REVIEW OF OUTDOOR RECREATION ECONOMIC DEMAND STUDIES WITH NONMARKET BENEFIT ESTIMATES, 1968-1988

By

Richard G. Walsh, Professor of Agricultural and Resource Economics
Colorado State University

Donn M. Johnson, Graduate Assistant, Agricultural and Resource Economics
Colorado State University

John R. McKean, Professor of Agricultural and Resource Economics
Colorado State University

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Fort Collins, CO 80523

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ABSTRACT

While issues in estimating nonmarket values continue to cause concern, resource economists now have more reason to be optimistic than ever before. More progress toward improved measurement has been made in the past five years than in the previous quarter century since development of the contingent valuation and travel cost methods. The new challenge is to learn how to adjust past studies to estimate nonmarket values for future policy analysis. The process involves developing an understanding of the important variables that explain the observed differences in estimates. This paper illustrates how the results thus far could be adjusted to develop some tentative estimates of the recreation use value of Forest Service resources.

We updated and evaluated a previous literature review that adjusted reported benefits for omission of the opportunity cost of travel time, sample truncation to instate residents, and use of the individual observation approach. The travel time adjustment is supported by the regression results and the other adjustments are less than indicated by the coefficients. Overall, they did not significantly change average benefit estimates because of offsetting effects. Recently, fewer studies have required adjustments for these reasons.

Newer methods of controlling for the effects of these and related variations in estimation give reason to believe that it may be possible to resolve many of the problems of information transfer for policy application in the future. These include adjusting for variation in the treatment of monetary and time cost of travel, substitution, site quality, and the functional form used in TCM applications. CVM problems include adjusting for variations in the method of payment, functional form used to analyze dichotomous choice questions, and information on resource quality, uncertainty, and substitution possibilities. In both the TCM and CVM approaches, the tie between consumer theory and statistical estimation is being improved via use of discrete choice and qualitative response models, with maximum likelihood statistical techniques.

In the future, more research projects should provide for the translation of findings to answer policy questions. Most of the studies reviewed here were designed to answer a specific question at a particular recreation site. As a result, certain types of research on some recreation activities have claimed substantial amounts of public support although they offer little prospect of affecting a basic change in recreation opportunities for the future. In those instances, there may be new lines of emphasis which promise larger returns. The new problem becomes to design dual purpose studies, with a direct use in policy application at the study sites and an indirect use to answer policy questions at other times and places.

Key Words: Information transfer, nonmarket valuation, outdoor recreation, public policy, travel cost method, contingent valuation method

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INTRODUCTION

Outdoor recreation is an important economic activity in rural areas throughout the nation. There is increasing evidence that land and water-based recreation resources provide substantial nonmarket benefits that contribute to the well-being of resident and nonresident participants. These benefits are equivalent to the dollar amount that participants would be willing to pay over and above their current expenditures to ensure the continued availability of opportunities to use recreation resources.

In the last two decades, interest in nonmarket valuation of natural resource use for outdoor recreation has grown more widespread and intense. This is true in the federal government where, for example, the Forest Service, Environmental Protection Agency, and Fish and Wildlife Service now have extensive responsibilities in an area which was once the preserve of the National Park Service and the Corps of Engineers. Also, nonmarket valuation work has been stimulated by increased interest from state government, particularly water development, environmental quality, forestry, wildlife, and recreation resource management divisions. Perhaps the most important reason for this expanded interest has been growing pressure from both inside and outside government for improvement in the criteria on which public expenditure

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*The authors are, respectively, professor, graduate research assistant, and professor, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins. The study was funded, in part, by Purchase Order No. 43-82FT-7-1253, Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S. Dept. of Agriculture, Fort Collins, and by the Colorado Agricultural Experiment Station, Western Regional Project W-133, Benefits and Costs in Resource Planning. We are grateful for the assistance of Kun H. John and helpful comments by Ovar Bergland, Gary Elsner, John Keith, John Loomis, George Peterson, V. Kerry Smith, and anonymous reviewers. Errors and omissions are, of course, the sole responsibility of the authors.

decisions are made. This general reforming trend has stimulated interest in nonmarket valuation since many governmental projects and programs affect recreation opportunities.

In the past, most studies focused on questions of management at a specific location. Although there is a growing body of findings from such studies, the increased demand for research results has far outpaced supply which has been severely constrained by reduced budgets of domestic funding agencies (President's Commission on Americans Outdoors, 1987). Concurrently, reduced budgets increase the urgency of estimates for immediate application to the difficult decisions with respect to effectiveness of alternative programs. The policy application must be done quickly and with resources that are usually not sufficient to permit generation of new value estimates (for example, Walsh and Loomis, 1986). There will rarely be time or budget to permit a new empirical study.

As a result, there is reason to believe that past nonmarket value studies will play an increasingly important role in future resource policy decisions. This means that evaluation of the adequacy of available research becomes an important question. In a keynote address celebrating the 35th anniversary of Resources for the Future last October, V. Kerry Smith (1988) emphasized the problem of information transfer. He concluded that: as experience is accumulated in valuing nonmarket resources, analysts must learn how to learn from that research and integrate the findings into improved use of what is on the "research shelf". Such learning would result in a better match between off-the-shelf estimates when they are applied to new valuation problems as well as better understanding of the research needed to make what is on the shelf more useful.

This report addresses some of the important issues in the past application of nonmarket value analyses from the perspective of future policy analysis. It is a retrospective glance at 20 years of empirical research applications using the contingent valuation (CVM), travel cost (TCM) and related methods. What is at issue is defining standards that allow these values to be compared. This report updates and evaluates the effectiveness of a recent attempt to review the reported values and adjust them for some important variations in method. There are sufficient existing studies so that they can be pooled and statistical methods applied to improve our understanding of the variables explaining some of the observed variation in the benefit estimates. This should enable terms of the debate over best practice to be more clearly defined.

The promulgation of standards for estimation of nonmarket values has a relatively short history. Interest was stimulated by the authorization of Senate Document 97 in 1962, which established benefit cost methods to be used in planning water and related resource development by federal agencies. Supplement No. 1 to Senate Document 97 was signed by President Kennedy and published in 1964, authorizing use of the unit day value method. He also set up the Water Resources Council as an interagency committee to administer the guidelines. Subsequently, the Council revised the guidelines in 1973 under President Nixon to authorize use of the TCM. They were revised again in 1979, when use of the CVM was approved by President Carter. Authorization of the three methods was reaffirmed in a 1983 edition of the guidelines signed by President Reagan and authorized by the Department of Interior in 1986. The bipartisan political support for the guidelines in the past indicates their broad acceptability within and outside of government. It seems likely that

future revisions in the guidelines will occur as improved methods are developed.

Initially, the unit day value approach relied on expert judgment to develop an approximation of the average willingness to pay for recreation activities. An estimate adjusted for characteristics of the study site was selected from a range of values approved by the federal guidelines. Based on estimates from a survey of entrance fees at private recreation areas in 1962, the unit day values recommended by the guidelines have been adjusted for changes in the consumer price index since then. Of particular interest here, the Forest Service has based unit day values on periodic reviews (1975, 1980, and 1985) of empirical studies using the CVM, TCM and related methods.

The TCM approach to the estimation of the nonmarket value of recreation is based on observed behavior of a cross-section of users in response to direct out-of-pocket and time cost of travel. The basic premise of the approach is that the number of trips to a recreation site will decrease with increases in travel cost, other things remaining equal. Most applications either specify the dependent variable in a demand function as trips per capita originating in distance zones or annual trips per individual observation (Dwyer, et al. 1977; Rosenthal, et al. 1984; McConnell, 1985; Ward and Loomis, 1986). The federal guidelines do not preclude the use of new techniques as, for example, the hedonic travel cost method, household production approach, or discrete choice or qualitative response models with maximum likelihood statistical techniques.

The CVM approach relies on the stated intentions of a cross-section of the affected population to pay for recreation use of resources contingent on changes in their availability depicted, for example, in color photos or maps (Stoll, et al. 1983; Cummings et al., 1986). The values reported are intended to represent the maximum willingness to pay rather than forego the recreation

opportunity. Most applications ask an open-ended value question where respondents report their maximum willingness to pay, or as an iterative question where respondents answer yes or no to a series of stated dollar amounts until their maximum willingness to pay is obtained. A recent variation is the public referendum approach with each respondent answering a single dichotomous choice question. The values are varied among subgroups of respondents and a logit demand function estimates the probability of paying each value stated.

PROBLEM STATEMENT

The problem is to apply the growing body of findings from past studies to future resource policy decisions. The present stock of studies is viewed as having a dual purpose, with a direct use in policy application at the study site and in an indirect use to answer policy questions at other times and places. If the existing studies produce the same set of findings, then an agency could with confidence predict the benefit of recreation activities at new or expanded sites. However, if the studies produce widely varying results for unexplained reasons, an agency could not easily predict the value of recreation based on the available literature. Adjustments would have to be made to facilitate the transfer of findings from the locations where studies were performed to areas where they were not. Even where studies were conducted, improved data transfer procedures could increase the precision of future net benefit estimates.

For this purpose, there is a need for research to develop an understanding of the variables that explain the observed difference in estimates. This study follows standard procedures developed by meta-analysis, the growing science of reviewing research (Cooper, 1984; Light and Pillemer, 1984). The approach introduces precision into the analysis with respect to specific purpose of the literature review; the selection of the studies for

review; the similarity of the units of analysis and subject matter across studies; the distribution of study values; and the relationship of study values to research design, characteristics of participants, quality of the sites and management programs.

The source of data is the literature on demand for outdoor recreation with nonmarket benefit estimates from 1968-88. The study represents an update and evaluation of a previous review by Sorg and Loomis (1984). Their 93 benefit estimates in studies completed from 1968-82 are supplemented with 20 they missed plus 164 in studies completed from 1983-88. For comparison purposes, the reported values are adjusted for inflation to the third quarter of 1987 using the GNP implicit price deflator. The inflation index used for each of the years is shown below.

1965	3.488	1977	1.752
1966	3.368	1978	1.633
1967	3.284	1979	1.500
1968	3.127	1980	1.376
1969	2.962	1981	1.254
1970	2.807	1982	1.179
1971	1.655	1983	1.135
1972	2.535	1984	1.093
1973	2.382	1985	1.057
1974	2.183	1986	1.030
1975	1.988	1987	1.000
1976	1.868		

The objective is to provide a range of benefits for major recreation activities in Forest Regions for the 1990 resource planning program (RPA) of the Forest Service, USDA. Congress requires that the agency prepare alternative long-run (50 year) forest plans every five years. As part of this exercise, the agency periodically reviews demand studies applying the contingent valuation (CVM), travel cost (TCM) and related methods to provide an empirical basis for revision of unit day values. For example, the Dwyer et al. (1977) literature review contributed, in part, to estimation of recreation values for the 1980 RPA. The exercise has been controversial because the

agency, lacking a scientific basis for adjustment, has relied on the concept of reasonable and proper levels for the purpose intended.

Detailed descriptions and evaluations of the design aspects of studies completed from 1968-82 were prepared by Sorg and Loomis (1984) on behalf of the Forest Service 1985 resource planning program. As might be expected, many of the early studies were of dubious quality from the standpoint of being able to make valid benefit inferences from them. Only midway in the review period did the federal government (Water Resources Council, 1973; 1979; 1983) issue guidelines on statistical sampling, vehicle travel cost, travel time cost, substitutes, and other aspects of experimental design to be used by new studies. The guidelines clearly were minimal when judged by the standards of some of the best studies. Even so, several of the studies did not meet them in important respects, and therefore were of almost no value in establishing comparable measures of the net benefits of recreation activities. The consensus judgment of a panel of evaluators was that substantial adjustment should be made in the reported values before presentation of the summary statistics. The panel of economists working in nonmarket benefit estimation included: Professor William Brown, Oregon State University; David King, University of Arizona; Elizabeth Wilman, University of Calgary, formerly Resources for the Future; Richard Walsh, Colorado State University; and Dennis Schweitzer, Gary Elsner, and Don Rosenthal, Forest Service, USDA.

As a result, Sorg and Loomis (1984) increased the reported TCM values by 30 percent for the omission of travel time; both TCM and CVM values were increased by 15 percent for omission of out-of-state users; and TCM values were decreased 15 percent for application of the individual observation approach. They argued that omission of travel time from the TCM demand function leads to a downward bias in estimated benefits. The cost of time spent traveling

represents the difference between sightseeing benefits enroute and the opportunity cost of the time in an alternative activity. Similarly, omission of out-of-state users tends to understate the number of visits to most resource-based sites at relatively higher travel costs. If they travel further than instate users, the upper limit of travel cost in the demand curve will be understated and benefits will be biased downward. The individual observation approach uses trips per participant as the dependent variable. While this is statistically more efficient than the zonal approach, it omits the effect of travel cost on the probability of participating. The resulting demand curve is often less elastic (steeper) which results in overstating recreation benefits of activities when the probability of participation decreases significantly at higher travel costs.

Table 1 illustrates the resulting summary statistics for the recreation use categories of the Forest Service. The 287 estimates of net economic value per day reported by 120 outdoor recreation demand studies from 1968 to 1988 are adjusted for method as in Sorg and Loomis (1984) and are in third quarter 1987 dollars. Mean value of the estimates is $34 per day, with a 95 percent confidence interval of $31 to $37 and a range of $4 to $220. The median is $27. These values are shown for each activity along with output of the agency. Average benefit of activities range from $12 to $72 per day with the highest values reported for hunting, fishing, nonmotorized boating, hiking and winter sports. This approach assumes that the socioeconomic characteristics of users and the quality of study sites are sufficiently similar that a common pattern of consumption applies to each. Ideally, the distribution of values would be approximately normal with a few outliers at both the high and low ends. Given a sufficient number of studies, the solid core of values in the middle would be the most reasonable estimate.

Table 1. Net Economic Values Per Day Reported by TCM and CVM Demand Studies from 1968 to 1988 Applied to National Forest Recreation Use Categories, United States (Third Quarter, 1987 Dollars)

Activity	Visitor, days 1,000[a]	Number of estimates	Mean	Median	Standard error of the mean	95% Confidence Interval	Range
Total	226,533 (100.0%)	287 (100.0%)	$33.95	$27.02	1.67	30.68-37.22	3.91-219.65
Camping, Picnicking and Swimming	66,811 (29.5)	36 (12.5)	20.14	17.80	1.80	16.61-23.67	7.05-46.69
Camping	53,666 (23.7)	18 (6.3)	19.50	18.92	2.03	15.52-23.48	8.26-34.89
Picnicking	7,838 (3.5)	7 (2.4)	17.33	12.82	5.08	7.37-27.29	7.05-46.69
Swimming	5,405 (2.3)	11 (3.8)	22.97	18.60	3.79	15.54-30.40	7.05-42.94
Mechanical Travel and Viewing	68,423 (30.2)	11 (3.8)	25.42	21.44	5.14	15.35-35.49	8.27-68.65
Sightseeing and Offroad Driving	62,451 (27.6)	6 (2.1)	20.29	19.72	3.73	12.98-27.60	10.33-31.84
Boating, Motorized	4,301 (1.5)	5 (1.7)	31.56	25.67	10.36	11.25-51.87	8.27-68.65
Hiking, Horseback Riding and Water Travel	19,900 (8.8)	17 (5.9)	41.74	24.72	10.53	21.10-62.38	10.26-183.36
Hiking	12,740 (5.6)	6 (2.1)	29.08	23.62	5.82	17.67-40.49	15.71-55.81
Boating, nonmotorized	3,419 (1.5)	11 (3.8)	48.68	25.36	15.85	17.61-79.75	10.26-183.36
Winter Sports	14,730 (6.5)	12 (4.2)	28.50	24.39	4.48	19.72-37.28	11.27-66.69
Resorts, Cabins, and Organized Camps[b]	15,117 (6.7)	2 (0.7)	12.48	--	--	---	3.91-19.93
Hunting	15,276 (6.7)	83 (28.9)	41.69	34.88	2.72	36.36-47.02	16.58-142.40
Big Game Hunting	10,729 (4.7)	56 (19.5)	45.47	37.87	3.47	38.67-52.27	19.81-142.40
Small Game Hunting	4,015 (1.8)	10 (3.5)	30.82	27.48	3.51	23.94-37.70	18.72-52.04
Migratory Waterfowl Hunting	532 (0.2)	17 (5.9)	35.64	25.27	5.87	24.13-47.15	16.58-102.88
Fishing	15,208 (6.7)	88 (30.7)	39.25	29.59	3.80	31.80-46.70	8.13-219.65
Cold Water Fishing	10,687 (4.7)	39 (13.59)	30.62	28.49	3.24	24.27-36.97	10.07-118.12
Anadromous Fishing[c]	-- --	9 (3.1)	54.01	46.24	11.01	32.43-75.59	16.85-127.26
Warm Water Fishing	4,072 (1.8)	23 (8.0)	23.55	22.50	2.46	18.73-28.37	8.13-59.42
Salt Water Fishing	226 (0.1)	17 (5.9)	72.49	53.35	14.05	44.95-100.03	18.69-219.65
Non-Consumptive Fish and Wildlife	1,532 (0.7)	14 (4.9)	22.20	20.49	2.30	17.69-26.71	5.27-38.06
Other Recreation Activities	9,537 (4.2)	9 (3.1)	18.82	16.06	3.65	11.67-25.97	6.81-43.39
Wilderness	12,014[d] (4.5)	15 (5.2)	24.58	19.26	6.10	12.62-36.54	8.72-106.26

[a] Thousands of 12-hour recreation visitor days reported by the Forest Service, USDA, for the year ending September 30, 1986. Statistical Abstract of the United States, 1988, p. 212.

