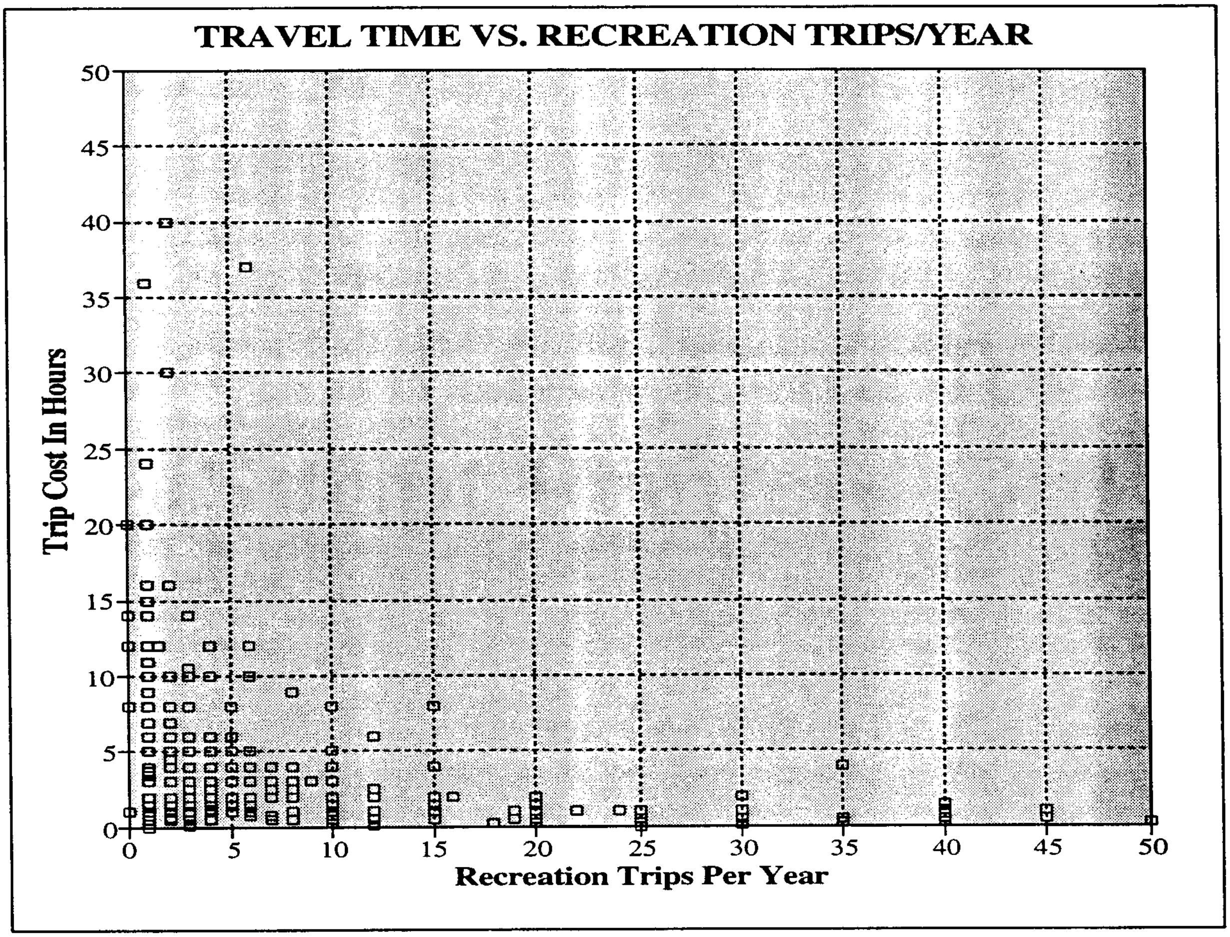

Figure 3 Travel time versus recreation trips per year

In summary, each price level along a down-sloping demand curve shows the marginal benefit or recreationist willingness-to-pay for that corresponding output level (number of outdoor recreation trips consumed). The gross economic value (total willingness-to-pay) of the outdoor recreation output of a public project is shown by the area under the statistical demand function. The annual net economic value (consumers surplus) of outdoor recreation 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 recreationists at the reservoirs. Because the statistical demand function is only for a sample of outdoor recreationists, the estimated value from the sample must be adjusted upward to reflect total public outdoor recreation participation at the reservoirs.

Recreation Demand Methods

The Lower Snake Rive Reservoir Demand Survey

The Lower Snake River expanded demand survey includes detailed socio-economic information about recreationists and data on money and physical time costs of travel, outdoor recreation, and other activities both on and off the reservoir outdoor recreation sites. The questionnaire used for the mail survey is shown in Appendix II. The questionnaire used in this study is similar to ones that we used previously to study outdoor recreation 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 those earlier surveys were by personal interview and used a much smaller sample size. The personal interview surveys had sample sizes of 200 and 150 while this survey had 408 useable responses. Sample size has varied widely in published water-based recreation studies. Ward (1989) used a sample of 60 mail surveys to estimate multi-site demand for water recreation on four reservoirs in New Mexico; Whitehead (1991-92) used a personal interview sample of 47 boat anglers for his fishing demand study on the Tar-Pamlico River in North Carolina; Laymen, et al. (1996) used a sample of 343 mail surveys to estimate angler demand for chinook salmon in Alaska.

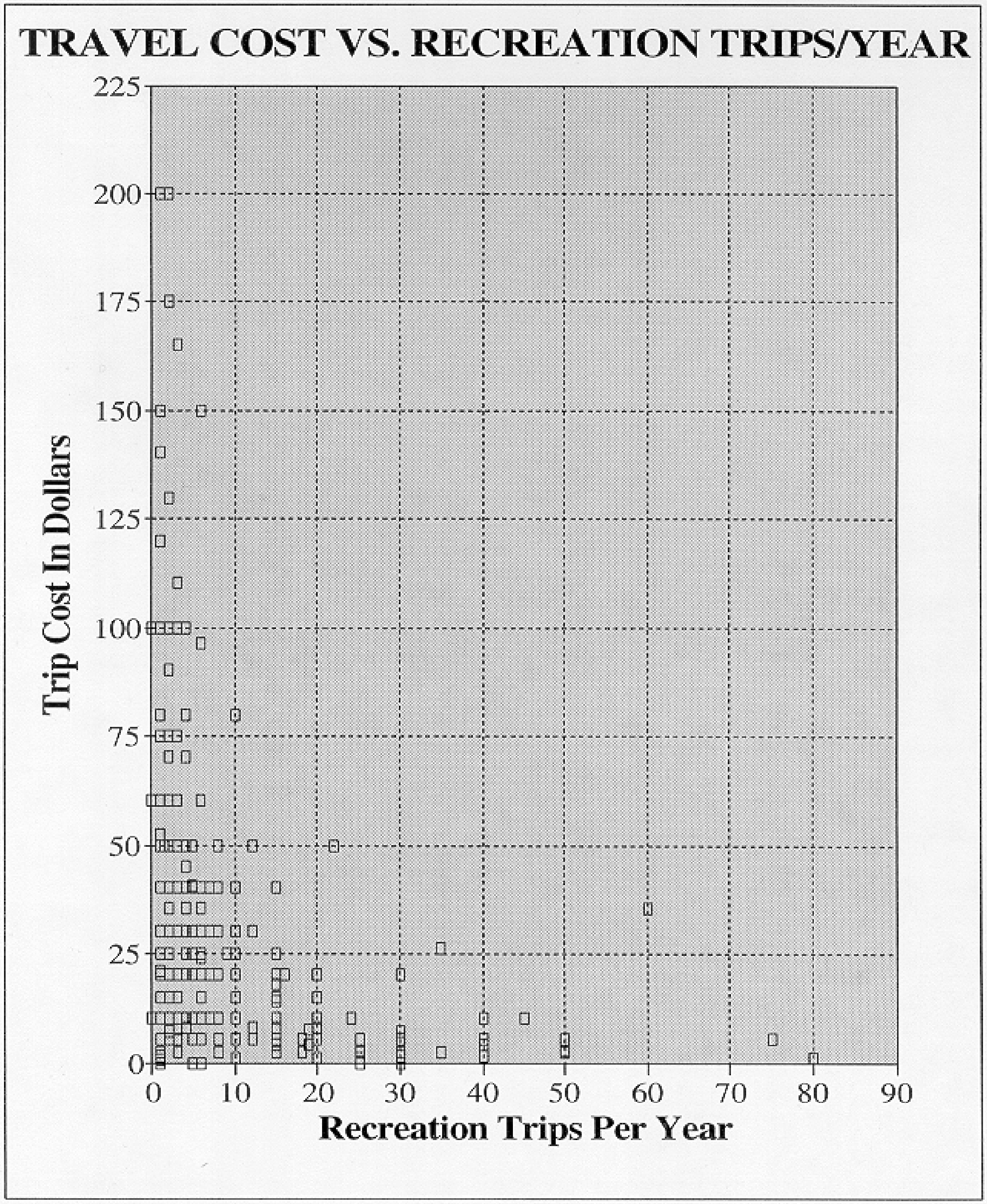

Figure 4 Travel Cost Versus Recreation Trips per Year

Recreationists in this study were contacted at the reservoirs over the period from May through October 1997 and requested to take part in the outdoor recreation demand mail survey. Most persons contacted on-site were agreeable to receiving a mail questionnaire and provided their name and mailing address. A small share of those contacted preferred a telephone interview and provided a telephone number.

The outdoor recreation demand mail survey resulted in a sample of 408 useable responses out of 438 surveys returned. Some surveys had to be discarded because they were incomplete. A total of 630 surveys were mailed out yielding a useable response rate of 64.8 percent for the recreation demand questionnaire. All 438 returned surveys were useable for other data, such as the distance from home to the Lower Snake River reservoir outdoor recreation site.

Reservoir Recreation Sites

A map of the reservoir region is shown in Figure 5. The Ice Harbor Reservoir and Lower Granite Reservoir outdoor recreation sites are relatively close to major population areas, Tri-Cities and Lewiston/Clarkston respectively. Lower Monumental and Little Goose reservoirs are more distant from major population centers.

Lower Granite Reservoir is about 39.3 miles in length and has a surface area of 8,900 acres. The upper terminus of the reservoir is Lewiston, Idaho and Clarkston, Washington. The reservoir is managed to maintain a water surface at the dam between elevations 724 and 738 in order to maintain a normal operating range between elevations 733 and 738 feet in Lewiston. Backwater levees have been constructed around Lewiston, Idaho.

Public boat launching facilities are available at 12 locations. There are 5,777.6 acres of project lands surrounding the reservoir.

Little Goose Dam is down river from Lower Granite Dam. The reservoir (Lake Bryan) is

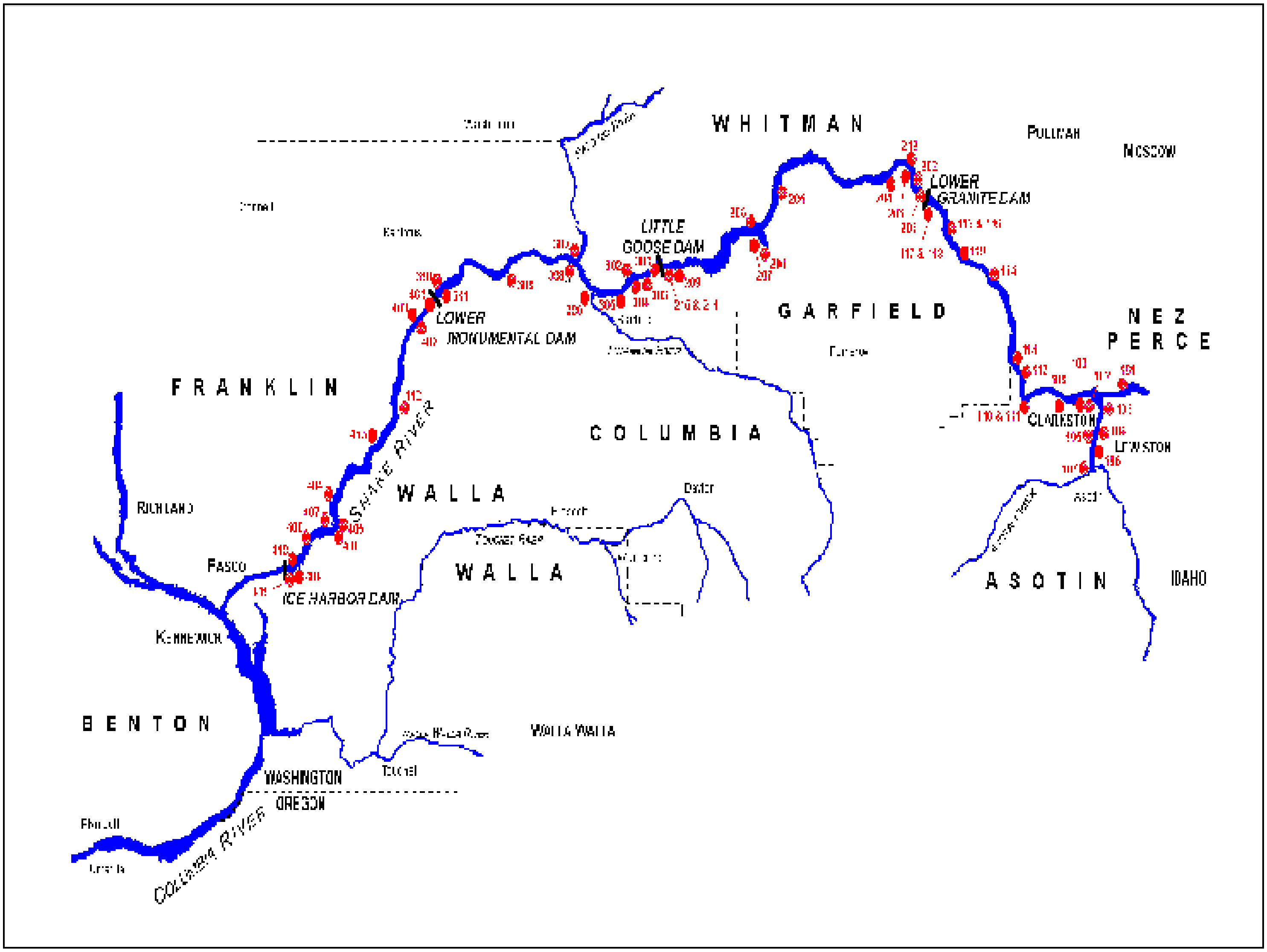

Figure 5 Map of the Lower Snake River Reservoirs.

about 37.2 miles in length and has a surface area of 10,025 acres. The reservoir is at an elevation of 638 feet. The normal operating pool varies between 633 and 638 feet of elevation. Public boat launching facilities are available at six locations. There are 5,398 acres of project lands surrounding the reservoir.

Lower Monumental Dam is down river from Little Goose Dam. The reservoir (Lake Herbert G. West) is 28.1 miles in length and has a surface area of 6,590 acres. The reservoir is at an elevation of 540 feet. The normal operating pool varies between 537 and 540 feet elevation. Public boat launching facilities are available at five locations. There are 8,335.5 acres of project lands surrounding the reservoir.

Ice Harbor Dam is down river from Lower Monumental Dam and lies upriver from the confluence of the Snake and Columbia rivers and the towns of Kennewick, Pasco and Richland. The reservoir (Lake Sacajawea) is 32 miles long and has a surface area of 9,200 acres. The reservoir is at an elevation of 440 feet. The normal operating pool varies between 437 and 440 feet elevation. Public boat launching facilities are available at six locations. There are 3,576 acres of project lands surrounding the reservoir (U.S. Army Corps of Engineers, Internet).

The reservoirs have few opportunities for major on-site purchases. The reservoirs provide high quality outdoor recreation. The average visitor recreated 15 hours per day. Mainly boat or an equal combination of boat and shoreline were used for outdoor recreation by 71.9 percent of the recreationists, whereas 28.1 percent recreated on the shore only (Figure 6). The typical recreationist had visited the Lower Snake River reservoirs for 12.3 years and traveled 120.5 miles (one-way) from home to site. Recreationists spent an average of 13.91 days per year engaged in outdoor recreation at the reservoir site where surveyed, and 21.59 days per year engaged in outdoor recreation at places other than that particular reservoir. About 59 percent of recreationists said they would leave for another site if recreation conditions were bad upon arrival. The average distance from the Snake River reservoir recreation site where contacted to the best alternate outdoor recreation site was 165 miles.

Recreationists can partake in a large variety of activities on or nearby the Lower Snake River reservoirs. The outdoor recreation demand survey listed 10 activities and recreationists were requested to select all that apply. Camping, motor boating and fishing were the three most favored activities. Nearly equal in importance were swimming, picnicking and water skiing. The input-output survey asked recreationists to rate 17 recreation activities using a scale from one to five where one was most important and five was least important. The complete results of this survey question are shown in the second section of this report. Eight recreation categories drew a response from more than half the recreationists: boating, swimming, water skiing, camping, other water sports, nature viewing, river fishing, and sightseeing. The activities with the highest rating (among those who rated them) included boating (rated 1.48), water skiing (rated 1.87, and swimming (rated 2.00).

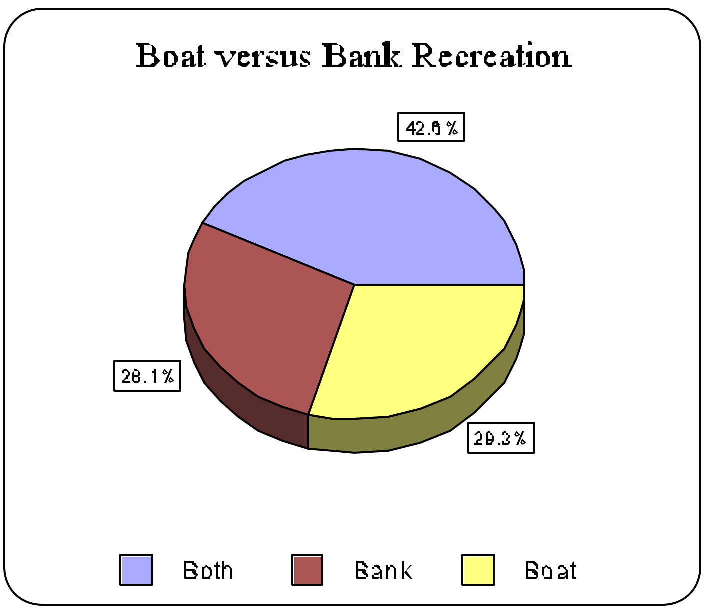

Figure 6 Recreation from boat, bank, or both boat and bank (sample=408)

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. (1990), 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 recreationists. 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 Lower Snake River 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 recreation 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. 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.

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 recreationists. Retirees, students, and unemployed persons do not exchange time for income at the margin. Many workers are not allowed by their employment contracts to make this exchange. Weekends and paid vacations of prescribed length are often the norm. Thus, the equilibrium labor market model may apply to certain self-employed persons, e.g., dentists or high level sales occupations, where individuals, (1) have discretionary work schedules and, (2) can expect that their earnings will decline in proportion to the time spent recreating. (Many professionals can take time off without foregoing any income). The equilibrium labor market subgroup of the population is very small. According to U.S. Bureau of Labor Statistics and National Election Studies (U.S. Bureau of the Census 1993), only 5.4 percent of voting age persons in the U.S. were classified as self-employed in the United States in 1992. The labor market equilibrium model applies to less than 5.4 percent of recreationists 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, money cost and physical travel time per trip from home to site enter as separate price variables in the demand function and 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 outdoor recreation sites. The B-S-H travel cost model can be estimated as;

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

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

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 equation two.

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

Where, as before, r is trips from home to site per year, c is out-of-pocket costs per trip, and *t* is travel time per trip. The term g'(w) is the marginal income foregone per unit time. It is assumed in the M-S model that any increase of travel cost, whether it is out-of-pocket spending or the money value of travel time expended, has an equal marginal effect on visits per year. The term [c + (*t*)g'(w)] imposed this restriction because it forces the partial effect of a change in out-of-pocket cost (Mf/Mc) to be equal in magnitude to a change in the opportunity time cost Mf/M[(*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. 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. 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.

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.

Inclusion of 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 recreation 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 complementary was the term used to connect enjoyment of a recreation site to the travel cost to reach it (Maler 1974). It is assumed that a travel cost must be paid in order to enjoy time spent at the recreation site. Without 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. 1990). Recreation trips are seldom single-purpose and travel is sometimes pleasurable and sometimes not. The effect of these "other activities" on the trip-travel cost relationship can be statistically adjusted for through the inclusion of the relevant prices paid during travel or on-site and for side trips. Furthermore, both trips and on-site recreation are required to exist simultaneously to generate satisfaction or the weak complementarity conditions would be violated (McConnell 1992). A relation between trips and site experiences is indicated such that marginal satisfaction of a trip depends on the corresponding site experiences. Therefore, the demand relationship should contain site quality variables, time-on-site, and goods used on-site, as well as other site conditions. Exclusion of these variables would violate the specification required for the weak complementarity condition which allows use of the TCM to measure benefits.

In this study of the Lower Snake River reservoirs, an expanded TCM survey was designed to include money and time costs of on-site time (McConnell 1992), on-site purchases, and the money and time cost of other activities on the trip. These vacation-enhancing closely related goods prices are added to the specification of the conventional TCM demand model. Empirical estimates of partial equilibrium demand could suffer underspecification bias if the prices of closely related goods were omitted.[3] 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 recreationists.

Travel Cost Demand Variables

The definitions for the variables in the disequilibrium and equilibrium travel cost models are shown in Table 3. The dependent variable for the travel cost model is (r), annual reported trips from home to the outdoor recreation site. Annual outdoor recreation trips from home to the four Lower Snake River reservoirs is the quantity demanded.

Prices of 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 outdoor recreation site. Our mail survey obtained travel costs for most of those surveyed. The average out-of-pocket travel cost for recreationists was about 20.2 cents per mile per car (compared to 19 cents per mile reported by anglers). The average party size was 4.87 (compared to 2.5 for anglers) resulting in a 4.12 cents per mile per recreationist travel cost (compared to 7.6 cents per mile for anglers). Reported one-way travel distance for each party was multiplied times two and times \$0.0412 to obtain the money cost of travel per person per trip. Cost per mile was based on average recreationist-perceived cost rather than costs constructed from Department of Transportation or

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

American Automobile Association data. Recreationists' perceived price is the relevant variable when they decide how many outdoor recreation 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 t_o which is round trip driving time in hours. Possible differences in sensitivity to time price were accommodated in the model by creating separate time price variables for different occupations. It would be expected that jobs with the least flexibility to interchange work and leisure hours would be the most sensitive to time price. Seven occupation or employment status categories including student, retired and unemployed were obtained in our survey. Dummy variables (0 or 1) were created for each of the occupations and the time price, t_o, was multiplied times the dummies to create separate price variables for each occupation category. For example, t_{o3} is either the "hourly wage earners" round trip travel time to the outdoor recreation site or zero if the recreationist is not an hourly wage earner. In this manner, the price elasticity of demand with respect to travel time c is allowed to vary, or be zero, for each of the occupation classes. Price elasticity with respect to travel time is defined as the percentage reduction in quantity demanded (trips per year) for a one percent increase in time required to travel from home to the fishing site.

Prices of Closely Related Goods

The B-S-H model calls for the inclusion of t_a, round trip driving time from home to an alternate outdoor recreation site, as the physical time price of an alternate outdoor recreation site. This variable was not significant and appeared to be highly correlated with the monetary cost of travel. The remaining alternate site price variable is c_a, which is the out-of-pocket travel costs to the most preferred alternate outdoor recreation site. This substitute price variable also 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 outdoor recreation 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 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 "inferior" types of consumer goods. Thus, the sign on the income coefficient conceptually can be either positive or negative.

Three other closely related goods prices were significant in the model: t_{os}, time spent on site at the four reservoirs, c_{os}, money spent on site at the reservoirs, and c_a, money spent on-site at alternate outdoor recreation sites away from the reservoirs during the reservoir recreation trip. The signs of the coefficients for the time variables indicate how they are considered by recreationists. As discussed earlier, spending more time-on-site at the reservoirs could increase the value of the trip leading to increased trips, but time-on-site could also be substituted for trips. Money spent on site is expected to be for complementary goods used for recreation at the reservoirs while money spent at an alternate site away from the reservoirs is part of the cost of a substitute recreation experience.

A price variable, c_{md}, measuring money travel cost for the second leg of the trip for recreationists visiting a second site away from the Snake River reservoirs was tested and found insignificant. If significant, this variable would have indicated how much the recreation demand at the Snake River reservoirs was influenced by the cost of going from the reservoirs to the second site for those considering multi-destination trips.

Other exogenous variables

The strength of a recreationist's preferences for outdoor recreation over other activities should positively influence the number of outdoor recreation trips taken to the reservoirs per year. The variable, *TASTE* is days recreated divided by available days, is used as one indicator for recreationist tastes and preferences. A second 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 second aspect of taste. Each reservoir may have a unique demand depending on its geographic location and outdoor recreation attributes. Each reservoir was represented by a dummy variable in the model. Only Lower Granite Reservoir near the towns of Lewiston and Clarkston showed a significant positive increase in outdoor recreation demand relative to the other reservoirs. This result is consistent with total recreation activity which also is largest at Lower Granite Reservoir. The dummy variable for Lower Granite Reservoir is *GRAN*. Age has often been found to influence various types of outdoor recreation activity. A quadratic function to allow outdoor recreation activity to first rise and then decline with age was tested and found insignificant. However, a log-log relationship to age was significant. A dummy variable, *BOAT*, that identified recreationists that used a boat for recreation either all or part of the time was included in the model. Possession of a boat was expected to positively influence visit rates.

Recreation Demand Results

The t-ratios for all important variables to estimate the value of outdoor recreation are statistically significant from zero at the 5 percent level of significance or better. Some of the tests for over dispersion (Cameron and Trivedi 1990; Greene 1992) were positive. Therefore, as discussed earlier, the truncated Poisson regression was replaced by the truncated negative binomial regression method. Use of the truncated negative binomial regression technique eliminated the overstatement of the t-ratios found in the Poisson regression results.

Estimated Demand Elasticities

The estimated regression coefficients and elasticities from the truncated negative binomial regression estimation for the Lower Snake River reservoirs outdoor recreation demand models are reported in Tables 4, and 5. Many 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 +(dummy) if the average value of the dummy is used. We will report the elasticity for the case where the dummy is one.[4]

Price Elasticity of Demand

Price elasticity with respect to out-of-pocket travel cost, c_t, is -0.1393. As expected for a regionally unique consumer good, the number of trips per year is not very sensitive to the price. A ten percent increase in travel costs would only reduce participation by 1.393 percent.

The elasticity with respect to physical travel time for retirees in the sample is -0.349. If the time required to reach the site increased by ten percent, annual visits would decrease by 3.49 percent. Elasticity with respect to travel time for students is -0.516. If the time required by a student to reach the site increased by ten percent annual visits would fall by 5.16 percent. Elasticity with respect to travel time for hourly wage earners is -0.265, indicating that a ten percent increase in travel time would reduce visitation by 2.65 percent. For professionals price elasticity with respect to travel time is -0.293. Most other occupation categories had few members represented in the sample and did not have significant coefficients.

Price Elasticity of Closely Related Goods

Demand elasticity with respect to time on site was -0.0798 indicating that a ten percent increase in time on site per trip would decrease trips per year by 0.798 percent. Time on site is a complement to trips in the sense that as the time price of a trip rises fewer trips are taken. Price elasticity for expenditures at the reservoirs also has a negative sign indicating that it too is complementary to the trip and a ten percent increase in on site expenditures would reduce trips per year by 1.42 percent.

Price elasticity for expenditures at the alternate outdoor recreation site is 0.236 and positive, indicating the alternate site is a substitute for the reservoirs. A ten percent increase in the time at an alternate outdoor recreation site would cause recreationists to increase visits to the reservoirs by 2.36 percent.

Price elasticity for the cost of travel to an alternate outdoor recreation site was not significant. Price elasticity with respect to the cost of the second leg of the journey for those visiting more than one site (other than at the Snake River reservoirs) also was not statistically significant.

Elasticity for Income and Time Constraints

Income elasticity is zero. Quantity demanded (outdoor recreation trips from home to the reservoirs per year), was not related to income, *INC*.