[b] Resorts were 1.83 percent valued at $19.93 per day; seasonal and year around cabins were 3.06 percent valued at $3.91 per day; and organized camps were 1.79 percent valued the same as camping.

[c] Anadromous fishing estimates included in cold water fishing. Estimated as roughly 5.0 percent.

[d] Included above.

By comparison, Smith and Kaoru (1988) review 77 TCM studies from 1967-86 with 734 benefit estimates averaging $73.40 per day or trip with a range of $0.30 to $1,023 (1987 dollars). The fact that the data sets are aggregated in a slightly different way causes some difficulty in comparing the results, since there are a different number of days in each trip. Using both trips and days as the unit of measure has the added problem that onsite sampling procedures tend to draw a disproportionate number of persons with longer length of stay (Shaw, 1988).

A number of problems should be considered before analysts could reasonably apply this information to policy decisions. First, for most recreation activities, an insufficient number of studies have been completed to obtain reasonable estimates of value by this method. Even where there are a large number of studies, the frequency distribution is often skewed with the majority of estimates clustered near the bottom of the range in values and a relatively few extremely high estimates. This substantially increases the sample mean and thus it is questionable whether the mean truly reflects the sample as a whole. The median would be a more appropriate measure to use if the purpose of the analysis is to determine a representative estimate.

Second, the approach does not reveal what is causing the extreme range in values, whether variation in characteristics of users, quality of sites, or research methods. A potentially useful approach to the data transfer problem would be to pool the data from existing studies and apply multiple regression analysis. If the basic model specification is complete, that is, if it includes all the relevant explanatory variables in the correct functional form, then it could explain the variation in benefits embodied in differences among the explanatory variables. The net benefit estimated for a site lacking data

would then be predicted by inserting appropriate values of explanatory variables into the model fitted to data from the other study sites.

The empirical model used to explain the variation in benefit estimates should be based primarily on applied microeconomic theory (McKean and Walsh, 1986). In an ordinary demand function for a recreation site, the dependent variable to be explained is the quantity demanded. The list of independent variables that influence demand includes a proxy for direct cost or price and such factors as travel distance or the value of time, the price and availability of substitutes, consumer income, other socioeconomic variables such as age, quality or attractiveness of the site, population of the consuming group, individual taste or preference, expectations and experience with respect to crowding or congestion. Other variables related to research method may include: recreation activity; sample size and coverage; CVM, TCM or other method; statistical model; econometric estimators; type of CVM question; and site administration. For review of problems in measurement of the variables, see Walsh (1977; 1986). McConnell (1985) discusses alternative TCM models.

The possible affect of the specification of each of these variables should be carefully evaluated. For example, measurement of quantity demanded in different units may effect the benefit estimate, whether trips, hours, visitor days per person or per capita. Specification of own price as distance with variable travel costs per mile from the U.S. Department of Transportation or reported by respondents may also affect benefit estimates (Duffield, 1988). The effect of travel time cost on benefit estimates has been shown to vary with the percent of wage rate used (McCollum, 1988). Shaw (1988) considers the effect of sample truncation and related problems of on-site surveys. Smith and Kaoru (1988) make an important contribution to understanding the effects of alternative methods of estimating travel time cost, presence of a substitute

price term, use of a regional model, type of site studied, functional form (linear, log-linear, or semi-log), and estimators (ordinary least squares, generalized least squares, or maximum likelihood-logit-tobit) used in TCM studies. They conclude that these methodological variations significantly affect benefit estimates. The question remains whether method would have the same effect in a regression model holding constant the effects of other potentially important variables including recreation activity, time on site, quality of the site, location of the site, variable cost per mile, travel time cost per hour, income and other socioeconomic variables, or sample size and coverage.

In the future, it seems likely that an ever larger number of studies will be accumulated on the demand for outdoor recreation. In this event, each subsequent work in the growing science of reviewing research can examine many possible variables that might be important, and provide a basis for eliminating some of them as serious candidates for new research. Using prior reviews to reduce the number of experimental variables should improve the statistical analysis and allocation of resources to new studies. Thus, each succeeding literature review should build upon previous ones.

In the early stages of this evolving process, the critical problem will be to correctly specify the variables that are expected to influence the benefit estimates. For if important determinants are omitted, the statistical equation will not predict effects accurately, as illustrated by Allen et al. (1981). Thus, the early review efforts should be treated with caution since by leaving important variables out of the regression analysis, they may attribute more or less of the variation to those that are included than would be the case with a more complete specification, as illustrated by Smith and Kaoru (1988).

RESEARCH PROCEDURE

A systematic search of the available literature was conducted in an effort to review as many empirical studies as possible from 1968 to 1988. The selection process was designed to fairly represent all the research on the topic in the United States. Included were studies in journals, chapters in books, unpublished research reports, masters and doctoral theses, research reports from private organizations and government agencies, and conference papers. In a number of cases, the authors were contacted by phone to clarify a methodological question or to obtain the results of unpublished studies. The overall effect of the selection process was to provide sufficient studies to identify interesting trends and get a broad flavor of the findings from both published and unpublished studies.

The values reported here represent consumer surplus calculated by the authors of each study from the demand functions they reported. The net economic values are equivalent to the dollar amount participants would be willing to pay over and above their current expenditures to ensure continued availability of the opportunity to use recreation resources. The review is limited to studies measuring the onsite recreation use benefits provided by a natural resource of given quality. Many of the studies also estimate the change in benefits with changes in the quality of the resource and interested readers are referred to the detailed descriptions of the original studies for estimates (Walsh et al., 1988). Also, the values reported here do not include the public benefits from preservation of resource quality such as option values of future use and existence values to the general population of users and nonusers. The omission of these off-site benefits is a significant limitation since they may be equal to or greater than onsite recreation benefits,

particularly for sites with unique natural resources (Walsh, 1986; Peterson and Sorg, 1987).

The standard unit of measurement is an activity day, defined as one person onsite for any part of a calendar day. When values are reported on any other basis than per activity day, they are adjusted to this common unit. For TCM demand functions, the appropriate unit of analysis often is number of trips, but most authors also report the results in terms of value per activity day. If not, values per trip are divided by the reported number of days per trip. Similarly, annual values are divided by the reported days of participation. Household group values are divided by the number of persons and days of participation per person. Where the value of recreation activities are reported for hypothetical quality changes, the base value for current site quality is used. There is a problem of defining recreation activity days at some sites, notably reservoirs with camping, swimming, boating and fishing on the same trip. In this case, the concept of recreation use is based on the standard procedure of the U.S. Census in which an activity is defined as primary use when it represents over 50 percent of total individual activity while at the site.

Table 2 defines the explanatory variables included in the equations. Most are conventional measures and require little added explanation. Most of the variables are qualitative, indicating that a particular treatment is either present or absent. Of primary interest are the three adjustments by Sorg and Loomis (1984) for omission of travel time, the use of individual observations, and instate sample coverage discussed earlier in this paper. Other important determinants of demand are included to hold constant their effects and to estimate the partial effect of each of these variables and other possible candidates for adjustment in benefit estimates. The other variables are:

Table 2. Description of Variables in the Analysis

Name	Definition of Variable
Dependent Variable	Consumer surplus estimated by each study, standardized to average values per activity day, adjusted to third quarter 1987 dollars.
Site Quality	Qualitative Variable = 1 if site was rated by each study as uniquely high quality, 0 if medium or low.
Forest Service Administered	Qualitative Variable = 1 if the study sites were Forest Service administered, 0 if otherwise.
Mixed Public & Private Sites	Qualitative Variable = 1 if household survey of participants in an activity at public and private sites, 0 if otherwise. (the omitted categories were other wholly public and wholly private)
Specialized Activity	Continuous variable = percent. Proportion of total recreation use of U.S. Forest Service resources in the activity category. Proxy of taste and preference for specialized vs. generalized activities.
Inflationary Adjustment	Qualitative Variable = 1 if data were collected for each study prior to 1980, 0 if 1980-1988.
Sample Coverage	Qualitative Variable = 1 if only instate residents were included in the sample of users, 0 if out-of-state residents were also included.
Method	Qualitative Variable = 1 if CVM, 0 if TCM or other method.
Substitution	Qualitative Variable = 1 if a substitute price term was included in the TCM demand specification, 0 if otherwise.
Travel Time	Qualitative Variable = 1 if travel time cost was omitted in the TCM demand specification, 0 if time was included.
Individual Observation	Qualitative Variable = 1 if TCM sample units were individual observations, 0 if otherwise.
Household Production & Hedonic Price	Qualitative Variable = 1 if household production or hedonic price TCM procedure, 0 if otherwise. (the omitted category was the zonal group approach)
Open-ended Question	Qualitative Variable = 1 if noniterative open-ended question was asked in a CVM, 0 if otherwise.
Dichotomous Choice Question	Qualitative Variable = 1 if dichotomous choice CVM question was used, 0 if otherwise. (the omitted category was the iterative question)
Socioeconomic Characteristics	Proxy for socioeconomic characteristics of participants in the service area of the study site. The nine Forest Regions are qualitative variables. Alaska is the omitted region.
Recreation Activity	The 19 national recreation use categories are potential qualitative variables for activities. Omitted categories include activities with limited representation in the studies, i.e. resorts, cabins, and organized camps.

recreation activity; whether specialized or general; site administration; quality; location; inflationary adjustment; method; open-ended, iterative, or dichotomous choice question; zonal, household production or hedonic price approach. Some potentially important variables are omitted: direct travel cost per mile, travel time cost per hour, income and other specific socioeconomic variables, sample size, functional form, and type of estimator used.

A quality variable is included to control for specific characteristics of sites which vary among recreation activities and expectations of individual participants. Sufficient information is available in the studies to apply a rough index of site quality in three categories--uniquely low, ordinary and uniquely high--based on a review of the physical and biological information provided. A site administration variable is included to test the hypothesis that Forest Service administered site benefits are not significantly different from other public and private sites. A mixed public-private site variable tests the hypothesis that household surveys are more effective than site specific studies, whether public or private. A specialized activity variable tests the hypothesis that benefits are lower for general activities than for specialized activities. This may be interpreted as a proxy for taste and preference. The federal guidelines (Water Resources Council, 1983) differentiate between general recreation activities engaged in by a large number of persons and specialized recreation limited to fewer participants with unique preference patterns. The guidelines associate specialized recreation with higher unit-day values and general recreation lower.

An inflationary adjustment variable is intended to begin examining the question whether recreation values increase at the same rate as changes in the purchasing power of the dollar. For comparison purposes, the reported values

must be adjusted for inflation. However, this is equivalent to assuming constant real prices, which would not be consistent with increased crowding and relative scarcity of natural resources available for resource-based recreation activities (President's Commission on Americans Outdoors, 1987). Moreover, the procedure assumes an equal proportional change in the reported values for any given year which tends to dampen (enlarge) the absolute dollar adjustment for studies reporting low (high) values. This is evident for surveys from 1968-79 when the inflation rate was 6.9 percent, compared to 4.8 percent from 1980-87. Finally, willingness to pay is, in part, a function of ability to pay which suggests that secular adjustments for per capita real income would be useful.

A method variable is included to test the hypothesis that intended willingness to pay estimates of the CVM are lower than behavior based TCM. This would be consistent with the observation that TCM values the entire trip including the primary activity and secondary activities while the CVM usually values the primary activity alone. For example, TCM always values the entire time onsite per calendar day of a weekend or vacation trip while CVM usually values only that part of the day that pertains to the primary activity, e.g., the 4 hours devoted to fishing each day.

A variable indicating location of the study sites in Forest Regions is included as a proxy for socioeconomic characteristics of the user population. Since the regression model controls for site quality and substitutes, the other important effect of location is the distribution of income and other socioeconomic characteristics of the population in the relevant market for the study site. While extensive data on household demographics and equipment ownership are available for outdoor recreation activities from national and state samples, similar information is available only for a small fraction of

the studies reviewed here. Thus, this important feature of variation in benefits would have to be ignored without an effective proxy variable.

STATISTICAL RESULTS

With the increased output of empirical studies in recent years, there are enough data to begin understanding the variables which explain the observed differences in benefit estimates. Table 3 includes three functions showing the statistical relationship of recreation benefits to some important explanatory variables. These are for the total sample of 287 benefit estimates, 156 TCM and related estimates, and 129 CVM. The number of observations is sufficient for statistically significant analysis. The R^2, adjusted for degrees of freedom, indicates that 36 to 44 percent of the total variation in the reported values is explained by the variables included in the functions. The overall equations are significant at the 0.01 level. The t-statistics shown in parentheses beneath the coefficients indicate that about two-thirds of the variables (27 of 42) are significant at the 0.10 level or above. Omission of a variable indicates that it is not related to benefits.

The panel nature of the data render the usual statistical tests of the model an approximation rather than precise estimate. Although the residuals are close to normally distributed, heteroscedasticity is likely to be present in any study with parameters drawn from different data sets. Even though review of the correlation matrixes indicates mostly low levels with few near a maximum of .70, multicolinearity is likely to result from inclusion of more than one benefit estimate from the same study. The t-statistics somewhat over- or under-estimate variable significance based on a Smith and Kaoru (1988) comparison of OLS estimates with the Newey and West (1987) variation of the White (1980) consistent covariance estimates of standard errors used in calculating t-statistics. The problem here is expected to be less severe since

Table 3. OLS Regressions of Recreational Values on Several Important Expanatory Variables, United States, 1987

Independent variable	Description of variable	Total		Travel Cost Method		Contingent Valuation Method	
		Mean	Coefficient[a]	Mean	Coefficient[a]	Mean	Coefficient[a]
Site quality	1 = High 0 = Other	0.129	33.568* (7.51)	0.154	39.171* (6.06)	0.101	25.082* (4.42)
Specialized activity	Percent of Forest Service output	4.917	-0.574* (-2.23)	5.235	-0.679* (-1.83)	4.571	-0.147 (-0.519)
Forest Service administered	1 = Forest Service 0 = Other	0.230	4.931 (0.98)	0.218	6.204 (0.84)	0.248	2.594 (0.42)
Mixed public and private sites	1 = Mixed 0 = Other	0.596	9.891* (2.29)	0.571	6.933* (1.12)	0.636	13.539* (2.46)
Inflationary adjustment	1 = 1980-88 0 = 1965-79	0.564	-7.971* (-2.35)	0.436	-10.579* (-2.03)	0.721	-16.582* (-3.31)
Sample coverage	1 = Instate sample 0 = Other	0.115	-6.892 (-1.33)	0.186	-11.759* (-1.77)	0.031	-7.464 (-0.86)
Method	1 = CVM 0 = TCM	0.449	-8.098* (-2.34)		--		--
Sorg-Loomis adjustments	1 = Not adjusted 0 = Adjusted	0.578	-4.290 (-1.09)		--		--
Travel time cost	1 = Omitted 0 = Included		--	0.192	-13.333* (-1.90)		--
Substitution variable	1 = Included 0 = Omitted			0.647	-10.831* (-2.05)		--
Individual observation	1 = Indiv. obs. 0 = Other		--	0.333	17.950* (3.44)		--
Household production & hedonic price	1 = HP 0 = Other		--	0.083	9.499 (1.03)		--
Open-ended question	1 = Open-ended 0 = Other		--		--	0.333	-3.659* (-0.76)
Dichotomous choice question	1 = Dichotomous 0 = Other		--		--	0.101	3.503 (0.62)
Southern region	1 = Southern 0 = Other	0.094	-13.089* (-2.48)	0.122	-12.333* (-1.66)	0.062	-10.998* (-1.67)
Northwest region	1 = Northwest 0 = Other	0.052	-10.676 (-1.47)		--	0.039	-12.186* (-1.53)
Pacific SW Region	1 = Pacific SW 0 = Other	0.059	-10.683* (-1.66)		--		--
Intermountain region	1 = Intermountain 0 = Other	0.171	-9.252* (-2.18)		--	0.155	-13.517* (-2.98)
Salt water and anadromous fishing	1 = S-A Fishing 0 = Other	0.091	34.566* (6.20)	0.096	42.939* (5.10)	0.085	24.454* (4.02)
Big game hunting	1 = Big Game 0 = Other	0.199	21.817* (5.33)	0.186	23.037* (3.58)	0.209	16.664* (4.04)
Waterfowl hunting	1 = Waterfowl 0 = Other	0.063	11.325* (1.80)		--	0.093	7.042* (1.28)
Constant			33.579* (6.89)		33.769* (4.24)		28.543* (3.98)
Sample size			287		156		129
Adjusted R^2			0.36		0.39		0.44

[a]T-ratios are shown in parentheses; an * indicates that the coefficient is significant at the 90 percent level or greater.

we used fewer data points from each study. For example, the data set contains 287 estimates from 120 studies, often selecting an average best estimate, or minimum and maximum of the reported values. The Smith and Kaoru (1988) TCM data set includes 722 estimates from 77 studies.