Elasticity with respect to discretionary time, *DT*, is 0.153. As in past studies, the discretionary

[4] Let the regression equation be ln(r) = "$_1$ + "$_2$ D + "$_3$ ln(Z) where Z represents all the continuous independent variables. The equation can be written as r = e$^{("1 + "2D)}$ Z$^{("3)}$. Elasticity of r with respect to D is defined as , = (% change in r) / (% change in D) = (Mr/MD)(D/r). Mr/MD = "$_2$ e$^{("1 + "2D)}$ Z$^{("3)}$; D can be 0, 1, or +(D); and r is defined above. Elasticity reduces to , = "$_2$D. Thus, , becomes zero if D is zero and , takes the value "$_2$ if D is one.

time was positive and highly significant. A ten percent increase in free time results in a 1.53 percent increase in outdoor recreation trips to the reservoirs. As expected, available free time acts as a powerful constraint on the number of outdoor recreation trips taken per year.

Elasticity With Respect to Other Variables

Elasticity with respect to *TASTE* was positive showing that recreationists who recreated a larger fraction of available days were likely to take more outdoor recreation trips per year to the reservoirs. Those who recreated ten percent more of their available days would tend to take 4.18 percent more outdoor recreation trips per year to the reservoirs.

The outdoor recreation experience variable, *EXP*, showed that those who have recreated the reservoirs over a long period of time tend to make more outdoor recreation trips to the reservoirs. A ten percent increase in years visited the reservoirs results in a 1.92 percent in annual trips to the reservoirs.

The dummy variables to distinguish demand among the reservoirs were mostly insignificant. Only the dummy demand-shift variable for Lower Granite Reservoir, *GRAN*, was significant. The coefficient estimated for the dummy variable indicated that many more outdoor recreation trips are demanded by recreationists at Lower Granite Reservoir compared to the other reservoirs after accounting for other variables in the model (such as travel distance etc.). For example, if ten percent of the recreationists switched from other reservoirs to Lower Granite, average trips per year would rise by 1.87 percent. (Note that the *GRAN* variable refers to trips per year by participants and does not predict participation rates by the population.)

The negative sign on age, *A*, indicates that trips per year declines with age. A ten percent increase in age results in a 2.97 percent decline in trips per year.

The dummy variable, *BOAT*, indicating a boat was used for recreating all or part of the time had a positive coefficient. Those using a boat for recreation would take more outdoor recreation trips to the reservoirs per year than those who recreated only on shore. Thus, increasing the number of recreationists with boats by ten percent would increase visits per year by 5.27 percent.

Consumers Surplus Per Trip

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

Consumers Surplus Per Trip From Home to Site

Estimated coefficients for the travel cost model with labor market disequilibrium, and using average reported travel cost per mile of 4.12 cents per mile per person are shown in Table 4. Application of truncated negative binomial regression, and using recreationist-reported travel distance times $0.0412 per mile per person to estimate out-of-pocket travel costs, results in an estimated coefficient of -0.014023 on out-of-pocket travel cost. Consumers surplus per recreationist per trip is the reciprocal or $71.31. Average recreationist trips per year in our sample was 8.364. Total surplus per recreationist per year is average annual trips x surplus per trip or 8.364 x $71.31 = $596 per year.[5]

Visitors to the Lower Snake River reservoirs spent an average of 42 hours recreating at the primary site at the reservoirs and 16.8 hours at other reservoir sites. Reported time at the primary reservoir site varied ¼ hour to 720 hours per trip. Figure 7 shows that many visitors stayed 12 hours or less per visit but many also stayed 48 hours, 72 hours or more than 90 hours per visit. Reported time spent at secondary reservoir recreation sites also varied widely. After removal of a few huge outliers, recreationists reported spending an average of 38.8 hours per trip recreating at the primary reservoir site and 9.4 hours per trip recreating at other reservoir sites on a typical trip.

Total Annual Consumers Surplus for Reservoirs Recreation

An important objective of the demand analysis was to estimate total annual willingness-to-pay for recreation on Lower Snake River reservoirs. As discussed above, consumer surplus was estimated at $71.31 per person per travel cost trip. The average number of recreation trips per year from home to the Lower Snake River reservoirs was 8.364 resulting in an average annual willingness-to-pay of $596 per year per recreationist. The annual value of the recreation sites or willingness-to-pay by our sample of 408 recreationists is 408 x $596 = $243,168.

The total annual willingness-to-pay for all recreationists requires knowledge of the total population of site visitors. The number of recreationists can be inferred from our sample values for hours on-site per day and days on-site per year combined with the estimated total annual hours on-site at the reservoirs (COE annual). Hours on-site per year for the average recreationist is estimated from the product of average hours on-site per day (15.07 hours) times average days per year (13.19) or 15.07 x 13.19 = 198.77 hours on-site per year for the average visitor. The COE (1997) estimated total annual hours on-site at the four reservoirs at 10,219,824 hours per year. Hours on site by persons primarily interested in fishing must be removed from the total annual hours to find total annual hours on site by recreationists. Normandeau Associates et al. (1998a) estimated 489,215 hours per year fishing at the reservoirs. Our survey of anglers at the reservoirs (Normandeau Associates et al. 1998b) showed that nearly one-half (19/40) the time on site is spent fishing, thus we double the fishing hours to convert it to on-site hours for anglers. Removing the total annual hours on site by anglers leaves 10,219,824 - (489,215 x 2) = 9,241,394 hours on site per year for recreationists. These data suggest that about 9.6 percent of the visitor time on-site is by those who are primarily interested in fishing and

[5] The estimated elasticities changed markedly when the flawed Poisson regression was used in place of the negative binomial regression and the estimated consumer surplus decreased greatly, ($26.28 per person per visit versus $71.31 per person per visit for the negative binomial).

91.4 percent of the visitor time on-site is by those who are primarily interested in the many other recreation possibilities at the reservoirs. Dividing total annual hours on-site by our estimate of on-site hours per year for an individual yields total recreationists or 9,241,394/198.77 = 46,493 unique recreationists that visit the reservoirs. Multiplying annual value per recreationist times the number of unique recreationists yields total annual willingness-to-pay of $596 x 46,493 = $27,709,828 per year.

Nonresponse Adjustment to Total Annual Willingness-To-Pay

An adjustment for bias caused by non-response could increase the total annual willingness-to-pay (and expenditures also) by as much as 14 percent. About 35 percent of recreationists contacted did not return a useable survey. A survey of non-responders was not attempted for this data set. However, a telephone survey on non-responding anglers reported in the Lower Snake River Reservoir angling survey resulted in an average of 13 trips per year compared to about 20 trips per year for those who did respond (Normandeau Associates et al. 1998b). These data suggest about 35 percent less participation by non-respondents. A crude adjustment for non-response bias assumes that the 35 percent reduction in trips also applies to recreationist hours per year from our survey. Given that assumption, the average hours per year remains 198.77 for responders and becomes 198.77 x (1-0.35) for non-responders and the adjusted average hours per recreationist is [198.77 x 0.65] + [198.77 x (1-0.35) x 0.35] = 174.42 where the response rate was 0.65 and the non-response rate was 0.35. The result of the adjustment for lower participation by non-responders is to lower the average on-site hours per year from 198.77 to 174.42 which is a 13.3 percent reduction in estimated average hours per year per recreationist. As before, the number of recreationists was estimated by dividing total hours per year for recreationists (COE) by annual hours per recreationist (9,241,394/174.42 = 52,984) unique recreationists. Compared to our previous estimate of 46,493 unique recreationists before the adjustment for nonresponse, this is a fourteen percent increase in unique recreationists. Multiplying annual value per recreationist times the number of unique recreationists yields total annual willingness-to-pay of $596 x 52,984 = $31,578,464 compared to $27,709,828 prior to the adjustment for nonresponse bias. A rough estimate of net value per day can be found by dividing total net value per year ($31,578,464) by the estimated total days recreated per year. Conversion of total recreation hours per year to total recreation days per year requires an assumption about the hours recreated per day. (The Corps uses 12 recreation hours per day in its conversion.) Our survey showed about 15 hours recreating per day. Thus, the 9,241,394 recreation hours per year converts to about 9,231,394/15 = 616,093 recreation days. Dividing total net value per year by total recreation days per year yields $31,578,464/616,093 = $51.26 per day of net value. Clearly, the per day value will vary depending on the somewhat arbitrary conversion factor from recreation hours to recreation days. Use of 12 recreation hours per day would result in $41.05 per day of net value. The appropriate conversion factor may depend on the mix of recreation activities. For example, our surveys showed that recreation hours per day were much larger than fishing hours per day.

The Snake River Reservoirs As An Intervening Opportunity

Only about 17 percent of the recreationists in our sample chose to recreate at a second recreation site away from the reservoirs during their trip.[6] In comparison, 40 percent of anglers chose to fish at a second site away from the reservoirs during their trip. Recreationists traveling on to another site spent an average of $31 to go there and stayed an average of 11 hours. The location of the Snake River reservoirs adjacent to other recreation sites increases their visitation and thus their recreation value. Part of the visitation to the Snake River reservoirs is attracted there because they are enroute to other desired recreation sites. Reservoirs with the same attributes as the Snake River reservoirs but which were located off the "path" followed by travelers among sites would have less recreation value. Recreationists who visit the Snake River reservoirs as part of a longer trip are expected to place a higher value on their visit (or, i.e., for the same travel cost to visit more often) than recreationists who only travel to the reservoirs and return home. A higher value is received by the multi-destination recreationists because their trip from home to site contains more complementary inputs as discussed in a previous section. Not all recreationists can utilize the "path" among recreation sites either because of time constraints or because of the location of their residence vis a vis the reservoirs. But some (17 percent) do take advantage of the multi-destination opportunity. The fact that the Snake River reservoirs are part of a multi-destination opportunity makes them more valuable to recreationists able to utilize the opportunity. If, for some reason, these multi-destination visitors were excluded from the sample the actual visitation and true site value of the reservoirs could be understated. A travel cost model which separates the price effects for single and multi-destination recreationists was estimated. Unfortunately, the sample size for those on multi-destination trips was small (67) and the coefficient for trip value was not significant. It was notable however, that the regression coefficient for those not on multi-destination trips was smaller than found for the total sample. When multi-destination trips were removed from the sample the coefficient on travel cost changed from -0.014 to -0.022 and surplus per trip fell from about $71 to about $45.

Measurement of the Intervening Opportunity Value of the Reservoirs

The intervening opportunity value of the Snake River reservoirs can be found by comparing the value with the existing share of multi-destination trips ($71/trip) to the value if only single destination trips occurred. The extra value of the Lower Snake River reservoir fishing site would be [annual trips] x [$71 - $45]. This location value is for the existing share of recreationists that are multi-destination (17 percent). If more recreationists could take advantage of multidestination trips the locational value of the reservoirs would rise. The intervening opportunity value of the reservoirs would disappear if the other recreation sites were eliminated, thus some economists would exclude the intervening opportunity value from the benefits attributed to the Snake River reservoirs. However, visitation and willingness-to-pay for recreation at the Snake River reservoirs is boosted by their location along the "path" to other recreation sites and neither this "path" nor the recreation sites that created it is likely to change greatly over the time period of the planning horizon.

[6] Defined as at least one hour of recreation at a site away from the reservoirs during the trip.

Representation of Reservoirs in the Consumer Surplus Valuation

The recreation sample data (which excludes persons who are primarily fishing) are weighted most heavily toward the reservoirs that are close to population centers and receive the most recreation use. The reservoirs listed in order of sample share for the travel cost estimation are: Lower Granite 41.42%, Ice Harbor 31.62%, Little Goose 15.69%, and Lower Monumental 11.28%. The recreation data set sample shares can be compared to those of the angler creel survey which provided our sample name list. The distribution of sport anglers among reservoirs was: Lower Granite 44.9%, Ice Harbor 25.0%, Little Goose 14.1%, and Lower Monumental 16.0% (Normandeau Associates et al. 1998a). Overall recreation use (including fishing) in the reservoirs is reported in Appendix J (recreation) of the *Columbia River System Operation Review* (1995). Using a seven year (1987-93) average of visitor-days results in: Lower Granite 64%, Ice Harbor 20%, Little Goose 10%, and Lower Monumental 6%.

Willingness-To-Pay Comparisons

This study of the Lower Snake River reservoirs resulted in an estimated value per recreation trip of $71.31 per person. Using reported hours on site per trip, this roughly converts to a per day value of about $29 to $35 per person.[7] Comparison of net benefits for recreation 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 persons studied have similar lengths of stay. Comparison of reported values per per person per day are difficult because different recreation activities have varying time limitations. Conversion of recreation consumption data into meaningful standard units of comparison, such as recreation-days consumed is difficult. Most recreation demand studies focus on one or a few particular activities instead of all outdoor recreation. Many recreation demand 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 an be attempted using the consumer price index. A major problem with older studies is the changes in both economic and statistical models used to measure value. More recent studies include an imputed value for the cost of travel time based on alleged foregone earnings. Different studies use part or all of the income rate in estimating foregone earnings. Thus, the more recent travel cost demand studies have an added source of arbitrary variation introduced by the imputed time values added to travel costs. Our surveys and published national statistics suggest that very little income is typically foregone by travel for recreation. Thus, studies that add large imputed time values to out-of-pocket travel cost may be upward biased. Adjustments (based on methodology of the time) for different travel cost model methodologies, as well as contingent value methodologies, and inflation, is shown in Walsh et al. 1990. Some recent studies used higher out-of-pocket cost per mile than we did for travel and also incorrectly used the earned 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 studies used Poisson regression and obtained extremely high t-values. Although no test for over-dispersion was mentioned, the very high-t-values suggest that

[7] The smaller value results if we leave in a few huge outliers in the reported hours on site data.

the requirement of Poisson regression that the mean and variance of trips per year (the dependent variable) be equal was violated. If that was the case, the Poisson regressions are inappropriate and should have been replaced with negative binomial regression.

Cameron et al. (1996) developed individual travel cost recreation models to predict the effect of water levels on all types of recreation at reservoirs and rivers in the Columbia River Basin. See Appendix J-1, COE *Columbia River System Operation Review* (*CRSOR*) (1995). The baseline (1993 water levels) estimates of consumer surplus varied between $13 and $99 per person per summer month over the nine sites. Annual estimates per trip were not reported. The study included recreation at Lower Granite Reservoir with a sample of 168 persons. The results for Lower Granite Reservoir were extrapolated to the other three Lower Snake River reservoirs. Consumer surplus per recreation day for summer recreation can be found using average visitor days shown in Tables 6,2g-6,2j and total summer consumer surplus shown in Tables 6,3g-6,3j (*CRSOR*). Division of total consumer surplus by average recreation days result in: Ice Harbor Reservoir $51.21 per recreation day, Lower Monumental Reservoir $40.33 per recreation day, Little Goose Reservoir $42.69 per recreation day, and Lower Granite Reservoir $35.40 per recreation day. Recreation days varied from 138,400 at Lower Monumental Reservoir to 1,670,600 at Lower Granite Reservoir. Values found for other reservoirs in the study included John Day Reservoir at $20.14 per recreation day, Lake Roosevelt Reservoir at $53.27 per recreation day, and Dworshak Reservoir at $54.01 per recreation day.

The values found in *CRSOR* (Cameron et al. 1996) are higher than estimated herein. Changes in consumer surplus estimated by the travel cost method are almost directly proportional to the changes in travel cost value that is used as price in the demand function. One reason for the high values in the *CRSOR* study is that the vehicle cost used in the price variable was $0.29 cents per mile (Department of Transportation estimate) whereas our vehicle cost was $0.202 per mile (based on our survey data). The price perceived by travelers is the appropriate measure. DOT data include fixed costs that are not relevant when making incremental trip decisions (Donnelly et al. 1985). In addition, Cameron et al. 1996, added in an opportunity time cost of travel based on estimated travel time valued at the reported average wage rate (see *CRSOR*, Appendix J-1, bottom of Table 5,4). Our methodology did not include a money cost of time in travel cost and physical travel time was included as a separate site price variable. Their assumption that all recreationists give up earnings when traveling to the site is incorrect based on their own survey data. The fraction of persons who stated they gave up some income to visit the sites appears to be only about 10 percent (about 19 persons) in their sample of 186 at Lower Granite Reservoir (see *CRSOR*, Cameron et al. 1996, Appendix B2 Survey Results part E, *About Your Typical Trips*).[8] The ten percent of visitors that gave up some income probably did so either on the way to the site or on the return trip but not both ways. The appropriate foregone income amount would only apply to half the trip time and to only ten percent of the visitors. Based on the survey characteristics of typical trips, the foregone income component of travel cost was overstated by about 95 percent. Their travel cost measure also included lodging costs which are discretionary and are not

[8] About 12.5 percent of recreationists in this sample indicated they gave up some income to travel to the recreation site. Our prior survey of anglers resulted in 11.9 percent indicating they gave up some income to travel to the fishing site.

usually considered part of the cost of a recreation trip (*CRSOR*, Appendix C). Their average "round trip transportation cost" to travel to the Lower Snake River reservoirs was about $23.37 per trip per person whereas ours was about $9.93 per trip per person. Michaleson (1977) used the individual observation travel cost method to estimate the value of camping associated with wild and scenic river recreation in Idaho. The imputed value of time was included in travel cost. He reported a value of $9 per activity day in 1971 dollars. Michaleson and Gilmour (1978) estimated the value of outdoor recreation trips associated with camping by 77 percent of the sample. An imputed value of time was included in travel cost. The study method was individual observation travel cost and used on site interviews in Sawtooth Valley, Idaho. The average value was $3.73 per person per day in 1971 dollars.

Brown and Plummer (1979) used the hedonic travel cost method to find the value of camping in western Washington. The imputed value of time was excluded from travel cost. They found a value for camping of $5.83 per person per day in 1976 dollars.

Sutherland (1980) used the zonal travel cost method to estimate the values of camping, swimming, and motorized boating in Idaho, Oregon and Washington states. The imputed value of travel time was excluded from travel costs. Values of $4.23 per person per day for camping, $4.31 per person per day for swimming, and $4.24 per person per day for motorized boating (all in 1979 dollars) were found.

Findeis and Michalson (1984) used a modified individual observation travel cost method to estimate the value of camping at developed sites in the Targhee National Forest in Idaho. An imputed value of time was included in travel cost. They found a values of $8.60 to $17.93 per person per day in 1974 dollars.

Daniels (1987) applied a zonal travel cost model in a study of visitors to four campgrounds in Lolo National Forest in Montana. An imputed value of time was included in travel cost. One-third of the sample were nonresidents and were all deleted on the grounds that the campgrounds were not their primary destination. An average value of $17.82 per person per day was found (in 1984 dollars).

Brox and Kumar (1997) apply a multi-site travel cost model for camping at 48 provincial parks in Ontario, Canada. The imputed value of time was excluded from travel cost but the arbitrary (government reimbursement rate) value for travel cost per mile was overstated. They report values per trip varying by park from $1.80 to $7,000 with most values under $300 per trip in 1990 dollars.

Knetch et al. (1976) used a zonal travel cost model to estimate the demand for day trips to California reservoirs where picnicking made up a large part of the activities. Truncation to day use only reduced the values significantly. An imputed value of time was included in travel cost. They found a value of $3.33 in 1969 dollars.

Walsh et al. (1980) measured the value of camping, picnicking and fishing on high country reservoirs located along the eastern slopes of the Rocky Mountains in Colorado. They used noniterative open-ended contingent value questions in on site interviews. They found a value of $10.90 per person per day in 1978 dollars.

Walsh and Olienyk (1981) applied an iterative contingent value survey on site to value picnicking at five recreation sites in national forests on the eastern slopes of the Rocky Mountains in Colorado. They found a value of $6.22 per person per day in 1980 dollars.

Ward (1982) estimated the demand for recreation (picnicking, boating, swimming) at reservoirs in southeastern new Mexico. He used an individual observation travel cost for model. An imputed value of time was included in travel cost. The survey was truncated to neighboring counties which would understate value. He found a value of $11.39 per person per day in 1978 dollars.

Rosenthal (1987) applied a zonal travel cost model to study recreation demand at 11 reservoirs in Kansas and Missouri. Recreation activities included picnicking, swimming, fishing and boating. The sample was limited to one-day trips which would understate value. An imputed value of time was included in travel cost. He found values of $4.04 to $7.10 per person per day in 1982 dollars depending upon treatment of substitute sites.

Wade et al. (1988) used a zonal travel cost model to find the demand for swimming at 14 reservoirs in California. An imputed value for time was included in travel cost.
The estimated value per person per day ranged from $15.84 to $35.04 in 1985 dollars. They also estimated the value of motorized boating on Lake Havasu in Arizona and at 12 reservoirs in California. An imputed value of time was included in travel cost. They found a value at Lake Havasu of $34.64 per day in 1985 dollars. Lake Havasu is unique for a number of reasons including reconstruction of the original London Bridge. Motorized boating at the California reservoirs was double in southern California compared with reservoirs in the rest of the state. The average value for motorized boating on reservoirs in California was $24.28 per person per day in 1985 dollars.

Brooks (1988) used a travel cost model to estimate the value of deer hunting in Montana. An imputed value of time was included in travel cost. The sample included both resident and nonresident hunters. Average value per person per day varied from $20.88 to $54.94 in 1986 dollars.

Offenbach and Goodwin (1994) estimate the demand for deer hunting in Kansas. They use an individual observation travel cost model estimated using the negative binomial regression technique. An imputed value of time was excluded from travel cost but costs for food and lodging were added to transport costs. They found value per trip of $160.79 to $176.55 in 1988 dollars. Data were not reported allowing conversion of value per trip to value per person per day.

Table 1 Definition of variables [9]

r	annual trips from home to the Lower Snake River reservoir outdoor recreation site (dependent variable).
c_r	recreationist's out-of-pocket round trip travel cost to the outdoor recreation site, in dollars.
$L(t_{o1})$	"retirees" round trip travel time to the outdoor recreation site, in hours.
$L(t_{o2})$	"student" round trip travel time to the outdoor recreation site, in hours.
$L(t_{o3})$	"hourly wage earners" round trip travel time to the outdoor recreation site, in hours.
$L(t_{o4})$	"professionals" round trip travel time to the outdoor recreation site, in hours.
c_a	recreationist's out-of-pocket travel cost to an alternate outdoor recreation site away from the reservoirs, in dollars.
$L(t_{os})$	time spent on-site at the reservoirs outdoor recreation during the trip, in hours.
c_{os}	recreationists on-site out-of-pocket costs at the reservoirs for outdoor recreation during the trip, in dollars.
$L(INC)$	annual family earned and unearned income, in dollars.
$L(DT)$	the recreationist's discretionary time available per year, in days.
$L(Taste)$	recreationist's ratio of days recreated (at all locations) divided by their available days.
$L(EXP)$	recreationist's total outdoor recreation experience at the reservoirs, in years.
$L(A)$	recreationist's age, in years.
BOAT	dummy variable, one for persons who recreated with a boat all or part of the time and zero for those who never used a boat.

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

Table 2 Travel cost model for the Lower Snake River reservoirs.

Variable	Coefficient	t-ratio	Mean of Variable	Elasticity
Constant	3.547	2.89	na	na
c_r	-0.014	-3.78	9.93	-0.14
$L(t_{o1})$	-0.349	-3.61	-	-0.35
$L(t_{o2})$	-0.516	-2.15	-	-0.52
$L(t_{o3})$	-0.265	-8.09	-	-0.27
$L(t_{o4})$	-0.293	-3.40	-	-0.29
$L(t_{os})$	-0.08	-2.39	2.70	-0.08
c_{os}	-0.0015	-2.75	94.98	-0.14
c_a	0.00075	2.02	31.44	0.02
L(*INC*)	-0.072	-0.78	10.90	ns
L(*DT*)	0.153	3.17	3.90	0.15
L(*TASTE*)	0.418	9.53	-1.56	0.42
L(*EXP*)	0.19	4.38	2.07	0.19
GRAN	0.187	2.25	0.41	0.19
L(*A*)	-0.297	-1.51	3.77	-0.30
BOAT	0.527	5.21	0.70	0.53

Travel Cost per Mile per Recreationist Assumed to Be $0.0412. Truncated Negative Binomial Regression[10], r = trips per year to the reservoirs (r = dependent variable), mean r = 8.364. $R^2 = 0.55$. R^2 estimated by a regression of the predicted values of trips from the truncated negative binomial model on the actual values.)

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

Table 3 Effects of exogenous variables on a recreationist's trips per year.

Exogenous Variable	Effect on Trips/Year of a +10% Change
Recreationist's Money Cost of Round Trip (single destination trip) ($/trip)	-1.39%
"Retiree" Recreationist's Round Trip Travel Time (hours/trip)	-3.49%
"Student" Recreationist's Round Trip Travel Time (hours/trip)	-5.16%
"Hourly Wage Job" Recreationist's Round Trip Travel Time (hours/trip)	-2.65%
"Professional Job" Recreationist's Round Trip Travel Time (hours/trip)	-2.93%
Time Spent at the Lower Snake River Reservoirs Outdoor recreation Site (hours/trip)	-0.80%
Money Spent at the Lower Snake River Reservoirs Outdoor recreation Site (dollars/trip)	-1.42%
Money Spent on Outdoor Recreation at an Alternate Site (not at reservoirs) (dollars/trip)	2.36%
Annual Family Earned Income ($/year)	0.00%
Recreationist's Discretionary Time (days/year)	1.53%
Recreationist's Fraction of Available Days Spent on Outdoor Recreation (Taste for Outdoor Recreation)	4.18%
Recreationist's Total Years of Outdoor Recreation Experience at the Reservoirs	1.92%
If Outdoor recreation Trip was to Lower Granite Reservoir	1.87%
Age	-2.97%
If Recreationist Used a Boat All or Part of the Time	5.27%

Differences in Trip Value Among The Four Reservoirs

The travel cost price variable was introduced separately for each reservoir in the demand equation using dummy variables. This allowed getting separate estimates of value per recreationist per trip (from home to reservoir) for each reservoir. The trip value results are as follows:

- Lower Granite, $91.16 per person per trip (t-ratio = -2.72)

- Little Goose, $46.36 per person per trip (t-ratio = -1.36)

- $ Lower Monumental, $38.55 per person per trip (t-ratio = -2.27)

- $ Ice Harbor, $28.05 per person per trip. (t-ratio = -3.17)

These results indicate that persons were willing to pay much higher costs of travel to recreate at Lower Granite Reservoir than at the other three reservoirs. The t-ratio for Little Goose reservoir is not significant. On average, a recreationist spent $9.93 (round trip) to drive to the reservoirs. However, the average recreationist at Lower Granite Reservoir was willing to spend $12.17 on transportation to the reservoir while at Ice Harbor Reservoir recreationists only spent an average of $7.11 to travel to the reservoir. Average spending to drive to Little Goose and Lower Monumental Reservoirs was $9.65 and $10.03 respectively. Thus, on average, recreationists at Lower Granite Reservoir were willing to travel nearly double the distance that recreationists at Ice Harbor Reservoir were willing to travel. Little Goose and Lower Monumental travel distances fall somewhere in between.

Lower Granite Reservoir accounted for 41 percent of the visitation, compared to 31.6 percent at Ice Harbor Reservoir, 15.6 percent at Little Goose Reservoir, and 11.3 percent at Lower Monumental Reservoir. Thus, Lower Granite Reservoir had both more people taking longer trips (paying more) to reach it and in total had more people visiting. If the consumer surplus values for each reservoir are weighted by the respective visitation share the average consumer surplus is only $58.28 per person per trip compared to $71.33 per person per trip estimated when all reservoirs were combined in a single variable (see Table 4).

SECTION TWO - OUTDOOR RECREATION EXPENDITURES

Recreationists were contacted at the reservoirs over the period from June 24, 1997 through November 29, 1997 and requested to take part in the outdoor recreation spending mail survey. Most persons contacted on-site were agreeable to receiving a mail questionnaire and provided their name and mailing address. A small share of those contacted preferred a telephone interview and provided a telephone number. The outdoor recreation spending survey data are expanded to show the direct economic effects on spending, earnings, and employment in the Lower Snake River region.

The outdoor recreationist input-output spending survey collected detailed information on the types of purchases and the place the purchase occurred. Separate data were collected for the trip to the reservoirs, while on-site at the reservoirs, and on the trip home. Expenditure data for some 26 seller categories were obtained. The data allow measuring the average expenditure by type of purchase for various distances from the reservoirs. The name of the town nearest where each purchase occurred was collected allowing estimation of average purchases for each of the seller categories for a large number of towns and counties.

The outdoor recreationist spending survey showed spending patterns useful in estimating the stimulus to jobs and business sales in the region created by recreationists attracted to the reservoirs. The total economic effects of sportfishing include both the initial spending stimulus on sales, employment, and personal income and the indirect economic effects as the initial spending effects spread throughout the local economy. This study estimates the initial economic effects which will be used in a separate economic multiplier study that estimates the total economic effects. The surveys also provided information on transportation, lodging, and other outdoor recreation activities enjoyed by outdoor recreationists while at the reservoirs.