Of primary interest here are the variables estimating the effect of the three adjustments in benefits by Sorg and Loomis (1984); namely, for omission of travel time cost, use of the individual observation approach, and for instate samples at sites with out-of-state users. The increase in reported values by 30 percent for omission of travel time cost seems to be about right. The statistically significant coefficient indicates that TCM benefits are about 34 percent less for the 30 studies omitting travel time cost, other variables in the equation held constant. On the other hand, the decrease in reported benefits by 15 percent for use of the individual observation approach seems quite conservative. The significant coefficient indicates that benefits are 46 percent greater for the 52 TCM studies using individual observations. The increase of both TCM and CVM values by 15 percent for omission of out-of-state users appears to be about right for the total sample where the coefficient shows a 20 percent increase although not statistically significant. The 15 percent adjustment seems conservative for TCM studies where the significant coefficient indicates the correct adjustment would be an increase of about 30 percent. Thus, while the arbitrary adjustments appear about right or to err on the low side, the overall effect is rather benign. There is no significant difference between the mean values of adjusted and unadjusted studies because of offsetting effects.

Another critical issue, of course, in the evaluation of the Sorg and Loomis (1984) adjustments is whether they are supported by applied microeconomic theory, accepted econometric procedures and federal guidelines.

Obviously, some adjustment for the omission of travel time is required, however, the precise level is not known and would vary for each study site. The statistical effect of the travel time cost variable could be improved if specified as a continuous variable in dollars per hour rather than as a qualitative variable indicating presence or absence of the adjustment. With respect to the adjustment for use of individual observations in TCM studies, some economists argue that values from zonal studies should be increased rather than those from individual observation studies decreased because of the dampening effect of aggregation problem in the zonal approach (McConnell and Bockstael, 1984). Finally, limitation of the sample to instate residents originates in the institutional constraints of the researcher. The precise level of adjustment for sample truncation would vary with the actual origin of the user population of each site.

The regression results indicate other prime candidates for adjustment not considered by the earlier work. Benefit estimates from TCM studies omitting an effective cross-price term for substitution could be decreased by 30 percent according to the regression results. If the behavior-based TCM results are accepted as the standard for benefit estimation, then the CVM estimates of intended willingness to pay could be increased by an average of 20-25 percent. Although the coefficient is not significant, the results suggest that perhaps benefit estimates from CVM studies using dichotomous choice questions are closer to TCM benefit estimates and require about half as much adjustment. However, benefit estimates from CVM studies asking open-ended willingness to pay questions could be increased by 10-15 percent more based on the preliminary regression results considered here. These are but a few of the possible adjustments that should be considered in applying the Sorg and Loomis

(1984) approach of making adjustments before presenting statistical summaries of the data in policy applications.

An important question raised by the Forest Service in applying the data to policy decisions is whether the benefit estimates from other public and private recreation sites are applicable to Forest Service resources. The insignificant coefficient for study sites administered by the agency suggest that there is no appreciable difference. Apparently, the benefit estimates from the literature review apply to valuation of the agency's recreation program. In theory, benefit estimates for a forest lacking data can be predicted by inserting appropriate values of explanatory variables into the regressions. Unfortunately, an insufficient number of studies have been completed to obtain more than a few estimates of value by this method. The agency requires benefit estimates for 19 national recreation use categories in nine Forest Regions, or a total of 171 (Table 4). However, only three of the 19 national recreation use categories and four of the nine Forest Regions are significant in the models fitted to data from the study sites. The other regions may not differ significantly from the average and thus cannot have significant coefficients, or possibly sample size for these regions is too small.

The specialized activity variable could provide a rough indication of the benefit for some activities with few studies. For example, the benefit of sightseeing and offroad driving, the largest single recreation activity with 27.6 percent of total output, would be $24 per day or $15 less than the mean TCM value of $39. This compares favorably to the mean of $20 for six studies of this activity in Table 4. It seems likely that the agency will need to rely on a combination of several approaches until a much larger number of studies of most recreation activities have been completed.

Table 4. Net Economic Value Per Day Reported by Outdoor Recreation Demand Studies in USDA Forest Regions, United States 1968-1988 (Third Quarter 1987 dollars)

Activity, Value, and Number of Cases (in parenthesis)	Average Total	Forest Regions 1 Northern	2 Rocky Mountains	3 South West	4 Inter-Mountain	5 Pacific Southwest	6 Pacific Northwest	8 Southern	9 Eastern
Total	$33.95 (286)	$33.90 (15)	$22.66 (56)	$34.96 (33)	$37.39 (49)	$31.15 (17)	$49.32 (25)	$25.05 (27)	$26.20 (38)
Camping, Picnicking and Swimming	20.14 (36)	22.40 (1)	15.11 (6)	26.53 (7)	19.49 (4)	22.20 (3)	10.28 (3)	26.41 (5)	16.97 (7)
Camping	19.50 (18)	22.40 (1)	15.65 (4)	23.75 (3)	19.49 (4)	--	11.21 (2)	27.19 (2)	20.61 (2)
Picnicking	17.33 (7)	--	14.04 (2)	31.25 (2)	--	12.82 (1)	--	--	8.96 (2)
Swimming	22.97 (11)	--	--	25.98 (2)	--	26.89 (2)	8.41 (1)	25.90 (3)	20.30 (3)
Mechnical Travel and Viewing	25.42 (11)	21.44 (1)	13.00 (3)	29.14 (4)	--	25.67 (1)	8.27 (1)	--	68.65 (1)
Sightseeing and Offroad Driving	20.29 (6)	21.44 (1)	13.00 (3)	30.67 (2)	--	--	--	--	--
Boating, Motorized	31.56 (5)	--	--	27.61 (2)	--	25.67 (1)	8.27 (1)	--	68.65 (1)
Hiking, Horseback Riding and Water Travel	41.74 (17)	--	20.21 (5)	46.41 (4)	80.76 (4)	--	22.84 (1)	11.53 (1)	33.03 (2)
Hiking	29.08 (6)	--	20.84 (3)	33.33 (1)	--	--	22.84 (1)	--	55.81 (1)
Boating, Nonmotorized	48.68 (11)	--	19.27 (2)	50.77 (3)	80.76 (4)	--	--	11.33 (1)	10.26 (1)
Winter Sports	28.50 (12)	--	25.19 (8)	--	41.51 (2)	35.71 (1)	--	--	21.75 (1)
Resorts, Cabins, and Organized Camps[a]	12.48 (2)	--	19.93 (2)	--	--	--	--	--	--
Hunting	41.69 (78)	38.93 (9)	44.95 (9)	40.39 (6)	38.83 (24)	53.20 (3)	41.88 (6)	32.77 (8)	49.40 (13)
Big Game Hunting	45.47 (56)	41.72 (8)	49.88 (7)	47.45 (4)	41.24 (17)	44.39 (1)	46.34 (5)	49.84 (3)	47.82 (9)
Small Game Hunting	30.82 (10)	--	35.08 (1)	34.55 (1)	34.63 (5)	--	--	19.09 (2)	--
Migratory Waterfowl Hunting	35.64 (17)	16.58 (1)	20.32 (1)	17.99 (1)	28.80 (2)	57.60 (2)	19.59 (1)	24.87 (3)	52.94 (4)
Fishing	39.25 (67)	31.01 (3)	15.23 (7)	37.91 (9)	28.02 (13)	28.66 (5)	67.14 (12)	25.29 (8)	40.10 (10)
Cold Water Fishing	30.62 (38)	42.46 (2)	15.77 (6)	43.47 (6)	22.95 (6)	19.28 (1)	64.33 (2)	26.62 (2)	35.13 (6)
Anadromous Fishing[b]	54.01 (9)	--	--	--	36.62 (3)	--	61.10 (5)	--	--
Warm Water Fishing	23.55 (23)	8.13 (1)	12.00 (1)	26.80 (3)	29.18 (4)	23.25 (1)	13.57 (1)	24.84 (6)	27.52 (2)
Salt Water Fishing	72.49 (17)	--	--	--	--	33.60 (3)	89.50 (4)	--	67.60 (2)
Non-Consumptive Fish and Wildlife	22.20 (14)	21.23 (1)	20.31 (1)	27.45 (3)	29.76 (1)	24.10 (3)	19.09 (1)	15.27 (3)	20.02 (1)
Other Recreation Activities	18.82 (9)	--	20.50 (7)	--	--	--	--	--	12.94 (2)
Wilderness	24.58 (15)	--	19.41 (8)	--	22.44 (1)	26.43 (1)	106.26 (1)	11.31 (2)	17.87 (2)

[a] Resorts were 1.83 percent valued at $19.93 per day; seasonal and year around cabins were 3.06 percent valued at $3.91 per day; and organized camps were 1.79 percent valued the same as camping.

[b] Anadromous fishing estimated as roughly 5.0 percent of cold water fishing.

The reader should view these results as subject to revision since by leaving important variables out of the regression, more or less of the difference in the estimates may be attributed to the variables that are included than would be the case with a complete specification. Nonetheless, this review includes many possibly important variables, and provides a basis for eliminating some of them as serious candidates for new research. The task remains to discover how far these results can be generalized. The importance of continued research is illustrated by the conceptual and empirical difficulties associated with their estimation and the potential importance of recreation benefit in the economic assessment of programs such as forest recreation.

DISCUSSION OF RESULTS

This section begins with a discussion of trends in nonmarket valuation studies. This is followed by a discussion of the coefficient of variation in the standard error of the mean values obtained by studies applying each of the three TCM and CVM methods. The difference in means provides some interesting insights although the cause of the differences cannot be explained by a two- or three-way classification since other factors also contribute to the differences. The section concludes with a discussion of several other questions that should be addressed in the application of nonmarket valuation research to public policy decisions.

More studies of recreation use values have been completed in the past six years than in the previous 15. The data summarized in Table 1 included 287 values from 120 studies during the two decades, 1968-88. There were approximately 50 studies reporting 117 values during the 15-year period, 1968-82, and 70 studies with 164 values in the 6-year period, 1983-88. This means that output has increased by approximately 3.5 times from an average of

3.3 studies with 7.8 benefit estimates per year during the 15-year period from 1968-82, to more than 11.7 studies with 27.3 estimates per year from 1983-88.

Although the TCM was the first and remains the most frequently used method, CVM has made a substantial contribution to nonmarket benefit estimation in the past and continues to do so today. Studies that use the CVM did not begin to appear in appreciable number until nearly 10 years after the initial travel cost studies. Still, the proportion of nonmarket value studies using the CVM approach apparently has increased during the review period. From 1968-82, one-third of the total estimates were CVM. From 1983-88, nearly 50 percent of the estimates were CVM with two actual cash transactions.

Comparison of the TCM and CVM approaches indicates that while they yield similar dollar values, the CVM are usually lower. It is noteworthy that the dollar gap between the two has narrowed in recent years. Table 5 shows for the 15-year period, 1968-82, average CVM estimates were $12 less than TCM. However, from 1983-88, CVM estimates were $9 less. These estimates are based on a sample of 230 studies.

There are many possible reasons why the differences between TCM and CVM benefit estimates have narrowed. Perhaps foremost are improvements in the TCM method since most of the change is accounted for by lower TCM estimates. During the 15-year period from 1968-82, 82 percent of the TCM values were adjusted either increased by 30 percent for omission of travel time, by 15 percent for omission of out-of-state users, or decreased by 15 percent for use of the individual observation approach. Since 1982, less than half of the reported TCM values have required adjustment for these reasons. Initial TCM demand functions were zonal and the method has continued to be the most frequently used procedure. From 1968-82, 72 percent of the zonal values were

Table 5. Comparison of TCM and CVM Benefit Estimates by Date of Publication, United States, Third Quarter 1987 Dollars

Variables	Mean	Median	Standard error of the mean	95% Confidence Interval	Range	Sample Size Total	Sample Size Adjusted
TCM, Total	$38.62	$29.78	2.82	33.09-44.14	6.81-219.65	148	95
1968-82	43.07	31.77	4.04	35.15-50.98	7.57-183.36	74	60
1983-88	34.17	26.90	3.88	26.56-41.77	6.81-219.65	74	35
Zonal							
1968-82	41.68	29.78	5.62	30.66-52.69	7.57-136.66	32	23
1983-88	26.25	22.42	2.74	20.88-31.62	6.81-106.11	46	11
Individual							
1968-82	42.03	28.77	7.11	28.09-55.96	8.42-183.36	31	30
1983-88	48.62	35.08	9.41	29.22-68.01	11.33-219.65	26	24
Hedonic & HP							
1968-82	50.04	31.77	9.26	29.40-70.67	14.16-93.08	11	8
1983-88	28.41	19.81	8.59	--	19.81-37.01	2	0
CVM, Total	28.48	22.12	2.42	23.73-33.22	3.91-127.26	82	54
1968-82	31.48	22.87	3.68	24.26-38.69	3.91-127.26	46	19
1983-88	24.65	19.39	2.80	19.16-30.13	5.27-99.48	36	8
Open-ended							
1968-82	37.62	27.23	4.82	28.17-47.06	15.00-127.26	32	12
1983-88	17.04	15.14	1.76	13.11-20.96	10.33-27.24	11	5
Iterative							
1968-82	14.86	14.76	1.76	10.98-18.73	3.91-27.44	12	7
1983-88	23.38	19.39	2.39	18.33-28.42	10.83-53.35	18	3
Dichotomous							
1968-82	33.07	31.84	1.22	--	31.84-34.29	2	0
1983-88	39.87	27.48	11.47	11.80-67.93	5.27-97.48	7	0

[a] The Mann-Whitney (Siegel, 1956) nonparametric test indicates whether two independent groups have been drawn from the same population. A z value of 1.96 correspondents to a 2-tail p value of .05 which is close to 95 percent confidence for moderate sized samples. Values in the 1968-82 period are significantly higher than in the 1983-88 period with p lower than .00006 and z = 6.50. TCM values are significantly higher than CVM with p lower than .00006 and z = 6.67. Individual observation TCM values are significantly greater than zonal with p = .00022 and z = 3.74. Hedonic and household production TCM values are significantly larger than zonal with p lower than .00006 and z = 5.10. Hedonic and household TCM values are significantly greater than individual observation values with p lower than .00006 and z = 4.75. Open-ended CVM values are not significantly different from dichotomous with p = .64 and z = .47. Open-ended CVM values are significantly higher than iterative values with p lower than .00006 and z = 4.79. No significant difference is detected between iterative and dichotomous values with p = .35 and z = .59. With a small sample of dichotomous values (9), the Mann-Whitney test may be unable to reliably detect significant difference.

adjusted. However, only 24 percent of the more recent zonal values were adjusted for these reasons.

Beginning in the mid-1970s, the individual observation based TCM supplemented the zonal approach and was nearly as frequently used through 1982. More recently, the number of studies using the individual observation approach have declined while those using some variation of the zonal approach have increased. Most of the individual observation TCM values reported from 1968-82 required adjustment which continued at nearly as high a rate from 1982-88. The hedonic TCM and household production methods were introduced with a series of studies in the late 1970s and early 1980s. Two-thirds of these were adjusted for one or more reasons. Only one such studies were reported during the period 1982-88.

Also, there have been some notable improvements in the CVM method. Recent use of iterative and dichotomous choice questions may result in respondents reporting their consumer surplus more accurately than open-ended noniterative questions used in the past. From 1968-82, 70 percent of the CVM studies used open-ended noniterative questions. From 1983-88, only 30 percent were open-ended noniterative while 50 percent were iterative and 20 percent were dichotomous choice which seems to have become the preferred question format at the present time.

TCM values have become somewhat less stable in recent years. The coefficient of variation in the standard error of the mean (SE) for TCM estimates widened in recent years while for CVM, it narrowed. Between the two periods 1968-82 and 1983-88, the TCM coefficient of variation in the SE widened from .09 to .11 of mean values. For studies using the individual observation approach, the coefficient of variation in the SE widened from .17 to .19 of

mean values. During the same time period, the CVM coefficient of variation in the SE narrowed from .12 to .11.

It seems likely that most future CVM estimates will continue to be lower than TCM. Perhaps the most important reason is that TCM values the entire trip including the primary activity and several secondary activities while the CVM usually values the primary activity alone. For example, TCM always values the entire time onsite per calendar day of a weekend or vacation trip while CVM usually values only that part of the day that pertains to the primary activity, e.g., the 4 hours devoted to fishing each day.

The geographic distribution of studies appears to be consistent with the distribution of resource-based recreation activities on public land. During the past two decades, about three-fourths of the study sites were located in the western half of the United States. This reflects the fact that the west accounts for nearly 80 percent of total recreation output of the U.S. Forest Service. The eastern region is defined to include all states in Forest Region 8 (southern) and 9 (eastern). The division is the eastern boarder of North Dakota, South Dakota, Nebraska, Kansas, and New Mexico.

Based on this sample, it appears that the average benefits of resource-based recreation activities are not significantly different in the east and west (with $p = .1676$ and $z = 1.38$). The average benefits of about $36 per day in the west were only slightly more than in the east, with $34. Apparently, the overall unique quality of public resource-based recreation sites such as cold water fishing in the west tends to be offset by their greater scarcity value in the east. However, further regressions shown in Table 3 indicate that southeastern values are significantly lower than other regions. Apparently the higher northeastern values offsets the lower southeastern values. Further

investigations may uncover additional information on values in the east and west.

There are several other issues that should be raised in the application of nonmarket valuation research to public policy decisions of resource-based recreation agencies such as the Forest Service (Stoll et al., 1983). Perhaps most important are questions having to do with tailoring research methods to the nature of the resource and behavior of the user. The recreation sites studied in most of the literature reviewed here are resource-based while some are intermediate areas. This follows the Clawson and Knetsch (1966) classification of outdoor recreation resources as: resource-based, intermediate, and user-oriented. The dominant characteristics of resource-based areas are their physical resources. Resource-based sites include national forests, mountains, deserts, national parks, wildlife refuges, historic sites, swamps, seashores, and major lakes which provide sightseeing, camping, hiking, mountain climbing, fishing, hunting, boating, etc. primarily on vacation trips. The major areas of this type are usually located a considerable distance from concentrations of population. Of course, a few people live nearby and can use them as user oriented or intermediate sites for day outings and weekend trips. For most people, however, visiting resource-based areas involves considerable travel, and thus both time and money in moderately large amounts. Intermediate sites include federal reservoirs and state parks which provide hiking, camping, fishing, boating, and hunting on day outings and weekend trips within 2 or 3 hour's drive from home. User oriented sites include city and county parks, golf courses, tennis courts, swimming pools, zoos, playgrounds, and the like within 1 hour's travel from home.

The TCM has been the preferred approach for estimating the benefits from recreation activities at existing, new, and expanded sites; and it can be an

acceptable approach for estimating the recreation benefits from changes in the quality of resources (Ward and Loomis, 1986; Rosenthal et al., 1984). The method has been successfully applied to intermediate areas located within 100-150 miles from the homes of most users, primarily state parks and reservoirs. However, the federal guidelines (U.S. Water Resources Council, 1983), recommend that TCM not be used to estimate the benefits of resource-based recreation sites. Because several sites are usually visited on a single vacation trip, the distance-traveled proxy for price cannot be assigned to a single destination.

The limited applicability of the TCM is a continuing problem in nonmarket valuation research. However, recent innovations in the study of resource-based sites indicate that it may be possible to learn how to adjust the method so that future revision of the guidelines will recommend it as providing acceptable measures. Haspel and Johnson (1982) illustrate how the proxy for price could be adjusted to apply to resource-based sites. The authors assign an equal proportion of the total distance traveled on a single trip to each of several resource-based recreation destinations in the Southwest. They conclude that the procedure provides a reasonably accurate demand curve. Others obtain satisfactory results by allocating travel costs on the basis of the number of days at each site. In future studies, consumers could be asked to provide the perceived allocation of trip costs among destinations.

Most of our research methods have been designed to study intermediate sites. Procedures have been developed to adjust regional demand studies to apply to proposed new intermediate sites. The Corps of Engineers, for example, adjusts values for the size of the proposed reservoir and population in the market area. Some studies adjust for differences in socio-economic variables such as income in the new market area. An adjustment for quality of the

proposed site also is included in some studies of new or proposed changes in existing recreation sites. Many of these procedures developed for the study of intermediate sites will be directly transferable to resource-based sites.

The most notable example of improvement in method is a series of bulletins (Sorg, et al. 1985) published by the Rocky Mountain Forest and Range Experiment Station in cooperation with the Idaho Department of Fish and Game, University of Idaho, and the U.S. Fish and Wildlife Service. These regional TCM demand studies for fishing and hunting in Idaho include nonresident participation, substitution, site quality, travel time cost, user reported travel costs and income.

In the past, most studies of resource-based sites treated demand for them as if they were intermediate sites. Samples often have been restricted to day-use, single-purpose trips, or instate residents. Nearly all studies have truncated the demand curve, ignoring as much as 50 percent of annual use. This means that studies have nearly always neglected tourists on vacation trips to multi-sites, driving or flying considerable distance, staying in commercial lodging, eating in restaurants, and paying various user fees. Tourists were excluded despite the fact that most states have found that they make a significant contribution to economic development. Tourism is especially important in western states with resource-based recreation sites on public land.

Typically, researchers decide on the appropriate travel cost per mile for a party or household group in a single vehicle. Most intermediate-site studies reviewed here define travel cost as the average variable costs of operating an auto, based on national estimates for gas, oil, maintenance, and parts per vehicle-mile for the year of the study (13.4 cents per mile in 1986). For longer trips to resource-based sites, there are often other travel costs such

as added food, lodging, equipment rental, and recreation supplies that are necessary to obtain the recreation experience. Such costs have been included in some studies (Burt and Brewer, 1971) and can result in travel costs per mile that are up to four times those limited to vehicle operating costs. Recreation economists have known for some time that vehicle operating costs average only about one-fourth of the cost of recreation travel (Clawson and Knetsch, 1966). Limiting specification of the TCM price variable can have a significant effect on estimation of recreation values of resource-based sites (Duffield, 1984). The reason is that a proportional change in travel cost tends to result in a similar proportional change in consumer surplus.

The relationship between travel cost per mile and consumer surplus estimates is illustrated in a series of wildlife recreation studies in Montana. For example, Duffield et al. (1987) show that TCM benefit estimates for elk hunting in the state increase from $28 per day with standard travel cost of 5.8 cents per mile to $68 with hunter reported travel cost averaging 34.6 cents per mile. Duffield (1988) reported that TCM benefit estimated for river fishing in the state increase from $49 per day with standard travel cost of 5.6 cents per mile to $103 with angler reported travel cost averaging 22.4 cents per mile. Also, there appears to be a direct relationship between the value of travel time and consumer surplus estimates. Bishop and Heberlein (1979) show that TCM benefit estimates for goose hunting increase from $11 per day without travel time to $28 with time valued at 25 percent of the wage rate and $45 at 50 percent. McCollum et al. (1988) show that deer hunting benefit estimates increase from $29 per day without travel time to $46 with travel time at 50 percent of the wage rate and $69 at 100 percent. Generally, the effect depends on the proportion of travel time cost to total trip cost. The higher the

proportion, the greater the change in consumer surplus resulting from a change in the value of travel time.

It would be useful to explore the possibility that there may be other adjustments which would improve the application of TCM to resource-based sites. Since vacation users tend to travel further it would be interesting to test for the possibility of increasing out-of-pocket and time cost with added distance. The hypotheses of increasing disutility of travel time would be consistent with the observation the people get more and more tired of riding on longer trips. Out-of-pocket costs are expected to be an increasing function of distance for the following reasons. For local users who live within 100 miles, the variable auto cost assumption may be satisfactory since they probably arrive at the few available free campsites earlier and in that case, 13.4 cents per mile could be increased by some amount to account for the higher costs of transportation in resource-based areas. For more distant users, camping fees, commercial overnight lodging, and added restaurant meals are often necessary expenditures for access to resource-based sites.

Studies show that time onsite becomes more variable for trips to resource-based sites and tends to increase with distance traveled. The effect on demand for trips can be controlled by including onsite time as an independent variable in TCM demand equations. The concept of substitutes may have less meaning for vacation users of resource-based sites. While they have considerable choice among possible alternative sites, by definition, they seem to have less interest in or knowledge of their availability and tend to arrive at popular resource-based sites during the peak holiday season. For these users, there may be external benefits of expanded access to new sites which relieve peak congestion at existing sites.

The CVM is the preferred approach for estimating the effect of changes in the quality of resources at recreation sites. It is also an acceptable approach for estimating the recreation demand for existing sites and the effects of changes in the availability of recreation opportunities, such as from the development of new and expanded access to resource-based sites. Although the CVM approach is gaining broad acceptance, it is generally recognized that it requires careful wording of questions and well-defined market structures including substitutes with which respondents are familiar. Several procedures have been used and none has emerged as superior in all cases.

The federal guidelines suggest that methods of payment such as taxes, utility bills, and hunting or fishing license fees usually should be avoided because they may result in an emotional reaction against the method of payment. Apparently, the subjective value of a dollar depends on what it is spent for. From the individual's perspective, a dollar spent on utility bills, user fees, or taxes may be valued differently than a dollar spent for direct trip costs or for the purchase of goods and services in general. For example, Davis (1963) who originated the CVM, initially tried a user fee but abandoned it after a pretest showed that willingness to pay direct trip expenses proved more realistic and acceptable to households engaged in fishing, hunting, and camping in the Maine woods. There is a need for further research to test the effectiveness of alternative willingness to pay questions.

In the past decade, an extensive body of literature has developed assessing the accuracy of CVM estimates of individual willingness to pay for the recreational use of resources. Initial results were challenged on the grounds that what people say they are willing to pay contingent on the availability of a resource represent behavioral intentions rather than a

directly observable action or historical fact. The relationship between intentions and actual behavior has been submitted to systematic empirical investigation. Despite some continuing controversies and unsettled points, CVM studies of the user benefits of familiar recreation resources have performed reasonably well when compared to the available empirical evidence from travel behavior, actual cash transactions, and controlled laboratory experiments (Cummings, et al. 1986). Levels of accuracy have been consistent with levels obtained in other areas of economics and in other disciplines.

The next important question is whether there are sufficient existing studies of each recreation activity to analyze the observed variation in benefit estimates. The following sections of this report present detailed information on the research methods, study sites, and results of 120 studies with 287 benefits estimates from 1968-88. This knowledge is essential to adjusting benefit estimtes to fit the requirements imposed by new situations addressed in policy analysis (Smith, 1987).

CAMPING, PICNICKING, AND SWIMMING

Many demand studies have been completed for the second largest national recreation use category of camping, picnicking, and swimming. However, with nearly 30 percent of total recreation use of the National Forests, this category accounts for only 12.5 percent of the benefit estimates. Tables 6 and 7 show that the value of camping and picnicking averages $19 and $17 per day, respectively. Most of the 36 studies were completed from 1968-82 and their adjusted average values were only slightly higher than the values reported by the few more recent studies. Table 8 shows that the average value of swimming, $23 per day, may have declined in recent years. For the most part, this appears to represent the effect of adjusting early studies for inflationary effects although recent concern about the health effects of water quality also may have affected the value of swimming.

CAMPING

King et al. (1988) applied the CVM in a study of nine campgrounds on National Forests in Arizona. Preliminary data from the unpublished study show that values averaged $19 per user day. The estimate will be compared to TCM values in a forthcoming publication.

Daniels (1987) applied a zonal TCM in a study of visitors to four campgrounds in Lolo National Forest, Montana. The study adjusted for the value of time traveling and onsite, but not for substitutes. One-third of the total users were nonresidents and deleted on grounds that the campgrounds were not their primary destinations. The average value of $22 was adjusted by 15 percent for the omission of nonresidents.

Mendelsohn (1987) applied a zonal TCM in a study of backcountry camping at 10 sites in the White Mountains of New England from 1975 to 1985. Nonresident visitors living as far as 300 miles from the sites were included in the analysis. Origins included 2,064 cities and towns over 2,500 in population. Socioeconomic data were from the 1980 U.S. Census. The study adjusted for travel time but not for substitution. Camping fees were $2 per night. Backcountry camping values averaged $11 per user day.

Findeis and Michalson (1984) modified the individual observation TCM to estimate the value of camping at developed sites in the Targhee National Forest, Idaho. The sample included nonresidents and the study included the effects of travel time and substitute sites. A double-log model was statistically superior to other models tried. The average value of camping ranged from $16 to $33 per day, adjusted for use of the individual observation approach.

Ward (1982) used the individual observation TCM in a study of recreation in southeastern New Mexico including sites with developed camping. The study

Table 6. Camping Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
King et al. (1988) Arizona 1985 CVM	18.20	19.24	19.24
Daniels (1987) Montana 1984 TCM	17.82	19.48	22.40
Mendelsohn (1987) Vermont 1980 TCM	7.67	10.55	10.55
Findeis and Michalson (1984) Idaho 1974 TCM	8.60	18.77	15.95
Findeis and Michalson (1984) Idaho 1974 TCM	17.93	39.14	33.27
Sutherland (1980) Washington & Oregon 1979 TCM	4.23	6.35	8.26
Ward (1982) New Mexico 1978 TCM	11.39	18.60	18.60
Walsh & Olienyk (1981) Colorado 1980 CVM	5.59	7.69	9.23
Walsh & Olienyk (1981) Colorado 1980 CVM	7.99	10.99	13.19
Walsh et al. (1980a) Colorado 1978 CVM	10.90	17.80	17.80
Walsh et al. (1980a) Colorado 1978 CVM	13.72	22.41	22.41
Brown & Plummer (1979) Washington 1976 Hedonic	5.83	10.89	14.16
Leuschner & Young (1978) Texas 1973 TCM	8.18	19.48	19.48
Michaleson & Gilmour (1978) Idaho 1971 TCM	3.73	9.90	8.42
Michaleson (1977) Idaho 1971 TCM	9.00	23.90	20.32
Martin et al. (1974) Arizona 1970 TCM	14.00	39.30	33.41
Gibbs (1974) Florida 1970 TCM	10.81	30.34	34.89
Kalter & Gosse (1969) New York 1965 TCM	6.50	22.67	29.47
Average total value 1983-1988 (5) 1968-1982 (13)	10.11 14.04 8.61	19.31 21.44 18.49	19.50 20.28 19.20

adjusted for the value of travel time. The survey was restricted to New Mexico counties near or adjacent to the sites under study. Adjustments for this sample restriction and use of the individual observation approach were offsetting. The average value was $19 per day.

Walsh and Olienyk (1981) used an iterative CVM procedure in an onsite study of camping in the Arapaho, Roosevelt, Pike, and Isabel National Forests along the front range of Colorado. The study compared two major types of camping in the national forest campgrounds. Primitive campgrounds without drinking water and other services were valued at $13 compared to developed campgrounds with a value of $9. The reported values were increased by 20 percent to adjust reported total trip values to onsite activity days. The elasticity of demand with respect to travel cost was estimated as -.4.

Walsh et al. (1980a) estimated a value of $22 for camping in underdeveloped sites near or adjacent to high mountain reservoirs in Colorado. The average value of camping at developed sites near or adjacent to high mountain reservoirs was $18. The study used a noniterative, open-ended CVM approach in onsite interviews.

Sutherland (1980) used the zonal TCM to estimate the value of camping in Oregon and Washington state. He did not adjust for travel time so the values reported were increased by 30 percent. The regional study adjusted for substitutes. The average value of about $8 per day was considered a conservative estimate owing to use of a very low assumption as to travel cost.

Brown and Plummer (1979) used a hedonic TCM to estimate the value of camping in western Washington state as $14 per day. The study did not adjust for travel time so the values reported were increased by 30 percent. The data were from onsite registration.