Average group expenditures were $524 per trip and the group size was 4.87 persons. Recreationist spending per person per trip was nearly $108 ($524/4.87). Recreationists in the input-output survey averaged 10.74 trips per year (compared to 8.364 trips in the travel cost demand analysis survey). Thus, average annual spending on trips to the reservoirs per recreationist was $1,156. Recreationist spending that occurred during the Lower Snake River reservoir outdoor recreation trips excluded spending made while traveling to other outdoor recreation sites and excluded major purchases of boats or other gear, maintenance, storage, insurance and other non-trip related outdoor recreation costs. Recreationist trip expenditures included any non-outdoor recreation related purchases made during the trip. Total annual spending by recreationists was estimated at $61,249,504 per year.

Outdoor Recreation Expenditure Results

The spending survey provided a list of potential spending choices and requested the amount spent and the location for each of the spending categories. Separate forms were provided for spending during travel to the site, spending while at the site, and spending on the trip home. A copy of the questionnaire is shown in Appendix II. The outdoor recreation input-output "spending" survey resulted in a sample of 367 completely useable responses. A total of 573 surveys were mailed out yielding a useable response rate of 64 percent.

Geographic Location of Economic Impacts

Figure 8 is based on the outdoor recreation travel cost "demand" survey that contained 438 observations. The figure shows that about 70 visitors, or 16.1 percent of the sample, lived within ten miles of the Lower Snake River reservoirs. An added 42 visitors (9.7 percent of the sample) lived within 20 miles of the reservoirs. Clearly, many (52 percent) of the outdoor recreation visitors in the demand survey sample lived and made purchases within 50 miles of the reservoirs.

Figure 9 is based on the outdoor recreationist input-output spending survey that contained 374 useable observations on the variable trips by distance. The figure shows that about 55 visitors, or about 14.9 percent of the sample, lived within a ten mile radius of the reservoirs. The number of visitors living between 10 and 20 miles from the reservoir was 61 which was 16.5 percent of the sample. About 64 percent of the spending survey sample lived and made purchases within 50 miles of the reservoir sites where they recreated.

Recreation Spending Distributions

Each type of purchase by outdoor recreationists can be described by a frequency distribution. Spending distributions can be constructed for the trip from home to site, while on site, and for the return trip home. Figures 10-17 show recreationist purchases on their way to the reservoirs in terms of store visits distributed by amount of spending for the more important types of purchases. Tables 7-9 show sample spending distributed across economic sectors for the trip to the reservoir, while on site, and during the return trip home.