Leuschner and Young (1978) used a zonal TCM to estimate the effect of pine beetle infestation in ponderosa pine shade trees at 19 campgrounds on three reservoirs in Texas. The study adjusted for travel time and substitutes. Nonresident use was not considered important. The best estimate of the average value of camping was $19 per day.

Michaleson (1977) used the individual observation TCM to estimate the value of camping associated with river recreation in Idaho. The adjusted value was $20 per day. In another study using the individual observation TCM, Michaleson and Gilmour (1978) estimated the value of outdoor recreation trips in which camping was the predominant activity reported by 77 percent of respondents. The study was based on data from onsite interviews and adjusted for travel time. The average value was $8 per day.

Martin et al. (1974) used the individual observation TCM to estimate the value of camping and general outdoor recreation in Arizona. The study adjusted for travel time and substitution. The sample was restricted to instate users which may tend to understate the value somewhat because camping tends to be a regional activity. The average value was $33 per user day. As discussed previously, values derived from individual observation TCM were adjusted to make them consistent with values derived from zonal TCM.

Gibbs (1974) used a variation of the individual observation TCM to estimate the value of camping associated with river and lake recreation in Florida. The approach was to analyze variations in onsite time as a function of cost per day. He reported value per trip of about 2 days. The study was based on individual observations and did not adjust for travel time so the value reported was increased by 15 percent. The adjusted value was $35 per day.

Kalter and Gosse (1969) used the zonal TCM to estimate the value of camping in New York state. The study did not adjust for travel time so the value reported was increased by 30 percent. The adjusted value was $29 as a statewide average.

PICNICKING

Rosenthal (1987) applied the zonal TCM in a regional demand study of day-use at 11 large reservoirs in Kansas and Missouri. Day-use included the recreation activity of picnicking and various water-based sports. Values ranged from $7 with an adjustment for substitution in a gravity logit model to $11 without substitution in a traditional model. The values were increased by 30 percent to adjust for truncation of the sample to day-use.

Ward (1982) estimated the value of recreation at several reservoirs in southeastern New Mexico. Because the reservoirs included state parks and were located near population centers, picnicking was one of the most frequent activities. The author used an individual observation TCM adjusted for travel time and substitutes. While the sample was restricted to counties adjacent to each reservoir studied, this was not a limitation in the case of a localized activity such as picnicking. As discussed previously, a downward adjustment is necessary for studies that used individual rather than zonal TCM when the decision to participate is related to travel costs. Picnicking is probably one of those activities. Thus, the value of $16 per day was adjusted downward by 15 percent.

Walsh and Olienyk (1981) applied an onsite iterative CVM to estimate the value of picnicking at five recreation sites in national forests along the Front Range of Colorado. The value was increased by 20 percent to $10 to adjust reported total trip values for time onsite.

Table 7. Picnicking Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Rosenthal (1987) Kansas, Missouri 1982 TCM	4.04	4.76	7.05
Rosenthal (1987) Kansas, Missouri 1982 TCM	7.10	8.37	10.88
Ward (1982) New Mexico 1978 TCM	11.39	18.60	15.81
Walsh & Olienyk (1981) Colorado 1980 CVM	6.22	8.56	10.27
Walsh et al. (1980a) Colorado 1978 CVM	10.90	17.80	17.80
Knetsch et al. (1976) California 1969 TCM	3.33	9.86	12.82
Martin et al. (1974) Arizona 1970 TCM	19.57	54.93	46.69
Average total value 1983-1988 (2) 1968-1982 (5)	8.94 5.57 10.28	17.55 6.57 21.95	17.33 8.97 20.67

Another Colorado study by Walsh et al. (1980a) used a noniterative open-ended CVM question in onsite interviews at high mountain reservoirs in national forests along the Front Range of the Rocky Mountains. Recreation use was primarily picnicking with some fishing. Access was primarily by hiking with some horseback riding. The authors reported a value of $18 per 4.2 hour day.

Knetsch et al. (1976) used the zonal TCM to estimate demand for day trips to California reservoirs using a zonal TCM. The regional model adjusted for travel time and substitute sites. Picnicking represented a large proportion of the use at the reservoirs. The average value was $13 per day, adjusted for truncation of the sample to day-use.

Martin et al. (1974) estimated the value of picnicking as part of general outdoor recreation in rural areas of Arizona. The authors applied the individual observation TCM to household trips. There were an average of 3.4 persons per household. The study adjusted for travel time and tested for the effect of substitutes. The sample was restricted to instate users which would not bias the results for an activity such as picnicking which tends to occur close to where people live. The high value of $47 reflects the effect of the upward adjustment for inflation even though it was adjusted downward by 15 percent to account for the use of individual rather than zonal TCM.

SWIMMING

Wade et al. (1988) used a zonal TCM model to estimate a regional demand function for swimming at 14 reservoirs in California. The primary purpose of the consulting report was to show that water-based recreation activities had higher values at storage reservoirs in southern California compared to other areas of the state. The study adjusted for travel time and substitution. The value of swimming ranged from $17 to $37 per day at the study sites.

Table 8. Swimming Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Wade et al. (1988) California 1985 TCM	15.84	16.74	16.74
Wade et al. (1988) California 1985 TCM	35.04	37.04	37.04
Rosenthal (1987) Kansas, Missouri 1982 TCM	4.04	4.76	7.05
Rosenthal (1987) Kansas, Missouri 1982 TCM	7.10	8.37	10.88
Roberts et al. (1985) Louisiana 1981 CVM	28.60	35.86	35.86
Ward (1982) New Mexico 1978 TCM	11.39	18.60	18.60
Sutherland (1980) Oregon, Washington, Idaho 1979 TCM	4.31	6.47	8.41
Martin et al. (1974) Arizona 1970 TCM	13.98	39.24	33.35
Gibbs (1974) Florida 1970 TCM	10.31	28.94	24.60
Kalter & Gosse (1969) New York 1965 TCM	9.47	33.03	42.94
Grubb & Goodwin (1968) Texas 1965 TCM	3.80	13.25	17.23
Average total value	13.08	22.03	22.97
1983-1988 (5)	18.12	20.55	21.51
1968-1982 (6)	8.88	12.68	24.19

Rosenthal (1987) applied the zonal TCM in a regional demand study of day-use at 11 reservoirs in Kansas and Missouri. Typical recreation activities included picnicking, swimming, fishing, and boating. The study adjusted for travel time and substitutes. The sample was limited to one-day trips to avoid the possibility that overnight users may take multiple-site trips. Reported values ranged from $7 per day with substitutes in a gravity logit model to $11 per day without substitutes in a traditional model. The values were increased by 30 percent to adjust for truncation of the sample to day-use.

Roberts et al. (1985) used iterative CVM questions in telephone interviews with scuba divers who swim in the Gulf of Mexico off the coast of Louisiana. The study estimated the value associated with off-shore oil platforms as sites for underwater fishing. Participants took 5.7 trips per year and 55 percent reported spear fishing. Method of payment was the purchase of an annual pass. The average value of scuba diving was estimated as $36 per day. The study is important because underwater use of lakes in the national forests is a growing recreation activity.

Sutherland (1980) used a zonal TCM model to estimate a regional demand model for swimming in the northwestern states of Idaho, Oregon, and Washington state. The primary purpose of the study was to estimate the effect of changes in water quality. The author adjusted for the effect of substitution but not for travel time. The average value of about $8 per day was increased by 30 percent to adjust for travel time. This is considered a conservative estimate resulting from a very low assumption as to travel cost.

Ward (1982) used the individual observation TCM to value water-based recreation on lakes and reservoirs of southeastern New Mexico. Swimming was an important activity in an extended summer season. The study adjusted for travel time and substitution effects. The average value was about $19, unadjusted

because sample restriction to nearby counties offset application of the individual observation approach.

Martin et al. (1974) used the individual observation TCM to estimate the value of swimming as a part of general outdoor recreation in rural Arizona. The study adjusted for travel time and substitution. The sample was restricted to instate users which is not expected to bias the results for an activity such as swimming which tends to occur close to home. The value was $33 adjusted by 15 percent to account for the use of the individual observation approach.

In Florida, Gibbs (1974) ran a variant of the individual observation TCM for water-based lake and stream recreation. Swimming was an important recreation activity year around. The study was unusual because it used cost per day on site as the price variable. The value derived was for 2-day trips. The value was $25 per day adjusted by 15 percent for the individual observation approach.

Kalter and Gosse (1969) used the zonal TCM to estimate the value of swimming in New York state. Data were from the Bureau of Outdoor Recreation national household survey. The study did not adjust for travel time or substitution. The high average value of $43 reflects the upward adjustment for inflation and a 30 percent increase for omission of travel time.

Grubb and Goodwin (1968) used the zonal TCM to derive a regional demand function for swimming at reservoirs in Texas. Adjustments were made for substitutes but not for travel time. Average value was $17 per day increased by 30 percent for the omission of travel time.

MECHANICAL TRAVEL AND VIEWING

Very few studies (11) have been published on the demand for mechanical travel and viewing scenery although it is the largest recreation activity in the U.S. and accounts for over 30 percent Forest Service output. Table 9 shows

that the average value of sightseeing and offroad driving is about $21 and ranged from $11 for driving offroad vehicles to $32 for sightseeing in a National Park. Thus far, the study sites have been located in western states. There is a need for further research in other regions. Table 10 shows that the average value of motorized boating is $31 per day. Appendix A lists the numerous other recreation activities in this category; for example, bicycle, motorcycle, train, bus, tour boat, aircraft, and aerial tram travel. Future research should address the demand for these types of recreation activity.

SIGHTSEEING AND OFFROAD DRIVING

Johnson and Walsh (1987) used iterative CVM questions to estimate the sightseeing value of trips to Blue Mesa Reservoir in southern Colorado. Net benefits of trips with the primary purpose of fishing were reported as $126 per person, about 14 percent of which was attributed to the value of sightseeing during the 12 hours roundtrip travel time. The average value of sightseeing was $18 per day.

Walsh et al. (1987) applied the CVM to estimate the value of pleasure driving in a study of trips to scenic rivers in the Colorado Rocky Mountains. The average was $10 per activity day for weekend trips averaging about 2.9 hours to travel 130 miles one-way at 45 miles per hour on mountain roads. Separate demand curves for pleasure driving were estimated for three types of trips: single-day, weekend, and vacation. Demand curves shifted with income, age, price of substitutes, and changes in the quality of scenery along the route.

Duffield (1984) applied a zonal TCM to estimate the value of sighteeing visits to Kootenai Falls in northwestern Montana. Data were from onsite interviews with single-destination and multi-destination users. The study adjusted for substitution but not travel time, based on response to questions

Table 9. Sightseeing and Offroad Driving Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Sightseeing			
Johnson & Walsh (1987) Colorado 1986 CVM	17.48	18.00	18.00
Walsh, Sanders, & McKean (1987) Colorado 1983 CVM	9.10	10.33	10.33
Duffield (1984) Montana 1981 TCM	17.10	21.44	21.44
Haspel & Johnson (1982) Arizona, Utah 1980 CVM	23.14	31.84	31.84
Haspel & Johnson (1982) Arizona, Utah 1980 TCM	21.43	29.49	29.49
Offroad Driving			
Walsh and Olienyk (1981) Colorado 1980 CVM	6.45	8.88	10.66
Average total value	15.78	20.00	20.29
1983-1988 (3)	14.56	16.59	16.59
1968-1982 (3)	17.00	23.40	24.00

addressing these issues. The unadjusted average value was estimated as $21 per day, based on a log-linear specification of the demand function for single-destination trips.

Haspel and Johnson (1982) compared the zonal TCM and CVM approaches to estimating the value of sightseeing vacation trips to Bryce Canyon National Park. The mail survey provided data on both residents and nonresidents who visited the park. The study adjusted for travel time and substitutes. Also, the authors illustrated how to allocate travel costs on multiple-site vacation trips. The CVM question asked auto drivers the maximum number of additional miles they would be willing to drive to visit the park. Sightseeing values of about $30 per activity day for TCM and $32 for CVM were not significantly different, lending credance to the comparability of the two methods.

Walsh and Olienyk (1981) applied the CVM to estimate the value of off-road vehicle driving in front range national forests of Colorado. The value of driving off-road vehicles was about $11 per activity day averaging 4.2 hours. The study utilized on-site interviews and iterative bidding. The method of payment was added trip costs. The value was adjusted by 20 percent to convert reported total trip values to on-site activity.

BOATING, MOTORIZED

Wade et al. (1988) used a zonal TCM model to estimate a regional demand function for motorized boating at Havasu reservoir in Arizona and at 12 reservoirs in California. The study adjusted for travel time and substitution. The value of boating and related recreation use was estimated at $37 per day at Havasu reservoir. The Arizona site was unique for a number of reasons including reconstruction of the original London Bridge. The value was more than $34 per day for boating use of reservoirs in Southern California compared

Table 10. Motorized Boating Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Wade et al. (1988) Arizona 1985 TCM	34.64	36.61	36.61
Wade et al. (1988) California 1985 TCM	24.28	25.67	25.67
Ward (1982) New Mexico 1978	11.39	18.60	18.60
Sutherland (1980) Oregon, Washington 1979 TCM	4.24	6.36	8.27
Kalter and Gosse (1969) New York 1965 TCM	15.14	52.81	68.65
Average total value 1983-1988 (2) 1968-1982 (3)	17.94 29.46 10.26	28.01 31.14 25.92	31.56 31.14 31.84

to $17 for reservoirs elsewhere in the state. Elasticity of demand with respect to travel cost was reported as -.54.

Ward (1982) used the individual observation TCM in a study of motorized boating at reservoirs in southeastern New Mexico. He adjusted for travel time and substitution; however, the survey of households was restricted to neighboring counties. The value was $19 per day. An increase of 15 percent to account for useage by residents of more distant counties including some out-of-state, would be offset by a decrease of 15 percent to make the individual observation TCM more nearly comparable to the zonal TCM.

Sutherland (1980) used a zonal TCM to estimate a regional demand function for motorized boating in Oregon and Washington. The study adjusted for the effect of substitutes but not for travel time. The reported value was increased by 30 percent to $8 to adjust for the omission of travel time.

Kalter and Gosse (1969) used a zonal TCM in a study of motorized boating in the state of New York. The study adjusted for the effect of substitutes but not for travel time. The high average value of $69 reflects the upward adjustment for inflation and a 30 percent increase for omission of travel time.

HIKING, HORSEBACK RIDING, AND WATER TRAVEL

There have been 17 benefit estimates for hiking and nonmotorized boating such as rafting, kayaking, and canoeing. However, there apparently have been no studies of the demand for horseback riding. The activities account for about 6 percent of the studies and 9 percent of Forest Service output. Table 11 and 12 show that the average value of hiking is $29 per day and nonmotorized boating, $49. The high average value for nonmotorized boating is affected by inclusion of unique sites such as the Grand Canyon and Middle Fork of the Salmon river, the first designated wild and scenic river.

HIKING

Rosenthal and Walsh (1986) applied the CVM to onsite interviews with hikers and backpackers in motorized zones of the Arapaho-Roosevelt National Forest in Northern Colorado. The method of payment was direct trip costs and the value question was iterative. The continued availability of substitutes outside of the National Forest without added payment was made clear by the interviewers. The reported value was $24 per RVD in the motorized zone located less than one-half mile from a road.

Walsh and Olienyk (1981) used an onsite interative CVM to estimate the value of hiking and backpacking at five sites in national forests located along the Front Range of the Rocky Mountains. Values of about $16 were virtually identical per 4-hour hiking day and 5.6 hour backpacking day. The values were increased by 20 percent to adjust reported total trip values for time onsite.

Walsh et al. (1980a) reported hiking and backpacking values associated with high mountain reservoirs in national forests along the Front Range of Colorado. Recreation use was primarily hiking and backpacking with some picnicking and fishing reported. The authors used a noniterative open-ended CVM question in onsite interviews. The average value was about $22 per day.

Brown and Plummer (1979) estimated the value of hiking and backpacking in western Washington. They used a hedonic TCM that did not adjust for travel time. The value of $23 was increased by 30 percent to adjust for the omission of travel time.

Martin et al. (1974) estimated the value of hiking as the second most important general outdoor recreation in rural areas of Arizona. The authors applied the individual observation TCM to household trips. There were an average of 3.4 persons per household. The study adjusted for travel time and tested for the effect of substitutes. The value per activity day was $33 after

Table 11. Hiking Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Rosenthal & Walsh (1986) Colorado 1981 CVM	19.45	24.39	24.39
Walsh & Olienyk (1981) Colorado 1980 CVM	9.51	13.09	15.71
Walsh et al. (1980a) Colorado 1978 CVM	13.72	22.41	22.41
Brown & Plummer (1979) Washington 1976 Hedonic	9.40	17.56	22.84
Martin et al. (1974) Arizona 1970 TCM	13.97	39.21	33.33
Kalter & Gosse (1969) New York 1965 TCM	16.00	55.81	55.81
Average total value 1983-1988 (1) 1968-1982 (5)	13.68 19.45 12.52	28.75 24.39 29.61	29.08 24.39 30.02

adjusting downward by 15 percent to account for the use of individual rather than zonal TCM. While the survey was restricted to Arizona residents, this may not result in a substantial underestimation of dollar values for national forest hiking. This is because hiking is a regional activity, at least given the national forest resource attractiveness in Arizona. Therefore, to be conservative, the value was not adjusted upward.

Kalter and Gosse (1969) estimated the value of hiking in New York state using the zonal TCM. Data were from the Bureau of Outdoor Recreation national household survey. The study did not adjust for travel time or substitutes. The updated value of $56 was not adjusted for omission of travel time since the upward adjustment for inflation since 1965 results in a very high estimate.

BOATING, NONMOTORIZED

The Boyle et al. (1988) Grand Canyon study used a CVM dichotomous choice format in a mail survey of whitewater rafters on single-day and multiple-day trips on the Colorado river. Both instate and out-of-state users were included in the sample. The purpose of the study was to estimate the effect of varying instream flow to increase hydro electric power production at Glen Canyon dam. With average annual instream flow, willingness to pay by individuals on single-day trips was $27 compared to $99 per day on multiple-day rafting and camping trips. The high value reflects the fact that for most multi-day participants, this was a once-in-a-lifetime whitewater rafting experience of outstanding scenery in Glen Canyon.

Klemperer et al. (1984) applied the individual observation TCM to whitewater boating in the Chattooga river located on the border between northeastern Georgia and northwestern South Carolina. The study adjusted for travel time and substitution. The sample was truncated at 400 miles which included 90 percent of total use. The authors tested for the effect on values

Table 12. Nonmotorized Boating Literature Review and Value Estimates, 1987

Author Study location Date of survey Method, Activity	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Boyle et al. (1988) Arizona 1985 CVM Rafting, single-day	26.00	27.48	27.48
Boyle et al. (1988) Arizona 1985 CVM Rafting, multiple-day	94.12	99.48	99.48
Klemperer (1984) Georgia, South Carolina 1979 TCM Rafting	7.55	11.33	11.33
Rosenthal & Cordell (1984) Delaware 1979 TCM Canoeing	8.40	10.26	10.26
Rosenthal & Cordell (1984) Idaho 1979 TCM Rafting, Kayaking	49.75	74.63	74.63
Keith et al. (1982) Arizona 1981 TCM Tubing	23.79	29.83	25.36
Walsh et al. (1980b) Colorado 1978 CVM Kayaking	12.65	20.66	20.66
Walsh et al. (1980b) Colorado 1978 CVM Rafting	10.94	17.87	17.87
Bowes & Loomis (1980) Utah 1978 TCM Rafting, Kayaking	19.00	31.03	40.34

Table 12. Nonmotorized Boating Literature Review and Value Estimates, 1987 (Continued....)

Author Study location Date of survey Method, Activity	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Michaleson (1977) Idaho 1969, 1971 TCM Rafting	10.36	29.08	24.72
Michaleson (1977) Idaho 1969, 1971 TCM Rafting, Kayaking	76.85	215.72	183.36
Average total value	30.86	51.58	48.68
1983-1988 (5)	37.16	44.64	44.64
1968-1982 (6)	25.60	57.37	52.05

of the relative difficulty of the rapids. The average value of $11 per day was not adjusted because of offsetting effects of sample truncation and use of the individual observation approach.

Rosenthal and Cordell (1984) applied a zonal TCM to the National River Recreation data base for canoeing the Upper Delaware river in Delaware and rafting or kayaking the Middle Fork of the Salmon river in Idaho. The study adjusted for travel time but not for substitutes. The Middle Fork is a wild and scenic river serving a national market while the Upper Delaware, which is also scenic, serves a local market, primarily the New York metropolitan area. The value of canoeing was estimated as $10 per day on the Upper Delaware compared to $75 for rafting or kayaking the Middle Fork of the Salmon river.

Keith et al. (1982) used the individual observation TCM to estimate the value of recreational inner tube floating on the Salt River in northern Arizona. The put-in point is on Forest Service land. Data were collected onsite and the study adjusted for travel time and substitution. The average value of $25 per day was adjusted downward by 15 percent to account for use of the individual observation TCM.

Walsh et al. (1980b) used an open-ended CVM to estimate the value of kayaking and rafting on the Colorado, Crystal, Roaring Fork, and Yampa rivers in western Colorado. The willingness to pay questions were asked in the context of added travel costs. The reported average values, adjusted for mean instream flow and congestion levels, were $18 for rafting and $21 for kayaking an average of 4.2 hours per day.

Bowes and Loomis (1980) applied a zonal TCM to estimate the value of whitewater rafting, kayaking, and floating at the Westwater Canyon of the Colorado River in eastern Utah. Data were from trip permits rather than

personal interviews. Average value was $40 adjusted by 30 percent for the omission of travel time.

Michaleson (1977) applied an individual observation TCM to the problem of estimating the value of whitewater rafting in Idaho. The study adjusted for travel time. The updated value of rafting the Middle Fork of the Salmon River was $183 per day. While this is a very high estimate, the river is renowned as the first wild and scenic river designated in the United States. For other rivers in the state, the value was $25 per day. Values were reduced by 15 percent for use of the individual observation approach.

WINTER SPORTS

Very few studies have been completed of the demand for winter sports such as downhill skiing, cross-country skiing, and snowmobiling. These activities account for 4.2 percent of the benefit estimates compared to 6.5 percent of Forest Service output. Table 13 shows average values of about $29 per day ranging from $16 for cross-country skiing in a National Forest to $46 for downhill skiing at Aspen, one of the foremost winter resorts with leased Forest Service land. Thus far, nearly all of the study sites are located in the Rocky Mountains. There is a need for further research in other regions particularly the west coast, lake states, and northeast. Appendix A lists several other recreation activities in this use category; for example, ice skating, sledding, tobogganing, tubing, snow sculpture, snow-balling, and snowshoeing. Future research should address the demand for these types of recreation activity.

Gilbert et al. (1988) applied the dichotomous choice CVM to compare the value of cross-country skiing in Colorado and Vermont. The method of payment was additional trip costs including transportation, trail fees, etc. Results were based on 239 interviews in Vermont and 577 interviews in Colorado.

Table 13. Winter Sports Literature Review and Value Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Downhill Skiing			
Morey (1985) Colorado 1968 TCM	4.45	13.92	16.01
Walsh, et al. (1983) Colorado 1980 CVM	24.30	33.44	33.44
Walsh & Davitt (1983) Colorado 1978 TCM	24.33	39.73	45.69
Cross-country Skiing			
Gilbert, et al. (1988) Vermont 1986 CVM	21.12	21.75	21.75
Gilbert, et al. (1988) Colorado, Vail Pass 1986 CVM	28.38	29.23	29.23
Gilbert, et al. (1988) Colorado, Cameron Pass 1986 CVM	21.03	21.66	21.66
Gilbert, et al. (1988) Colorado, Brainard Lake 1986 CVM	10.94	11.27	11.27
Gilbert, et al. (1988) Colorado, Rocky Mtn NP 1986 CVM	26.23	27.02	27.02
Walsh, et al. (1984) Colorado 1980 CVM	12.50	17.20	17.20
Keith (1980; 1983) Utah 1978 TCM	10.00	16.33	16.33
Cicchetti, et al. (1976) California 1972 TCM	12.25	31.05	35.71
Snowmobiling			
Keith (1978; 1983) Utah 1976 TCM	42.00	78.46	66.69
Average total value (12)	19.79	28.42	28.50
1968-1982 (1)	12.25	31.05	35.71
1983-1988 (11)	20.48	28.18	27.84

Single-day trip values in Vermont averaged $22 per day and ranged from $16 per day at the von Trapp Family Center to $16 at Catamount and Williston, to $34 at Mountain Top and Chittendon in or near Green Mountain Forest. Single-day trip values averaged $21 in Colorado, including $11 at Brainard Lake, $22 at Cameron Pass, $27 in Rocky Mountain National Park, and $29 at Vail Pass.

Morey (1985) used a variation of the TCM in a regional demand analysis of a proposed new downhill ski area in Colorado. The multinomial logit analysis relied on a sample of 163 college students at 11 instate universities taking 1,453 trips to 15 instate ski areas per year. The study assumed that ski trips by college students were exclusively single-day with travel by private auto. A unique feature of the study was the specification of travel cost as travel and onsite time valued at the minimum wage rate. The author reported that the physical characteristics of the site, the skiing ability of individual students, and the opportunity cost in terms of an individual's time valued at minimum wage rate accounted for 57 percent of the variation in proportion of trips to each of the 15 ski sites. The regional study adjusted for substitutes. The estimated equivalent variation measure of consumer surplus to college students associated with development of the new ski area was $16 per day. The value was increased by 15 percent to adjust for truncation of the sample to instate students.

Walsh et al. (1983) applied the iterative CVM in onsite interviews with downhill skiers at a small (Loveland), medium (Copper Mountain), and large (Vail) ski resort in Colorado. Values increased with size of ski area which tends to be related to the quality variable, length of run. The method of payment was additional trip costs. Average value was $33 per activity day of five hours. Willingness to pay was inversely related to level of congestion in lift lines and on the slopes.

In a closely related study, Walsh and Davitt (1983) applied the individual observation TCM in a study of visitors to Aspen for the primary purpose of downhill skiing. Residents of the county who ski were not interviewed. The dependent variable in the demand function was the number of days per trip. The number of trips averaged only 1.3 per year, so the primary decision was how many days to stay on a single trip. The study adjusted for substitution but not for travel time because of lack of appreciable variation among respondents who traveled primarily by plane. The logarithmic functional form indicated an elasticity of demand with respect to travel cost of -.73. The average value of $46 per activity day was reduced by 15 percent to adjust for use of the individual observation approach and increased by 30 percent for omission of travel time.

Walsh et al. (1984) used the iterative CVM in onsite interviews with cross-country skiers at a private concessioner (roaded natural) and public (nonroaded) site in Roosevelt National Forest, Colorado. The method of payment was additional trip costs. Values at the two sites averaged $17 per activity day of four hours. Values were about $4 higher in the roaded natural zone with convenient urban services for winter recreation use. These included a warming hut, food and beverages, ski rental, ski lessons, trail grooming, and regular patrol.

Keith (1978; 1983) used the individual observation TCM to estimate the value of snowmobiling in Utah. The study adjusted for travel time and substitutes. The average value of $67 per day was adjusted by 15 percent for use of the individual observation approach.

In a closely related study, Keith (1980; 1983) used the individual observation TCM to estimate the value of cross-country skiing in the Cache Valley of Utah. Data were obtained from diaries kept by 28 participants who

reported a total of 200 trips per year. The sample may not be representative as it was constrained to primarily Utah State University students and faculty. The primary purpose of the study was to estimate the effects of congestion resulting from the presence of snomobilers, and concluded that the effect was relatively small. The average value of cross-country skiing was $16 per day. The value was not adjusted because the 15 percent decrease for use of the individual observation approach was offset by a 15 percent increase for truncation of the sample.

Cicchetti, et al. (1976) used a variation of the zonal TCM in a regional demand analysis of the proposed Disney development of Mineral King ski area in California. The regional model adjusted for substitution effects in the form of skiers drawn from existing ski areas. The study assumed first year utilization at 55 percent of capacity during a 20-week season, travel cost of 4.4 cents per mile and travel time valued at $3 per hour. On this basis, the average value of skiing at the proposed site was estimated as approximately $36 per day. The value was increased by 15 percent to adjust for truncation of the sample to instate users.

RESORTS, CABINS, AND ORGANIZED CAMPS

Thus far, the only estimate of the value of resorts, cabins, and organized camping activities are from a single study in the Rocky Mountains. With 6.7 percent of the total recreation use of the National Forests (identical to hunting) the category accounts for less than 1 percent (0.7) of the benefit estimates. Table 14 shows an average value of $20 per day for staying at resorts and about $3 per day for staying in mountain homes, both seasonal and year-around. There is a need for further research in other regions of the United States. Appendix A lists several other activities in this recreation use category; for example, organized camps and commercial public services such

Table 14. Resorts, Cabins, and Organized Camps Literature Review and Value Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Resorts			
Walsh & Olienyk (1981) Colorado 1980 CVM	12.07	16.61	19.93
Cabins			
Walsh & Olienyk (1981) Colorado 1980 CVM	2.84	3.91	3.91

as hotels, stores, restaurants, etc. Perhaps the latter activities are more properly classified as indoor recreation.

Walsh and Olienyk (1981) applied the CVM in onsite interviews with visitors to resorts in or adjacent to the Arapaho, Roosevelt, Pike, and Isabel National Forests along the front range of Colorado. The method of payment was additional trip cost and value questions were asked using the iterative procedure. The average value of $20 per day was adjusted to convert reported total trip values to onsite activity days.

In the same study, Walsh and Olienyk (1981) applied the CVM in onsite interviews with residents of cabins in or adjacent to the same National Forests in Colorado. Homeowners reported total direct costs and total willingness to pay per month, which was divided by number of persons and 30 days. Roundtrip travel costs (averaging 381 miles one-way) were included for seasonal mountain homeowners and commuting travel costs for year-around residents. Net value per activity day averaged about $4 per person.

HUNTING

Hunting has the distinction of having more studies of recreation demand with nonmarket benefit estimates than any other recreation use category except fishing. With only 6.7 percent of total recreation use of the National Forests, hunting accounts for nearly 29 percent of the benefit estimates. Tables 15 and 16 show the average value of big game hunting as $45 per day compared to $31 for small game hunting. This compares to an average value of $36 per day for waterfowl hunting shown in Table 17. The available studies suggest that the value of hunting may have declined in recent years, but still exceeds the value of most outdoor recreation activities by a substantial amount. Appendix A lists other recreation activities in this recreation use category such as upland bird hunting and trapping. A number of small game

hunting studies include upland birds, but no studies have been made of trapping which may not be an outdoor recreation activity.

BIG GAME HUNTING

Brooks (1988) used a regional TCM to estimate the value of deer hunting in Montana. The analysis adjusted for both travel time and substitutes. The sample included both resident and nonresident licence holders. The average net value ranged from $22 per day for standard travel costs to $57 per day with travel costs reported by the individual hunters.

Duffield (1988) applied a regional TCM to estimate the value of elk hunting in Montana. The sample included both resident and nonresident license holders. The study adjusted for travel time and substitutes. Average values ranged from $28 per day for standard travel costs to $68 per day for reported travel costs.

Loomis and Cooper (1988) applied a regional TCM to estimate the value of antelope hunting in Montana. The sample included both resident and nonresident license holders. The study adjusted for travel time and substitutes. Average values ranged from $37 per day for standard travel costs to $64 per day for reported travel costs.

Hay (1988) reported the result of a CVM study of deer and elk hunting by residents of each state. Data were obtained from the 1985 national survey of fishing and hunting which included interative willingness to pay questions but not a protest question. The values were adjusted to delete zero bids and those over $130 per day as outlyers to leave a core of reasonable values. The state values were converted to regional values weighted on the basis of population 16 years of age and older and the proportion participating in big game hunting. The eight Forest Service regional values ranged from $28 to $46 per day of deer

Table 15. Big Game Hunting Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Brooks (1988) Montana 1986 TCM Deer	20.88	21.51	21.51
Brooks (1988) Montana 1986 TCM Deer	54.94	56.59	56.59
Duffield (1988) Montana 1986 TCM Elk	26.90	27.71	27.71
Duffield (1988) Montana 1986 TCM Elk	66.06	68.04	68.04
Loomis & Cooper (1988) Montana 1986 TCM Antelope	35.78	36.85	36.85
Loomis & Cooper (1988) Montana 1986 TCM Antelope	62.03	63.89	63.89
Hay (1988) Deer			
Northern	26.04	27.52	27.52
Rocky Mountain	32.22	34.06	34.06
Southwestern	43.07	45.53	45.53
Intermountain	39.45	41.70	41.70
Pacific Southwest	42.00	44.39	44.39
Pacific Northwest	29.33	31.00	31.00
Southern	31.63	33.43	33.43
Eastern	30.40	32.13	32.13
Hay (1988) Elk			
Montana	30.00	31.71	31.71
Colorado	40.00	42.28	42.28
Wyoming	48.00	50.74	50.74
Idaho	33.00	34.88	34.88
Utah	41.00	43.34	43.34
Oregon	27.00	28.54	28.54
Washington	48.00	50.74	50.74
McCollum et al. (1988) Wisconsin 1984 TCM Deer	40.04	43.76	43.76
McCollum et al. (1988) Wisconsin 1984 TCM Deer	42.80	46.78	46.78
Bishop et al. (1988) Wisconsin 1983 CVM Deer	43.00	48.81	48.81
Bishop et al. (1988) Wisconsin 1983 Cash Deer	19.00	21.57	21.57
Brown & Hay (1987) U.S. 1980 CVM Deer	19.00	26.14	26.14
Donnelly & Nelson (1986) Idaho 1983 CVM Deer	19.18	21.77	21.77

Table 15. Big Game Hunting Literature Review and Benefit Estimate, 1987 (Continued...)