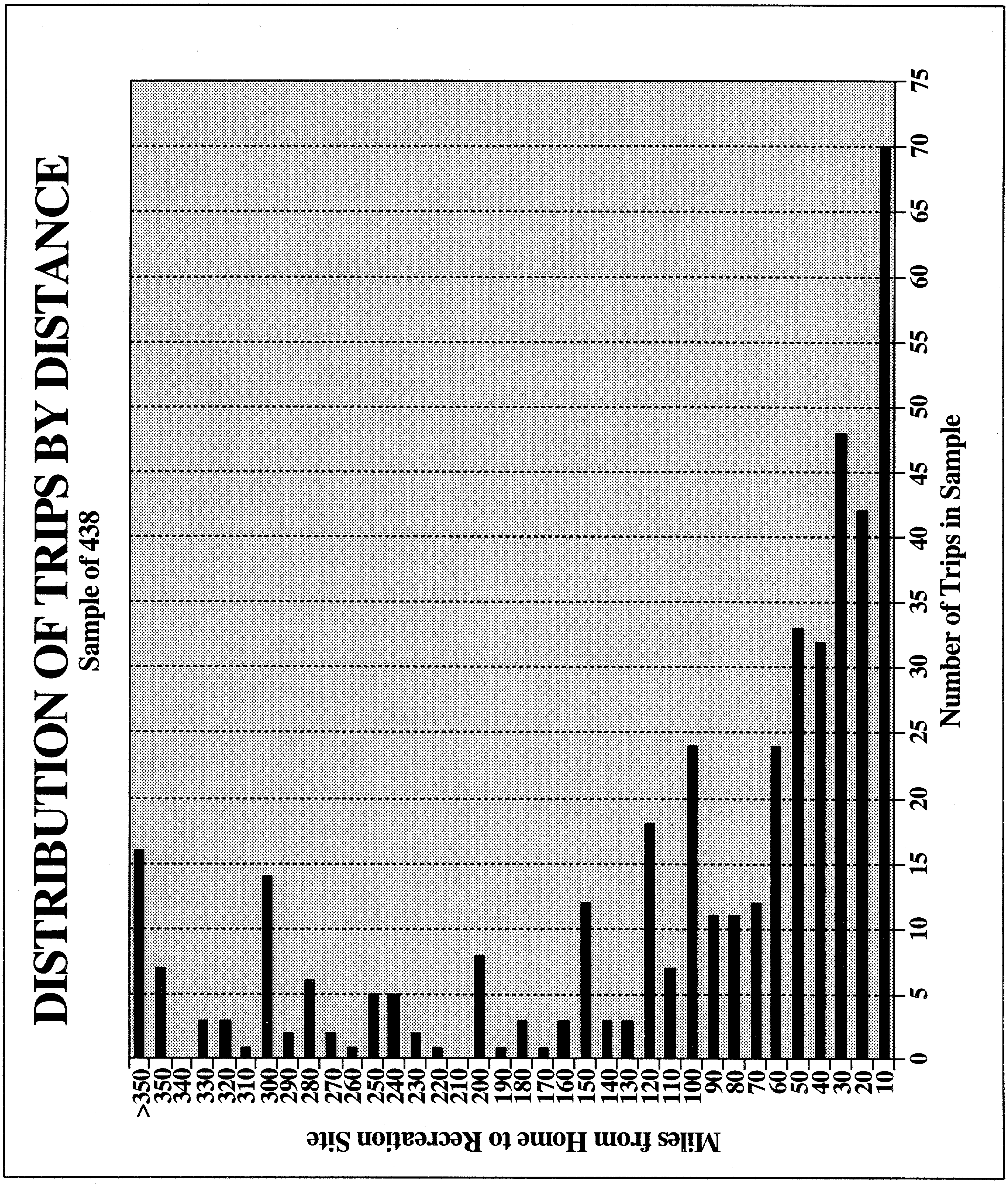

Figure 8 Trips by Distance Traveled - Recreation Demand Survey

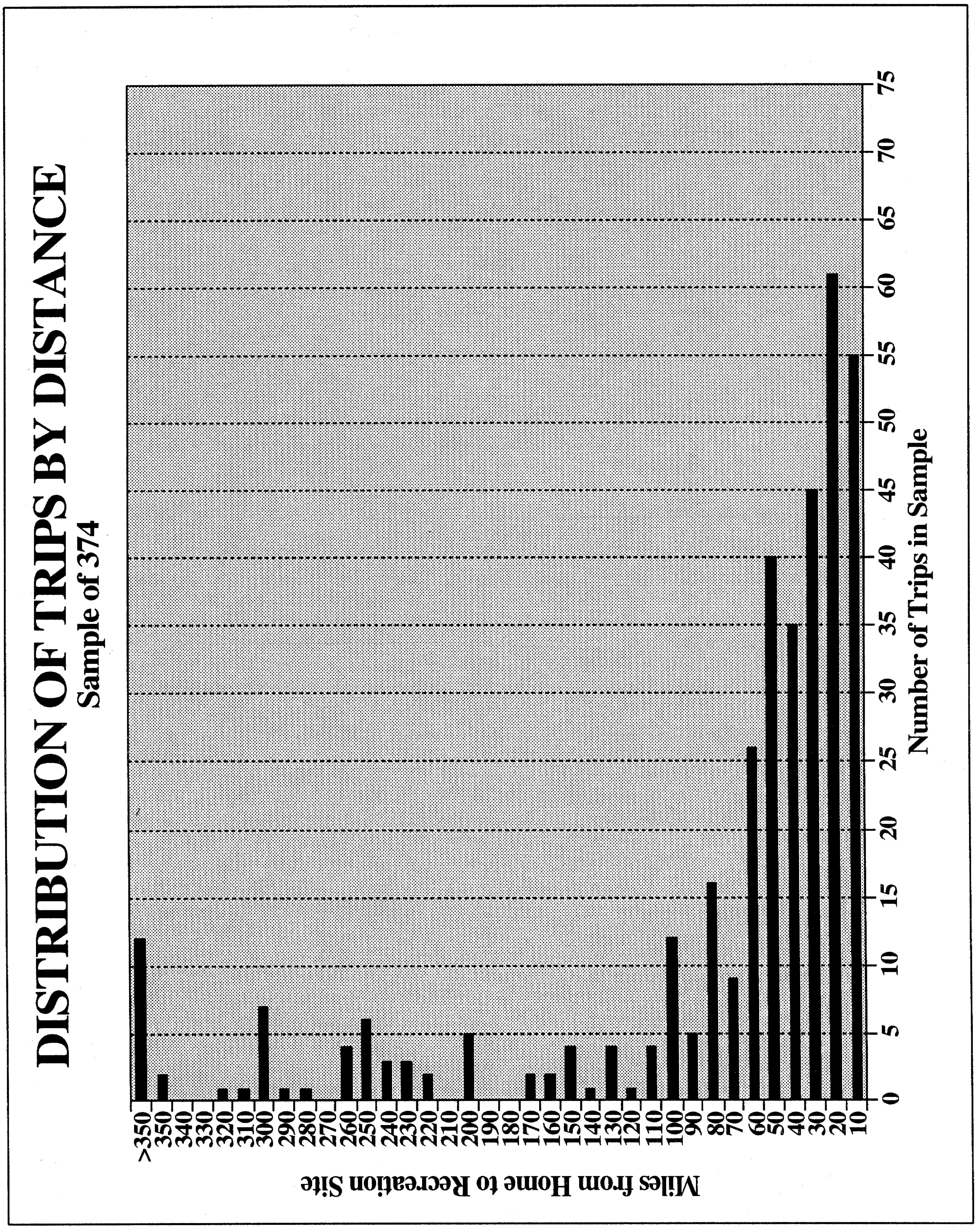

Figure 9 Trips by Distance Traveled - I-O Spending Survey

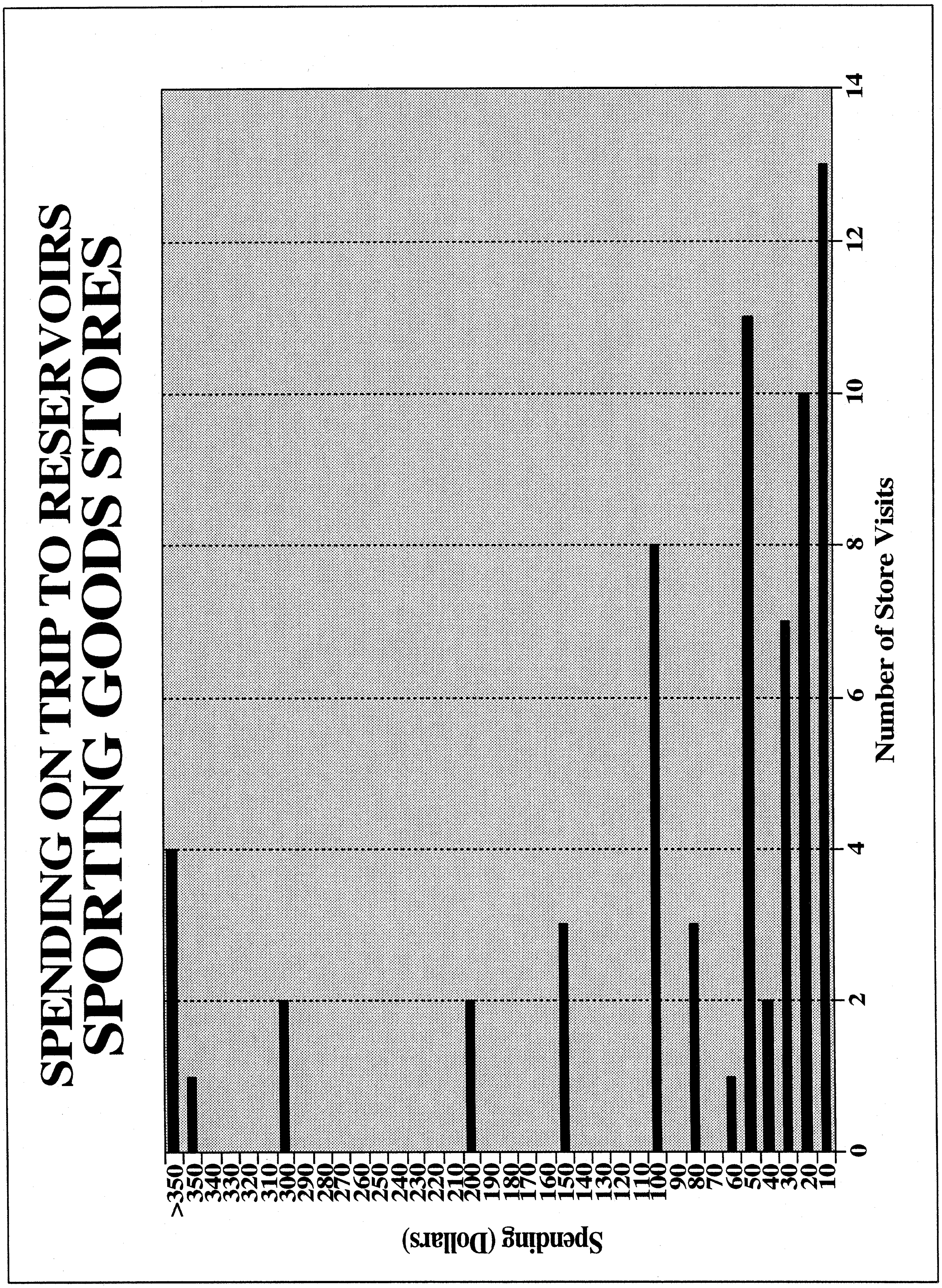

Figure 10 Recreationists by Amount of Purchase from Sporting Goods Stores

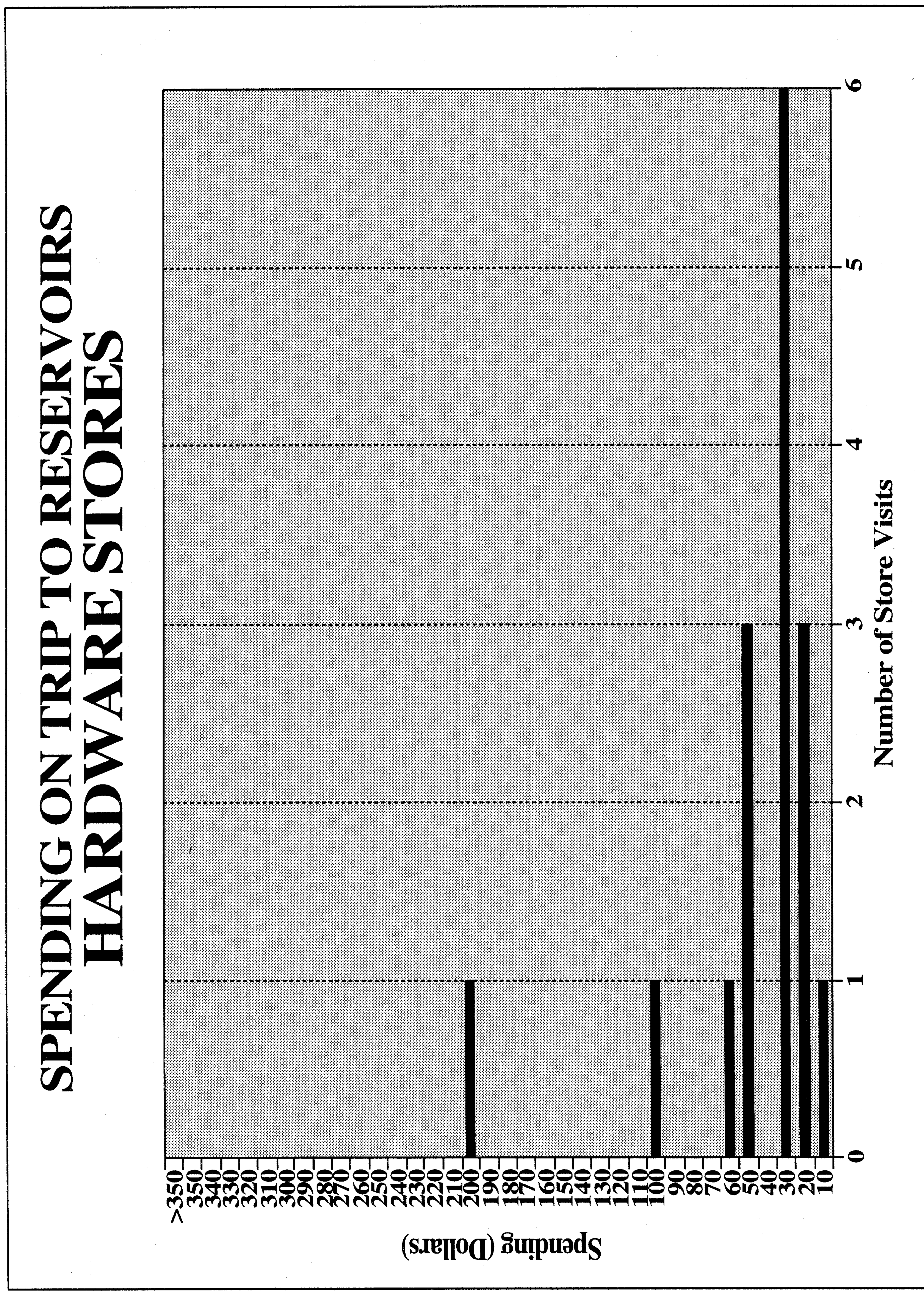

Figure 11 Recreationists by Amount of Purchase from Hardware Stores

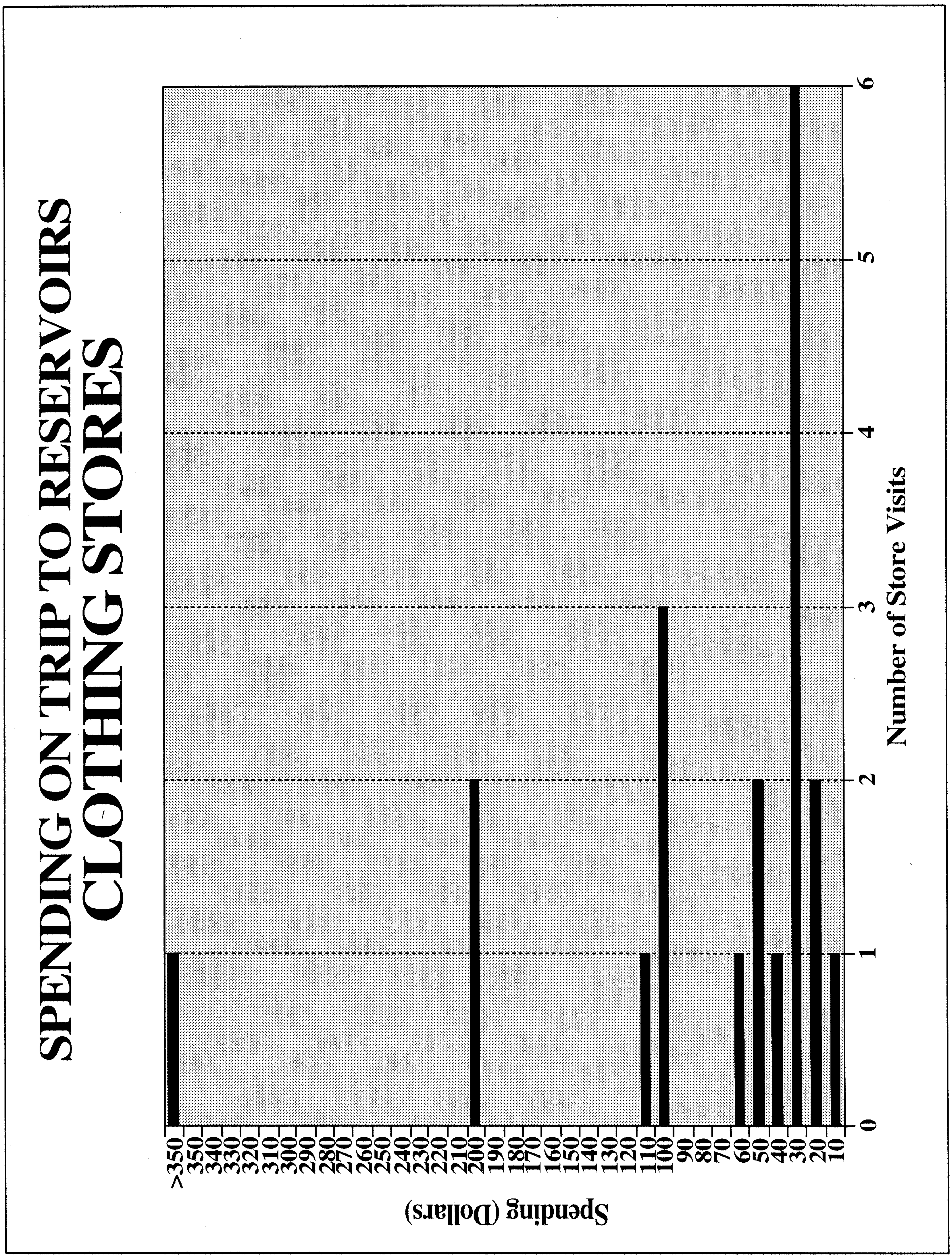

Figure 12 - RECREATIONISTS BY AMOUNT OF PURCHASE FROM CLOTHING STORES

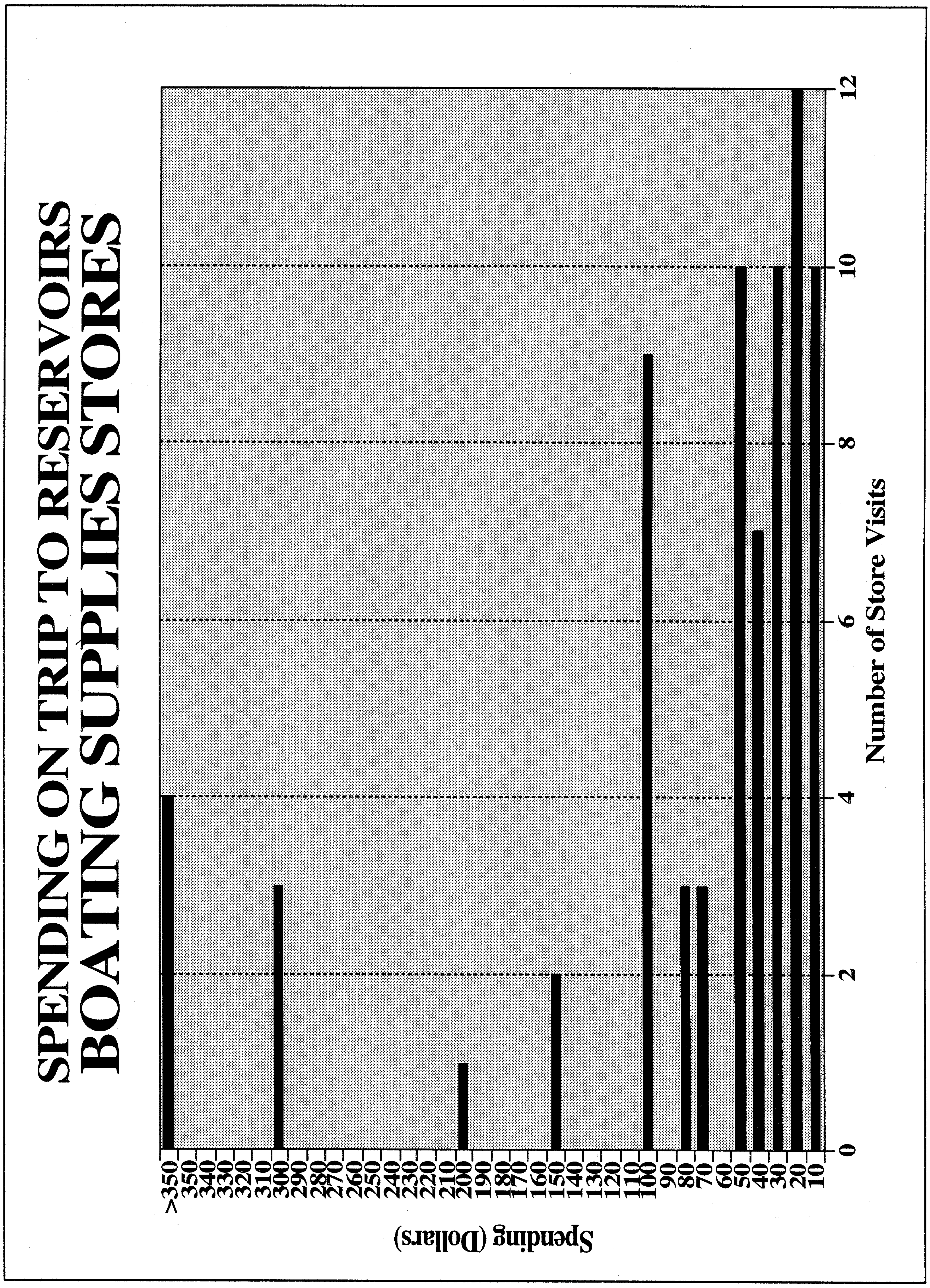

Figure 13 Recreationists by Amount of Purchase from Marine Supply Stores

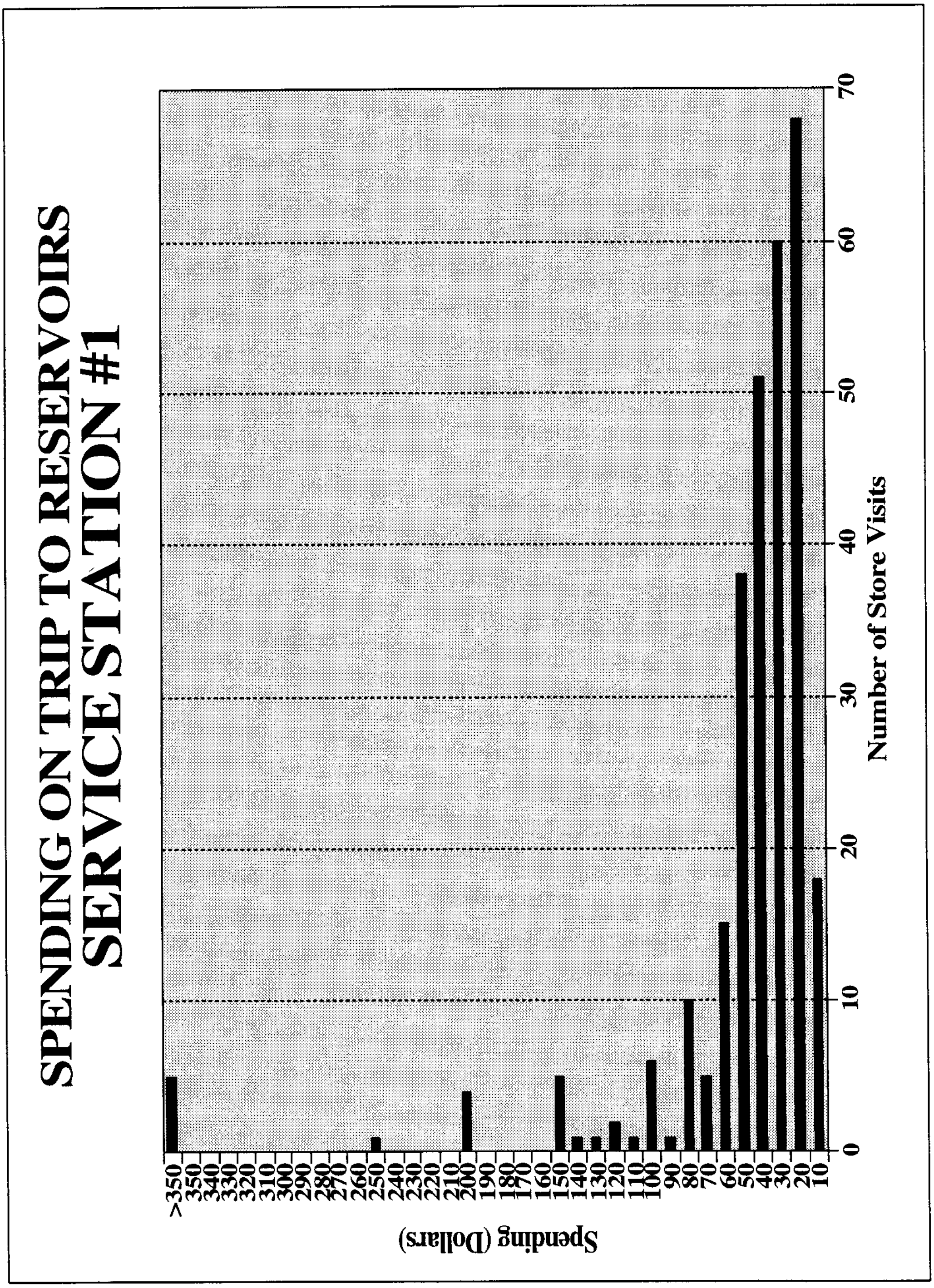

Figure 14 Recreationists by Amount of Purchase from Service Station #1

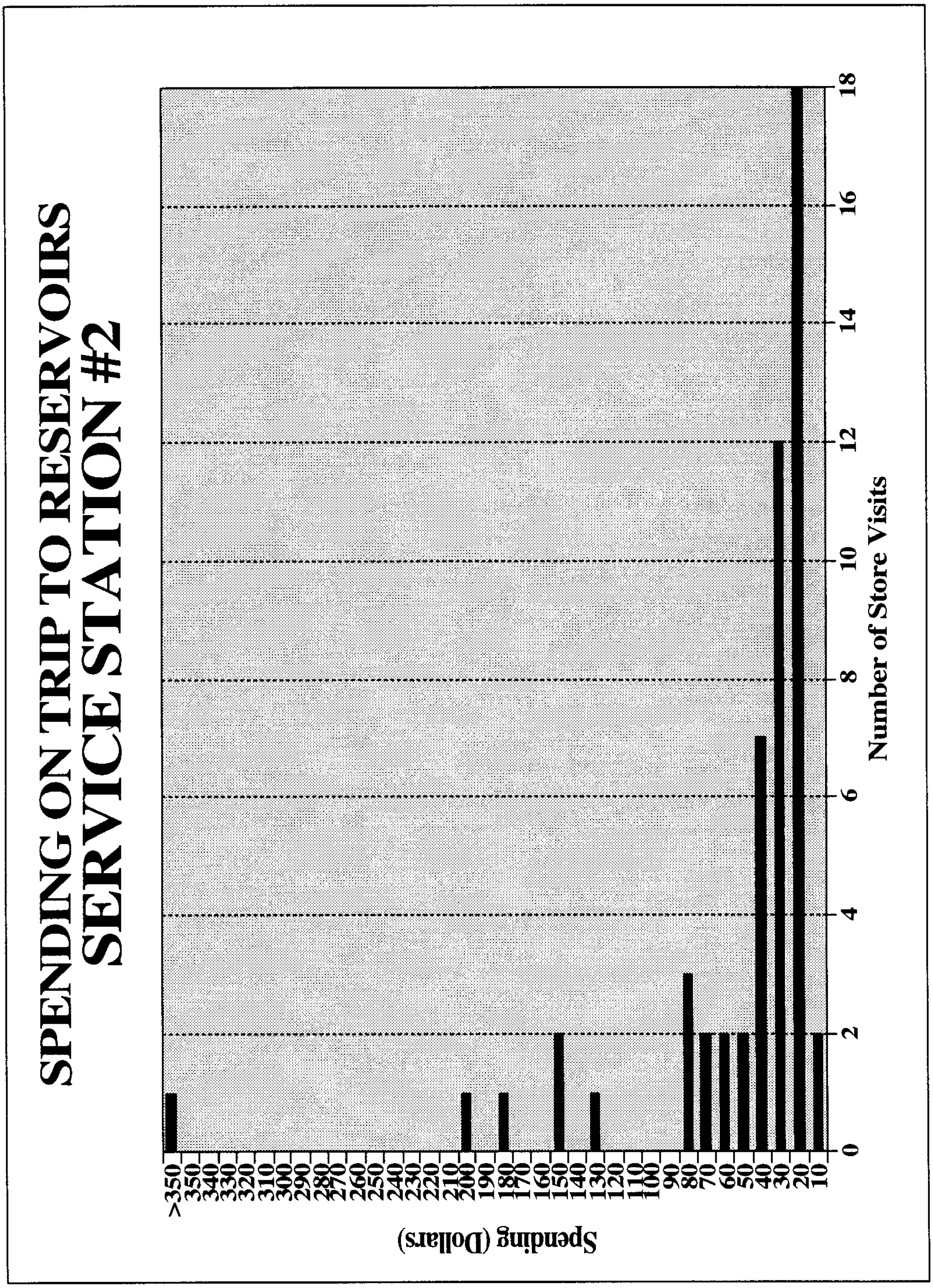

Figure 15 Recreationists by Amount of Purchase from Service Station #2

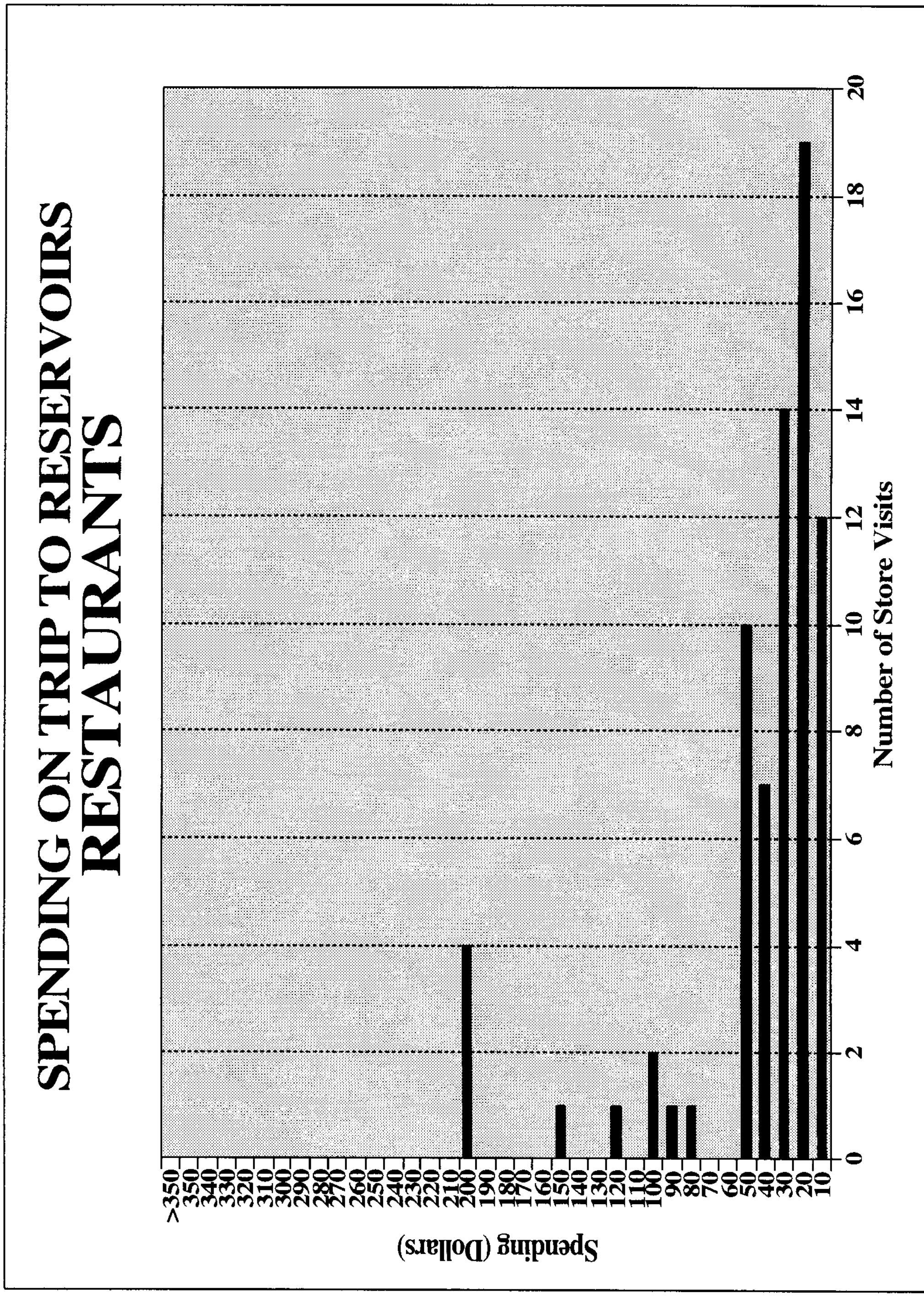

Figure 16 Recreationists by Amount of Purchase from Restaurants

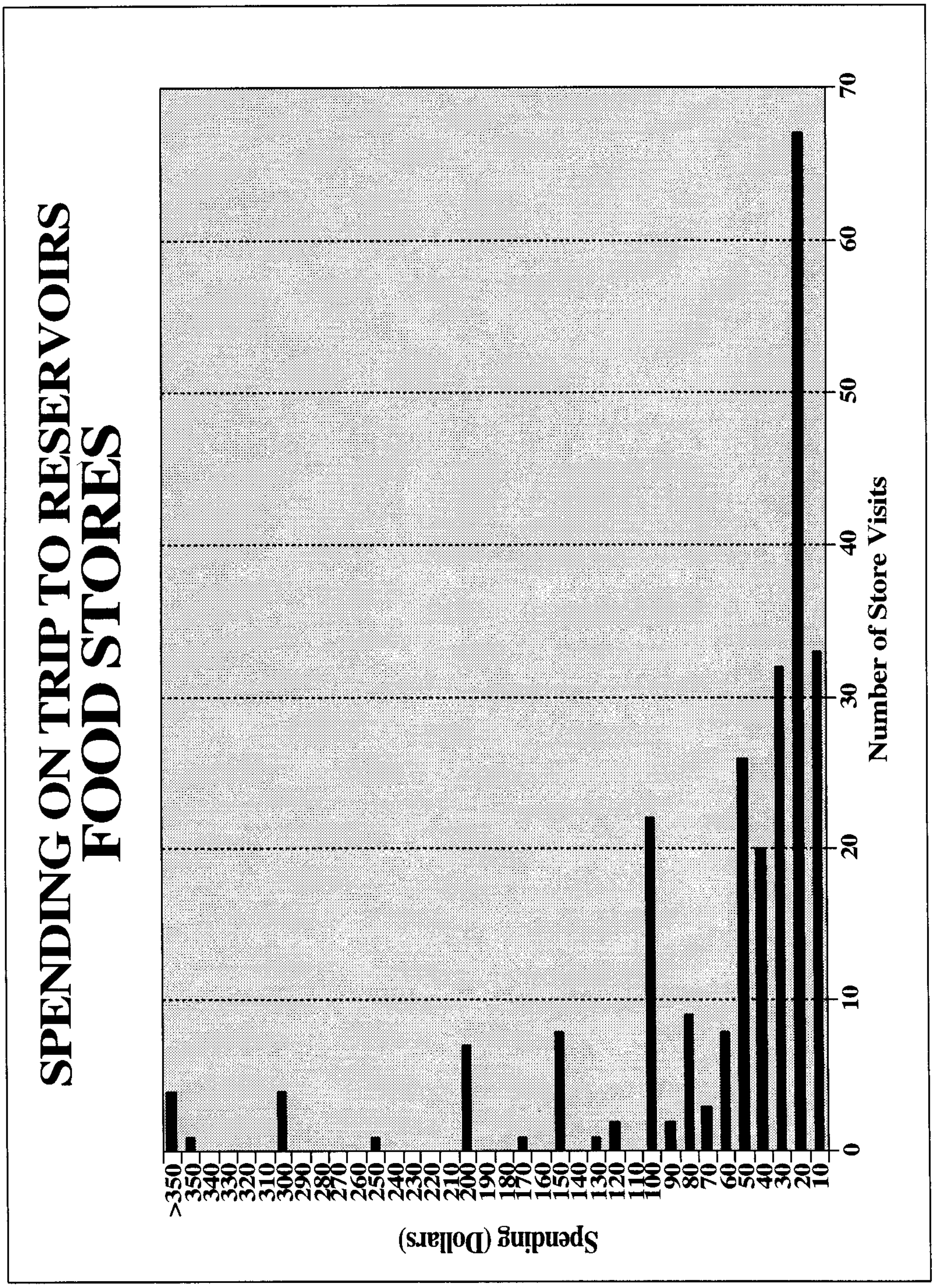

Figure 17 Recreationists by Amount of Purchase from Grocery Stores

Table 4. Spending by recreationists traveling to the reservoirs.