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Donnelly & Nelson (1986) Idaho 1982 TCM Deer	26.86	31.67	31.67
Sorg & Nelson (1986) Idaho 1982 TCM Elk	35.18	41.48	41.48
Sorg & Nelson (1986) Idaho 1983 CVM Elk	22.57	25.62	25.62
Corey & Martin (1985) Arizona 1981 CVM Elk	29.40	36.87	36.87
Heberlein & Bishop (1985) Wisconsin 1984 Cash Deer	25.00	27.33	27.33
Heberlein & Bishop (1985) Wisconsin 1984 CVM Deer	31.00	33.88	33.88
Loomis et al. (1985) Idaho 1982 TCM Mountain Goat	90.00	106.11	106.11
Loomis et al. (1985) Idaho 1982 TCM Bighorn Sheep	27.80	32.78	32.78
Loomis et al. (1985) Idaho 1982 TCM Moose	19.12	22.54	25.92
Loomis et al. (1985) Idaho 1982 TCM Antelope	35.58	41.95	41.95
Miller (1984) Louisiana 1980 TCM Deer	67.00	92.19	78.36
Miller & Hay (1984) Pennsylvania 1980 TCM Deer	35.00	48.16	40.94
Wilman (1984) South Dakota 1980 H-P Deer	14.40	19.81	19.81
Wilman (1984) South Dakota 1980 H-P Deer	26.90	37.01	37.01
Loomis (1982a) Utah 1979 TCM Antelope	13.80	20.70	23.81
Fisher (1982) Pennsylvania 1975 TCM Deer	80.00	159.04	135.18

Table 15. Big Game Hunting Literature Review and Benefit Estimate, 1987 (Continued...)

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Bell (1981) Louisiana 1975 All hedonic	14.60	29.02	37.72
Miller (1980) Colorado 1974 TCM Deer	65.23	142.40	142.40
Miller (1980) Colorado 1974 CVM Deer	9.11	19.89	22.87
Brown & Plummer (1979) Oregon 1976 All hedonic	38.14	71.25	92.63
Brown & Plummer (1979) Idaho 1976 All hedonic	32.73	61.14	79.48
Charbonneau and Hay (1978) United States 1975 CVM Big game	64.00	127.23	89.06
Hansen (1977) Intermountain 1975 CVM Elk	22.63	44.99	44.99
Hansen (1977) Intermountain 1975 CVM Antelope	11.70	23.26	23.26
Hansen (1977) Intermountain 1975 CVM Deer	20.55	40.85	40.85
Martin et al. (1974) Arizona 1970 TCM Deer	18.54	52.04	52.04
Martin et al. (1974) Arizona 1970 TCM Other	20.15	56.56	56.56
Wennergren et al. (1973) Utah 1970 TCM Deer	9.34	26.22	38.02
Brown et al. (1973) Oregon 1968 TCM All	9.20	28.77	28.77
Average total value (56)	36.65	45.65	45.41
1983-1988 (41)	36.01	40.31	39.88
1968-1982 (15)	28.65	60.22	60.51

hunting. The seven state values ranged from $29 to $51 per day for elk hunting.

McCollum et al. (1988) compared the effectiveness of a logit probabilistic TCM to the traditional zonal TCM to estimate the value of deer hunting at the Sand Hills preserve in Wisconsin. The study illustrated the effect of adjusted for travel time valued at zero, 10 percent, 20 percent, 33 percent, 50 percent, 60 percent, and 100 percent of the wage rate. Since hunters were successful drawing a special deer hunting permit for access to the fenced experimental site, a substitution variable was not included in the demand functions. With travel time valued at 33 percent of the wage rate, the results were nearly identical, with an average value of $44 per day for the probabilistic approach and $47 per day for the traditional zonal method.

Bishop et al. (1988) reported on a 1983 survey of the value of deer hunting at the San Hills preserve in Wisconsin. The study compared several methods including a CVM dichotomous choice question and actual cash payment in a sealed bid auction. Each method derived a value of access to the fenced experimental site and the right to shoot one deer by purchasing a special deer hunting permit. An average value of $49 per day was reported by a subsample asked a dichotomous choice question. A second subsample paid $22 per day in actual cash to obtain a deer hunting permit.

Brown and Hay (1987) used the CVM to estimate the average value of deer hunting in the United States. The 1980 national survey of fishing and hunting included a willingness to pay question on deer hunting. Zero bids and bids over $100 per day were deleted from the study. The average U.S. value was estimated as $26 per day.

A regional TCM and iterative CVM were used by Donnelly and Nelson (1986) to estimate the value of deer hunting in Idaho. The TCM was adjusted for

substitutes and travel time. The data were collected from a survey of both residents and nonresidents. Average values were $22 per day for the CVM compared to $32 for the TCM.

Sorg and Nelson (1986) used both a regional TCM and iterative bidding CVM to estimate the value of elk hunting in Idaho. The authors adjusted the TCM for both substitutes and travel time. The data were collected from a survey of both residents and nonresidents. The CVM value was $26 per day compared to $41 for the TCM.

Corey and Martin (1985) used open-ended CVM questions to estimate the value of elk hunting in the Apache Sitgreaves Forest, Arizona. Data were collected by mail from a sample of elk license holders. The purpose of the study was to evaluate the trade-off in multiple-use of forage by cattle and elk. Values were reported per trip. Assuming an average of two days per trip, the value of elk hunting was $37 per day for the late rifle season.

Heberlein and Bishop (1985) valued deer hunting at the Sand Hills preserve in Wisconsin. The study compared several methods including stated willingness to pay and actual cash payment. Each method derived a value of access to the site by purchasing a special deer hunting permit. The average CVM value of $34 was reported by a subsample asked a dichotomous choice question. A second subsample paid $27 in actual cash to obtain a deer hunting permit. The results are consistent with the hypothesis that CVM willingness to pay values closely approximate actual payment.

Loomis et al. (1985) used a regional TCM to estimate the value of hunting in Idaho for several unique species including bighorn sheep, mountain goat, and moose. It was reported that no substitute sites were available in Idaho for these species. In the case of moose hunting, state regulations excluded out-of-state hunters. Thus the moose hunting value of $26 is understated.

Nonresidents were included in the bighorn sheep hunting value of $33, antelope hunting $42, and mountain goat hunting $106. These values for hunting unique species should not be considered indicative of general big game hunting values in Idaho or other states.

Miller (1984) used an individual observation TCM to estimate the value for big game hunting in the bottomland hardwoods of Louisiana. Data were obtained from the 1980 National Survey of Fishing and Hunting. The study adjusted for the value of travel time but not substitutes. The average value of $78 per day was adjusted by 15 percent for use of the individual observation approach.

Data from the 1980 national survey of fishing and hunting was used by Miller and Hay (1984) to estimate the value of big game hunting in Pennsylvania. The authors adjusted for travel time but not for substitutes. The average value of $41 per day was adjusted by 15 percent for the individual observation approach.

Wilman (1984) applied the household production approach to estimate the value of deer hunting in the Black Hills National Forest, South Dakota. The purpose of the study was to predict the effects of improved forest management for deer habitat. For example, the value of deer hunting by residents of Custer were estimated as $20 to $37 per day without and $34 to $54 with the improved forestry practices. The without values are reported here.

Loomis (1982a) used a zonal TCM to estimate the value of antelope hunting in Utah. The data available was limited to instate users. The study adjusted for travel time but not for substitute sites. Average value was $24 per visitor day, adjusted by 15 percent to account for nonresident use. The author suggested that the value may be an underestimate based on use of the linear function form.

Utilizing the individual observation TCM, Fisher (1982) estimated the value of deer hunting in Pennsylvania. The study adjusted for travel time but not substitute sites. Average value was estimated as $135 per day, even decreased by 15 percent for use of the individual observation approach. This value seems extremely high, but at the time of the study, the annual deer harvest in Pennsylvania was higher than in any other state.

Bell (1981) used the hedonic method to value big game hunting in southcentral Louisiana along the Atchafalaya River Basin. Data were from the 1975 National Survey of Hunting and Fishing and the Atchafalaya Basin users survey. The study did not adjust for travel time or substitute sites. Average value of $38 per day was increased by 30 percent to adjust for the omission of travel time.

Miller (1980) estimated the value of deer hunting in Colorado using both individual observation TCM and noniterative open-ended CVM. The study derived separate values for resident and nonresident rifle hunting, resident sportsman hunting, muzzle-loading rifle hunting, and archery hunting. The TCM and CVM values reported here are for resident rifle hunting. Muzzle-loading and archery licenses represent a very small portion of total hunting. The study used a mail questionnaire sent to a random sample of license holders. The TCM study adjusted for travel time but not substitutes. The CVM value represented willingness to pay additional costs for access to hunting areas. The CVM value was $23 compared to $142 for the TCM. Both values were increased by 15 percent because of the instate sample, and the TCM value was reduced by 15 percent to adjust for the individual observation approach.

Brown and Plummer (1979) used a modified hedonic TCM to estimate the value of big game hunting in Idaho. The study did not adjust for travel time or substitutes. Average value was $79 per activity day. The authors also used

the hedonic TCM to estimate the value of big game hunting in western Oregon. Average value was $69 per activity day. Both state values were increased by 30 percent to adjust for travel time.

Charbonneau and Hay (1978) reported the results of a CVM study of big game hunting in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individual hunters were asked to value their favorite and second favorite hunting and fishing activities. Because the value of big game hunting was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect big game hunting values (Miller, 1980). The average value was $89 per day.

Hansen (1977) utilized the CVM to estimate the value of deer, antelope, and elk hunting in the Intermountain Region. Data were from the 1975 National Survey of Hunting and Fishing. The mail survey question was noniterative, open-ended. Respondents were asked how much more they would be willing to spend before not engaging in the particular hunting activity in question. The average value of deer hunting was $41, antelope hunting at $23, and elk hunting at $45 per day.

The individual observation TCM was used by Martin et al. (1974) to estimate the value of big game hunting in Arizona. They reported a value for deer hunting and a value for all other big game hunting. The study adjusted for travel time and substitute sites. Data were collected from instate user households. The value of deer hunting was $52 per day and other big game hunting was $57 per day. The increase in 15 percent for instate sampling was offset by a 15 percent decrease for use of the individual observation approach.

Wennergren et al. (1973) used the zonal TCM to estimate the value of deer hunting in Utah. Data were collected from an instate sample. The study did not adjust for travel time or substitutes. The Average value was $38 per day increased by 15 percent for the instate sample and 30 percent for omission of travel time.

Brown et al. (1973) used the individual observation TCM to value deer and elk hunting in Oregon. The study adjusted for travel time but not for substitute sites. It was based on instate mail sampling from a list of hunters supplied by the Oregon State Game Commission. Average value was $29 per day. The increase in 15 percent for instate sampling was offset by a 15 percent decrease for use of the individual observation approach.

SMALL GAME HUNTING

Young et al. (1987) used a zonal TCM and an iterative bidding CVM to estimate the value of small game hunting in Idaho. The regional demand function adjusted for substitutes and travel time. The data were collected by phone from a sample of residents and nonresidents. The TCM value was $22 for hunting all small game species and $20 for pheasant. The CVM value was $25 per day.

Miller (1984) used the individual observation TCM to estimate the value for small game hunting in the bottomland hardwoods of Louisiana. The data were from the 1980 National Survey of Fishing and Hunting. The study adjusted for travel time but not for substitute sites. Average value of $19 per day was reduced by 15 percent to adjust for use of the individual observation approach.

Miller and Hay (1984) used data from the 1980 National Survey of Fishing and Hunting to estimate the value for small game hunting in South Dakota. An individual observation TCM approach was used. The authors adjusted for travel

Table 16. Small Game Hunting Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Young et al. (1987) Idaho 1982 TCM	19.02	22.42	22.42
Young et al. (1987) Idaho 1982 CVM	21.31	25.12	25.12
Miller (1984) Louisiana 1980 TCM	16.00	22.02	18.72
Miller & Hay (1984) South Dakota 1980 TCM	30.00	41.28	35.08
Bell (1981) Louisiana 1975 Hedonic	9.79	19.46	19.46
Brown & Plummer (1979) Idaho 1976 TCM	21.43	40.03	52.04
Charbonneau and Hay (1978) United States 1975 CVM	21.00	41.75	27.23
Hansen (1977) Intermountain 1975 CVM Small game	13.95	27.73	27.73
Hansen (1977) Intermountain 1975 CVM Upland birds	23.06	45.84	45.84
Martin et al. (1974) Arizona 1970 TCM	14.48	40.65	34.55
Average total value	19.00	32.63	30.82
1983-1988 (4)	21.58	27.71	25.34
1968-1982 (6)	17.29	35.91	34.48

time but not for substitutes. The value of $35 per day was reduced by 15 percent to adjust for use of the individual observation approach.

Bell (1981) utilized the Hedonic method to estimate small game hunting values for the southcentral portion of Louisiana. Data were from the 1975 National Survey of Hunting and Fishing along with the Atchafalaya Basin users survey. The study adjusted for substitutes and travel time. Average value was $19 per day.

Brown and Plummer (1979) used the zonal TCM in combination with the hedonic method to allow for better utilization of available data in a study of hunting in Idaho. Data was obtained from the 1976 Recreation Information Management System (RIM) and the 1976 RARE II analysis. The study did not adjust for travel time or substitutes. The average value of $52 per day was increased by 30 percent to adjust for the omission of travel time.

Charbonneau and Hay (1978) reported the results of a CVM study of small game hunting in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individual hunters were asked to value their favorite and second favorite hunting and fishing activities. Because the value was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect values (Miller, 1980). The average value was $27 per day.

Hansen (1977) reported the value of small game hunting in the Intermountain region including Utah, Idaho, Western Wyoming, and Nevada. The author obtained data from the 1975 National Survey of Hunting and Fishing. The survey used a noniterative open-ended CVM question. The average value was $28 per visitor day.

Hansen (1977) utlized the CVM to estimate a value for upland game hunting in the Intermountain region. Data were obtained from the 1975 National Survey of Hunting and Fishing. The value question was noniterative, open ended and the return rate was acceptable (30 percent) although lower than desired. The average value was $46 per day.

Martin et al. (1974) utilized the individual observation TCM to estimate the value of small game hunting in Arizona. Data collection was restricted to instate users which appears reasonable for this activity. The study adjusted for substitution and travel time. The statewide value was $35 per day, reduced by 15 percent to adjust for use of the individual observation TCM.

MIGRATORY WATERFOWL HUNTING

Hay (1988) reported the results of a CVM study of waterfowl hunting by residents of each state. Data were obtained from the 1985 national survey of fishing and hunting which included iterative willingness to pay questions but not a protest question. The results were adjusted to delete zero values and those over $130 per day. The reported state values were averaged to obtain regional values, weighted on the basis of population 16 years of age and older and the proportion participating in waterfowl hunting. The Forest Service regional values ranged from $17 to $37 per day.

Brown and Hay (1987) reported CVM estimates of the value of waterfowl hunting in the United States. The data came from the 1980 National Survey of Fishing and Hunting which included CVM questions on waterfowl hunting. The value question was open-ended non-iterative. The study deleted zero bids and bids over $100 per day. The average value was $18 per day.