Type of Purchase	Average Expenditure per Outdoor Recreation Group[1/]	Total Expenditure In-Sample For This Type of Purchase	Share of All Purchases
County Government	$7.31/$7.57	$2,778	1.76%
State Government	$17.32/$18.64	$6,840	4.33%
Federal Government	$2.60/$2.59	$951	0.60%
Tour Boat	$2.75/$2.74	$1,006	0.64%
Airline	$0.00/$0.00	$0	0.00%
Auto/Truck/RV Rental	$2.39/$2.38	$873	0.55%
Service Station #1	$42.27/$44.06	$16,170	10.24%
Service Station #2	$7.82/$7.80	$2,863	1.81%
Grocery Store	$41.05/$43.66	$16,023	10.15%
Auto Dealer	$0.38/$136.62	$50,140	31.76%
Clothing Store	$3.34/$6.05	$2,220	1.41%
Boat/Marine Store	$37.68/$92.08	$33,793	21.41%
Sporting Goods Store	$15.42/$16.74	$6,144	3.89%
Hardware Store	$1.99/$1.98	$716	0.45%
Restaurant	$7.64/$8.17	$2,998	1.90%
Department Store	$0.51/$0.78	$286	0.18%
Other Retail	$0.73/$0.73	$268	0.17%
Lodging	$2.20/$2.19	$804	0.51%
Guide Services	$0.96/$0.95	$349	0.22%
Equipment Rental	$0.12/$0.12	$44	0.03%
Parking & Car Wash	$0.22/$0.63	$231	0.15%
Auto Repair	$20.21/$22.88	$8,397	5.32%
Other Repair	$2.96/$2.95	$1,082	0.69%
Entertainment	$3.37/$4.72	$1,732	1.10%
Health Services	$0.00/$0.00	$0	0.00%
All Other Purchases	$2.39/$3.10	$1,138	0.72%

1/ The first column under Average Expenditure excludes one group that made very large automotive and boat purchases.

Table 5. Spending by recreationists while staying at the reservoirs

Type of Purchase	Average Expenditure per Outdoor Recreation Group	Total Expenditure In-Sample For This Type of Purchase	Share of All Purchases
County Government	$1.15	$422	1.64%
State Government	$4.98	$1,828	7.11%
Federal Government	$3.64	$1,336	5.20%
Tour Boat	$0.37	$136	0.53%
Airline	$0.00	$0	0.00%
Auto/Truck/RV Rental	$0.38	$139	0.54%
Service Station #1	$8.46	$3,105	12.08%
Service Station #2	$1.43	$525	2.04%
Grocery Store	$9.86	$3,619	14.08%
Auto Dealer	$0.00	$0	0.00%
Clothing Store	$0.53	$195	0.76%
Boat/Marine Store	$2.04	$749	2.91%
Sporting Goods Store	$0.91	$334	1.30%
Hardware Store	$0.29	$106	0.41%
Restaurant	$5.64	$2,070	8.05%
Department Store	$7.06	$2,591	10.08%
Other Retail	$0.44	$161	0.63%
Lodging	$2.76	$1,013	3.94%
Guide Services	$0.00	$0	0.00%
Equipment Rental	$1.37	$503	1.96%
Parking & Car Wash	$1.00	$367	1.43%
Auto Repair	$7.13	$2,617	10.18%
Other Repair	$0.42	$154	0.60%
Entertainment	$3.02	$1,108	4.31%
Health Services	$1.91	$701	2.73%
All Other Purchases	$5.24	$1,923	7.48%

Table 6. Spending by recreationists returning from the reservoirs

Type of Purchase	Average Expenditure per Outdoor Recreation Group	Total Expenditure In-Sample For This Type of Purchase	Share of All Purchases
County Government	$0.00	$0	0.00%
State Government	$0.03	$11	0.12%
Federal Government	$0.02	$7	0.08%
Tour Boat	$0.00	$0	0.00%
Airline	$0.00	$0	0.00%
Auto/Truck/RV Rental	$0.67	$246	2.78%
Service Station #1	$6.65	$2,441	27.63%
Service Station #2	$1.30	$367	4.15%
Grocery Store	$3.05	$1,119	12.66%
Auto Dealer	$0.00	$0	0.00%
Clothing Store	$0.08	$29	0.33%
Boat/Marine Store	$0.64	$235	2.66%
Sporting Goods Store	$0.63	$231	2.61%
Hardware Store	$0.08	$29	0.33%
Restaurant	$4.45	$1,633	18.48%
Department Store	$1.16	$426	4.82%
Other Retail	$0.38	$139	1.57%
Lodging	$1.62	$595	6.73%
Guide Services	$0.00	$0	0.00%
Equipment Rental	$0.01	$4	0.05%
Parking & Car Wash	$0.05	$18	0.20%
Auto Repair	$1.29	$473	5.35%
Other Repair	$0.00	$0	0.00%
Entertainment	$0.87	$319	3.61%
Health Services	$0.54	$198	2.24%
All Other Purchases	$0.86	$316	3.58%

Expenditure Per Visitor per Year and Total Annual Spending

Summing the modified detailed expenditures collected in the spending survey and shown in Tables 7-9 results in a spending total of $192,385 for the 367 recreationist groups in the survey. Average group expenditures for the sample were $524 per outdoor recreation round trip or $524/4.87 = $107.6 per recreationist per trip. The average number of trips per year was 10.74 resulting in $107.6 x 10.74 = $1,156 average annual spending per recreationist on trips to the reservoirs.

Recreational spending induced by the presence of the reservoirs can include capital purchases as well as spending during travel and while recreating at the reservoirs. One group spent $50,000 for automotive equipment and $20,000 for boating equipment. Only three groups spent anything for automotive equipment. The first column in Table 7 shows average expenditures for each type of purchase when the group purchasing capital items was excluded from the sample (reducing the sample to 366). The remainder of Table 7 is based on the full sample of 367 recreational groups.

Total annual spending by recreationists visiting the reservoirs (excluding those primarily fishing) is the product of annual spending per visitor ($1,156) times the number of unique visitors (estimated at 52,984 in the first section of the report) or $1,156 x 52,984 = $61,249,504 per year.

Recreation Expenditure Rates by Town

The database collected by the outdoor recreation spending survey will allow detailed measurement of spending by community or county, by type of purchase, and by travel to site, on-site, or return trip. For example, for every 100 recreationists visiting the reservoirs, a specified town or county will have so many dollars of sales by each economic sector during the trip to the reservoirs while on-site and on the return trip. About 85 towns where outdoor recreationist spending occurred are identified in the database. These detailed spending data will be used in forthcoming regional economic impact analyses.

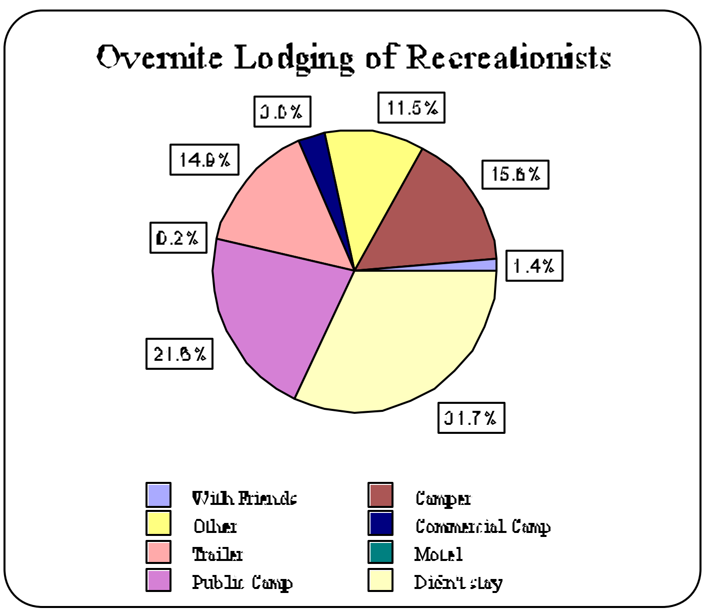

Figure 16 Overnite lodging

Recreation Lodging

About 68.3 percent of the 438 recreationists in the demand survey (299) stayed overnight at the reservoirs. In contrast, only about one-third of the visitors included in the angler survey stayed overnight. Figure 18 shows that, of those recreationists that do stay overnight, only a small fraction stay at motels or commercial campgrounds. Most of the overnighters stay in campers, trailers, tents, or in other accommodations.

Recreation Mode of Transportation

Method of travel used by the 367 recreationists in the input-output spending survey sample was classified into eight categories as shown in Table 10. As expected, personal car/van/truck dominated the transport method. Personal camper or RV was second most likely to be used for transport.

Table 7. Type of transportation used by recreationists [1/]

Mode of Transport	Percent of Sample
Personal Car/Van/Truck	84.20
Rented Car/Van/Truck	0.01
Personal Camper/RV	22.62
Rented Camper/Mobile Home/RV	0
Bus	0
Tour Bus	0
Tour Boat	0.01
Other	0.07

[1/] Total percent exceeds 100 because some recreation groups used more than one transportation type.

Importance of Recreation Activities During the Trip

Recreationists 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 11. The question was phrased, "what recreation activities were important to you and your group on this trip?"

Average group size for the 374 recreationists who responded to this survey question was about 4.87. Table 11 shows the number of recreationists responding for each recreation category. Many persons did not rate all of the types of recreation on the questionnaire. For example, only 86 persons out of 374 responded to the "other" category. Evidently recreationists avoided rating recreation activities that were undefined or irrelevant to them. Table 11 assumes that recreationists had no opinion on the categories of recreation that they left blank and thus the average for some categories is calculated over a small sample. However, the response rate itself may be an indicator of recreationist interest in other types of recreation. Eight recreation categories drew a response from more than half the recreationists: boating, swimming, water skiing, camping, other water sports, nature viewing, river fishing, and sightseeing. The activities with the highest rating (among those who rated them) included boating (rated 1.48), water skiing (rated 1.87, and swimming (rated 2.00). It is clear that the recreationist group (which was selected to exclude primary anglers) visits the reservoirs mainly to engage in water sports.

Table 8. Importance of recreation activities during outdoor recreation trip

Type of Recreation Activity While on Outdoor recreation Trip	INTENSITY	Number of Recreationists Responding to Question out of 374 Surveyed	Average Rating to Group (1 = most important, 5 = least important) Nonresponses Excluded
Lake Fishing	14	158	4.27
River Fishing	9	207	3.26
Boating	1	325	1.48
Water Skiing	2	282	1.87
Swimming	3	295	2.00
Other Water Sports	5	233	2.35
Camping	4	238	2.33
Other	6	86	2.79
Bird Hunting	16	156	4.60
Sml. Game Hunting	17	151	4.74
Big Game Hunting	15	155	4.54
Hiking	11	171	3.80
Bird Watching	12	162	4.05
Wildlife Watching	10	185	3.41
Sightseeing	8	205	3.00
Biking	13	163	4.10
Nature Viewing	7	208	2.85

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APPENDIX I - Statistical concerns for demand curve estimation.

Truncated Poisson or truncated negative binomial regression is appropriate for dependent variables with count data (integer), and truncated negative binomial regression is used in this study (Greene 1981; Creel and Loomis 1990, 1991; Hellerstein and Mendelsohn 1993).[11] Because the data for the dependent variable (visits per year), are integers, truncated below one visit per year, equation estimation by ordinary least squares regression (OLS) is inappropriate. Truncation occurs when part of the data are excluded from the sample. The on-site survey excluded persons not consuming recreation at the study site. Maddala (1983) shows that the regression slopes estimated by OLS will be biased toward zero when the dependent variable data are truncated. The result is that the least squares method understates price elasticity [12] and overstates consumers' surplus.

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.[13] 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 regression 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, ", was 0.385 with a t-value of 8.94. This result provided strong evidence of overdispersion because the negative binomial regression implies:

$$var(r) / E(r) = \{1 + a\, E(r)\} = \{1 + 0.385\, E(r)\}$$

and our sample estimate of E(r) was 8.364 outdoor recreation trips from home to the reservoirs per year. The Poisson regression assumption that var(r)/E(r) = 1 is clearly violated. The t-values found in the truncated negative binomial regression were much smaller than in the truncated Poisson regression.

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[11] 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).

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

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

That result was further evidence that Poisson regression had overdispersion. Therefore, the truncated negative binomial regression technique was used in place of truncated Poisson regression.

APPENDIX II - Questionnaires

LOWER SNAKE RIVER OMB # 0710-0001OUTDOOR RECREATION TRAVEL SURVEY
Expires 9-30-1998

General Information Questions

1. What is your ZIP code? ________
2. How many outdoor recreation trips to the Lower Snake River region did you take in the last 12 months? _______ trips

The remaining questions refer to the trip when your were contacted at the Lower Snake River and agreed to help with this survey.

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 outdoor recreation 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 outdoor recreation
< > river outdoor recreation
< > 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

A map is enclosed that shows the Lower Snake River region. Please use the map to identify local stopping points on your trip when answering the questions on the following pages.

9. Expenditures made by your group while traveling to the Lower Snake River outdoor recreation 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 <u>at the Lower Snake River outdoor recreation site</u>.

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.

OMB # 0710-0001 Lower Snake River Recreation Survey

Thank you for agreeing to participate in this recreation survey. This questionnaire only pertains to the single Lower Snake River reservoir where you were contacted.

The Lower Snake River reservoir where you were contacted was:
{Ice Harbor}   {Lower Monumental}   {Little Goose}   {Lower Granite}

1. Circle one ... {mainly recreate on boat}   {mainly recreate on bank}
{equal amount on 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 stay on average?
_________ hours per day

4. Typically, how many days per year are you on recreation trips to the reservoir where you were contacted? _________ days per year

5. Typically, how many days per year are you on recreation trips to places other than the reservoir where you were contacted? _________ days per year

6. Circle all that apply ... Please rank your recreation activities at the site where you were contacted in order of importance to you, one is most important and ten is least important. water skiing___, swimming___, picnicking___, camping___, motor boating___, sailing___, wildlife viewing___, hunting___, fishing___, other___.
Please describe "other"____

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

9. Circle all that apply ... How did you travel to the recreation site?
{car}   {boat}   {bus}   {plane}   {Pickup Truck}   {other, describe other____________}

10. How many years have you recreated at the Lower Snake River reservoirs? _______ years

11. How many days per year are you free from other obligations so that you could engage in recreation? ______ days per year

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

13. What is the typical total cost to you of a trip to the reservoir where you were contacted 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) DOLLARS OF TRIP COSTS
Recreating at the reservoir		
Recreating at other sites than the reservoir during the trip		
Travel to and from the recreation site from your home		
Recreation at other places than the reservoir during the trip		
Other non-recreation activities on trip (explain below)*		
	TOTAL HOURS =	TOTAL DOLLARS =

* Please describe other (non-recreation) 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 alternate recreation site if you didn't recreate at the reservoir where you were contacted? _____ miles one-way

18. What is the name & location of your most preferred alternate recreation site?
____

19. Circle one ... Will you typically leave the site where you were contacted for alternative reservoirs, lakes, or streams, if recreation 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 contacted to the alternate site? ______ miles one-way

21. For the kind of recreation you like to do, how many other sites besides the reservoir where you were contacted are available to you? ______ other sites

22. Typically, how many recreation trips per year do you take to the reservoir where you were contacted? ______ 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 recreating 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 recreation trip to the reservoir where you were contacted? $ ______________

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 Survey Project

FIELD(First_Name) FIELD(Last_Name)
FIELD(Address)
FIELD(City), FIELD(State) FIELD(Zip)

Dear FIELD(First_Name) FIELD(Last_Name),

Recently you helped the University of Idaho by participating in a use survey at FIELD(Where_Surveyed) on the Lower 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 Lower Snake River.

Please find enclosed a small token of our appreciation, for you to keep, for your participation in this effort to learn more about the Lower Snake River.

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 form.

Sincerely,

Bill Spencer
Project Consultant

Lower Snake River Survey Project

May 18, 2000

FIELD(First_Name) FIELD(Last_Name)
FIELD(Address)
FIELD(City), FIELD(State) FIELD(Zip)

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