Miller (1984) used the individual observation TCM to estimate the value of waterfowl hunting in the bottomland hardwoods of Louisiana. Data was obtained from the 1980 National Survey of Fishing and Hunting. The author adjusted for

Table 17. Waterfowl Hunting Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Hay (1988)			
Northern	15.69	16.58	16.58
Rocky Mountain	19.22	20.32	20.32
Intermountain	16.66	17.61	17.61
Pacific Southwest	35.00	37.00	37.00
Pacific Northwest	18.53	19.59	19.59
Southern	23.91	25.27	25.27
Eastern	21.21	22.42	22.42
Brown & Hay (1987) U.S. 1980 CVM	13.00	17.89	17.89
Miller (1984) Louisiana 1980 TCM	16.00	22.02	18.72
Bell (1981) Louisiana 1975 Hedonic	15.41	30.64	30.64
Bishop & Heberlein (1980) Wisconsin 1978 Cash	63.00	102.88	102.88
Bishop & Heberlein (1980) Wisconsin 1978 CVM	21.00	34.29	34.29
Bishop & Heberlein (1980) Wisconsin 1978 TCM	32.00	52.16	52.16
Charbonneau and Hay (1978) United States 1975 CVM	39.00	77.53	57.27
Hansen (1977) Intermountain 1975 CVM	20.12	40.00	40.00
Martin et al. (1974) Arizona 1970 TCM	6.41	17.99	17.99
Brown & Hammack (1972) Pacific Flyway 1968 CVM	25.00	78.18	78.18
Average total value	23.60	37.20	35.81
1983-1988 (9)	19.91	22.08	21.71
1968-1982 (8)	27.74	54.21	51.68

travel time but not substitutes. The average value was $19 per day, reduced by 15 percent to adjust for use of the individual observation approach.

Waterfowl hunting in a marsh area of southcentral Louisiana was valued by Bell (1981), using the Hedonic method. Data were from the 1975 National Survey of Hunting and Fishing and the 1975 Atchafalaya Basin users survey. The study adjusted for substitutes and travel time. The value was $31 per day.

Bishop and Heberlein (1980) compared several methods to value goose hunting at Horicon Marsh in Wisconsin. The actual cash payment accepted to give up a day of goose hunting was $103. The format involved checks from $1 to $200 sent to current holders of permits. They could either accept the check and give up the permit or vice versa. A second sample was asked their willingness to pay additional money for a permit. The dichotomous choice CVM question resulted in an average net willingness to pay of $34 per day. A third sample was asked questions which allowed implementing the zonal TCM. The TCM value was $52 per day with travel time valued at one-half of the wage rate.

Charbonneau and Hay (1978) reported the results of a CVM study of waterfowl hunting in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individual hunters were asked to value their favorite and second favorite hunting and fishing activities. Because the value was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect values (Miller, 1980). The average value was $57 per day.

An Intermountain Region value was derived by Hansen (1977) using the CVM. Data were obtained from the 1975 National Survey of Hunting and Fishing. The

mail survey contained noniterative open-ended questions. The value was $40 per day.

Using the individual observation TCM, Martin et al. (1974) estimated the value of waterfowl hunting in Arizona. The study adjusted for substitutes and travel time. The reported value per household trip was converted to a value of $18 per day. The value was not adjusted because the 15 percent increase for instate sample and 15 percent decrease for use of the individual observation approach were offsetting.

Brown and Hammack (1972) used the CVM to estimate the value for waterfowl hunting in the Pacific Flyway. The study used a mail, noniterative open-ended questionnaire. Respondents were asked willingness to pay additional costs during the waterfowl season. Average value was $78 per activity day.

FISHING

There have been more studies of fishing in the five-year period from 1983 to 1988 than during the previous 15 years, 1968 to 1982. With only 6.7 percent of total recreation use of the National Forests, fishing accounts for 30.7 percent of the benefit estiamtes. Tables 18, 19, 20 and 21 show the average value of cold water fishing as $31 per day and warm water fishing, $24, compared to anadromous fishing with a much higher $54, and salt water fishing nearly $72 per day. The later values are influenced by the high values for salmon fishing in the northwest and Alaska. Appendix A lists ice fishing as another recreation activity in this recreation use category and future research should address its demand.

COLD WATER FISHING

Two studies in Colorado utilized the CVM to measure the value of cold water fishing. Johnson and Walsh (1987; 1988) utilized iterative bidding

questions which asked willingness to pay additional trip costs. Average values reported were $19 at Blue Mesa reservoir where catch rate was high and $15 at the heavily fished Poudre River, where the catch rate was somewhat lower and the average size caught about three inches smaller. At Blue Mesa reservoir, values increased $0.95 per day per additional fish and $1.25 per day per additional inch. The river fishing value was increased by 15 percent to adjust for nonresident use.

Wade et al. (1988) applied the zonal TCM in a study of fishing at large reservoirs in California. A regional demand function was used and the study adjusted for travel time and substitute sites. The average value of cold water fishing was $19 per day at four reservoirs in northern California.

The Boyle et al. (1988) Grand Canyon study used a CVM dichotomous choice format. Willingness to pay for cold water fishing was estimated as $40 per day on the Colorado River in Arizona. The site is a trophy class fishery with outstanding scenery.

Duffield et al. (1987) used a regional TCM to estimate the value of cold water fishing in Montana. The zonal study adjusted for substitutes and travel time. An average value of $49 per day was reported for rivers and $34 for lakes. Although the values appear high compared to most states, many of the sites such as the Madison River at $79 per day and the Upper Yellowstone River at $103 per day are among the highest quality in the nation.

Brown and Hay (1987) used the 1980 national survey of fishing and hunting which included CVM data on cold water fishing. Zero bids and bids over $100 per day were deleted from the open-ended noniterative study. Average U.S. value was about $17 for trout fishing.

Fiore and Ward (1987) used the zonal TCM to estimate the value of fishing at Heron Reservoir in New Mexico. The study adjusted for travel time and

Table 18. Cold Water Fishing Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Johnson & Walsh (1988) Colorado 1986 CVM	13.01	13.40	15.41
Wade et al. (1988) California 1985 TCM	18.24	19.28	19.28
Boyle et al. (1988) Arizona 1985 CVM	37.60	39.74	39.74
Fiore & Ward (1987) New Mexico 1981 TCM	9.25	11.60	11.60
Johnson & Walsh (1987) Colorado 1986 CVM	18.83	19.39	19.39
Brown & Hay (1987) U.S. 1980 CVM	12.00	16.51	16.51
Talheim et al. (1987) Ontario, Canada 1980 TCM	17.00	23.39	23.39
Oster et al. (1987) Wyoming 1986 TCM	9.78	10.07	10.07
Duffield et al. (1987) Montana 1985 Lakes TCM	32.48	34.33	34.33
Duffield et al. (1987) Montana 1985 Streams TCM	47.86	50.59	50.59
Kealy & Bishop (1986) Wisconsin 1978 TCM	19.54	31.91	31.91
Richards et al. (1985) Arizona 1982-83 TCM	120.10	138.96	118.12
Mullen & Menz (1985) New York 1976 TCM	19.90	37.17	37.17
Sorg et al. (1985) Idaho 1982 CVM	15.63	18.43	18.43
Sorg et al. (1985) Idaho 1982 TCM	25.55	30.12	30.12
Miller & Hay (1984) Idaho Minnesota Arizona Maine Tennessee 1980 TCM	 27.00 29.00 35.00 23.00 30.00	 37.15 39.90 48.16 31.65 41.28	 37.15 39.90 48.16 31.65 41.28
Adamowicz & Phillips (1983) Alberta, Canada 1975-76 CVM	13.99	26.97	31.02

Table 18. Cold Water Fishing Literature Review and Benefit Estimate, 1987 (Continued...)

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Vaughn & Russell (1982) U.S. 1979 CVM	21.00	31.50	31.50
Vaughn & Russell (1982) U.S. 1979 TCM	15.23	22.85	22.85
Vaughn & Russell (1982) U.S. 1979 TCM	19.85	29.78	29.78
Weithman & Haas (1982) Missouri 1979 TCM	15.67	23.51	23.51
Walsh & Olienyk (1981) Colorado 1980 CVM	8.94	12.30	14.76
King & Walka (1980) Arizona 1980 TCM	9.30	12.80	14.72
USFWS (1980) Idaho 1980 CVM	12.93	17.79	17.79
USFWS (1980) U.S. 1980 CVM	14.50	19.95	19.95
Walsh et al. (1980a) Colorado 1978 CVM	10.90	17.80	17.80
Walsh et al. (1980b) Colorado 1978 CVM	10.53	17.20	17.20
Brown & Plummer (1979) Washington 1976 Hedonic	19.00	35.49	46.12
Brown & Plummer (1979) Oregon 1976 Hedonic	34.00	63.51	82.55
Charbonneau and Hay (1978) United States 1975 CVM	21.00	41.75	29.23
Hansen (1977) Intermountain Region 1975 CVM	9.76	19.40	19.40
Martin et al. (1974) Arizona 1970 TCM	10.15	28.49	28.49
Gordon (1970) Idaho 1968 TCM	3.65	11.41	14.83
Bianchi (1969) Kentucky 1969 TCM	3.51	10.40	11.96
Kalter & Gosse (1969) New York 1965 TCM	9.19	32.05	46.47
Average total value (39) 1983-1988 (20) 1968-1982 (19)	21.12 28.04 13.85	29.95 34.65 24.99	30.62 33.71 27.36

substitute sites. The reservoir was stocked with catchable size rainbow trout. The average value per fishing day was estimated as about $12.

A zonal TCM was used by Oster et al. (1987) to derive fishing values at Flaming Gorge Reservoir in Wyoming. The authors conducted a survey of anglers visiting the reservoir, 98 percent of which came from the four state area: Utah, Wyoming, Colorado, and Idaho. As a result, 93 percent lived within a 250-mile radius of the reservoir. The study adjusted for travel time and substitutes. An estimated value of $10 per day probably reflects the deteriorated quality of fishing in the reservoir.

Talheim et al. (1987) used a modification of the zonal TCM to estimate changes in angler values due to acid rain in lakes of Eastern Ontario. The study appears to include an adjustment for travel time and substitutes. The average value of fishing was estimated as $23 per day.

Kealy and Bishop (1986) used a maximum likelihood zonal TCM model to estimate the value of sport fishing in Lake Michigan as $32. They suggested that use of ordinary least squares estimation procedure would have biased consumer surplus estimates upward. The location of the study would indicate that these results could also have been placed in the anadromous fishing section. Anglers were fishing for trophy quality salmon as well as trout.

Mullen and Menz (1985) used a zonal TCM to study the impact of acid deposition on the value of fishing in Adirondack lakes. Data were collected from a survey of licensed New York state resident anglers. Since more than 90 percent of the Adirondack anglers live in New York state, the value was not adjusted for nonresidents. The authors adjusted for travel time and substitutes. The average value was estimated as $37 per day.

Richards et al. (1985) used an individual observation TCM to estimate the value of cold water fishing at Lee's Ferry on the Colorado river in Arizona.

The study adjusted for travel time but not for substitute sites. Average value was $118 per day. The site is considered a trophy class fishery and is approximately the same location as the Boyle et al. (1988) study. The value was reduced by 15 percent to adjust for application of the individual TCM.

Sorg et al. (1985) used both an iterative CVM and zonal TCM to estimate the value of cold water fishing in Idaho. The regional study included resident and nonresidents visits to 51 sites and adjusted for travel time and substitution. The TCM value was $30 per day compared to a CVM value of $18. The CVM value increased $2.12 per additional fish and $1.89 per additional inch.

Miller and Hay (1984) used data from the 1980 national survey of fishing and hunting to derive regional values for cold water fishing in five states. The study used the individual observation TCM approach and adjusted for travel time but not for substitutes or nonresident use. Values ranged from $32 in Maine to $48 in Arizona. The values were not adjusted because the 15 percent increase for instate sample was offset by the 15 percent decrease for use of the individual observation approach.

Adamowicz and Phillips (1983) used the iterative CVM in a survey of Alberta resident fishermen. The average value was about $31 per day for cold water angling in the province, increased by 15 percent to adjust for nonresident use. Using the hedonic method, they estimated the value of an additional fish as $2.37 to $3.74.

Vaughan and Russell (1982) used a zonal TCM and open-ended noniterative CVM to estimate a national value for trout fishing. Data were collected at private fee fishing sites. The study adjusted for travel time and substitutes. A 200-mile radius was used as the cutoff for market area. The TCM values ranged from $23 for hatchery trout to $30 for wild trout and the CVM value was

about $32. They are corrected and updated estimates previously presented in Sorg and Loomis (1984).

Weithman and Haas (1982) used a zonal TCM to estimate the value for cold water fishing in Lake Taneycomo, Missouri. The study adjusted for travel time but not substitute sites. The value was about $24 per day.

Walsh and Olienyk (1981) used an iterative CVM procedure to study cold water fishing in four national forests along the Front Range of Colorado. The reported average willingness to pay was adjusted by 20 percent to $15, correcting reported total trip values to on-site activity.

King and Walka (1980) used an individual observation TCM in a study of cold water fishing on the Fort Apache Indian Reservation, Arizona. The study did not adjust for substitutes or travel time. The average value was $15 per day, increased by 30 percent to adjust for travel time and decreased by 15 percent for use of the individual observation approach.

The U.S. Fish and Wildlife (1980) Hunting and Fishing Survey derived a national average value for trout fishing. The personal interviews utilized an iterative CVM format. Respondents were asked willingness to pay additional trip costs. The average value was $20 per day for the nation and $18 for Idaho.

Two separate studies in Colorado utilized the CVM to measure the value of cold water fishing. Walsh et al. (1980a) utilized an in-person, noniterative, open-ended question which asked willingness to pay additional trip costs. Data for this study were collected at high mountain reservoirs and lakes. The average value was $18 per activity day.

Walsh et al. (1980b) reported the results of a CVM study of fishing on Homestake Creek, Frying Pan River, and Eagle River in western Colorado. The open-ended willingness to pay questions were asked in the context of added

travel costs. The reported average value of $17 per day was adjusted for congestion levels. It should be noted that the Frying Pan River has become trophy class fishing since this study and would have a significantly higher value.

Brown and Plummer (1979) used a modified hedonic TCM to value cold water fishing in Washington and Oregon. The study did not adjust for substitutes or travel time. Average values were $46 in western Washington and $83 in Oregon. The values were increased by 30 percent to adjust for travel time.

Charbonneau and Hay (1978) reported the results of a CVM study of trout fishing in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individual fishermen were asked to value their favorite and second favorite hunting and fishing activities. Because the value was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect values (Miller, 1980). The average value was $29 per day.

Hansen (1977) used the CVM to estimate the value of cold water fishing in the Intermountain Region: Utah, Idaho, Western Wyoming, and Nevada. Data were obtained from the 1975 National Survey of Hunting and Fishing. The mail survey utilized a noniterative, open-ended format. Respondents were asked how much they were willing to spend before they would not engage in cold water fishing. The study reported a value of $19 per activity day.

Martin et al. (1974) applied the individual observation TCM to estimate the value of cold water fishing in Arizona. The resident household survey was adjusted for travel time and substitution. The average value of $28 per activity day was not adjusted. A 15 percent increase for nonresident values

would be offset by a 15 percent decrease for use of the individual observation approach.

Gordon (1970) estimated the value of Idaho cold water fishing using the zonal TCM. The study did not adjust for substitutes or travel time. The average value was $15 per day for fishing in high country lakes. The value was increased by 30 percent to adjust for omission of travel time.

The value of cold water fishing in Kentucky was estimated by Bianchi (1969) using the zonal TCM. Fishermen were approached onsite and given a survey to complete and return by mail. The study adjusted for travel time and substitutes within the state. A 150-mile zonal cutoff was used when deriving the demand curve. The study reported a value of $12 per activity day, increased by 15 percent to adjust for nonresident use.

Kalter and Gosse (1969) used a modified zonal TCM to estimate the value of cold water fishing in New York state. The study was based on national survey data and did not adjust for travel time or substitute sites. The value of $46 per day was increased by 30 percent for omission of travel time and increased by 15 percent for use of an instate sample.

ANADROMOUS FISHING

Donnelly et al. (1983) used a regional TCM and iterative bidding CVM to estimate the value for Steelhead fishing in Idaho. The telephone survey included both residents and nonresidents having an Idaho steelhead license. The regional demand function adjusted for travel time and substitutes. The average TCM value was $17 and the CVM value, $24 per day. The values appear low compared to others reported. The authors suggest that this is due to the higher average round-trip distance of 331 miles. The CVM value was equivalent to $7.95 per fish caught. It was reported that the runs of anadromous fish

Table 19. Anadromous Fishing Literature Review and Value Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Donnelly et al. (1983) Idaho 1982 TCM	14.29	16.85	16.85
Donnelly et al. (1983) Idaho 1982 CVM	20.26	23.89	23.89
Strong (1983) Oregon 1977 TCM	22.95	40.21	46.24
Brown et al. (1980) Oregon 1977 TCM	17.36	30.41	34.97
Brown et al. (1980) Washington 1977 TCM	20.92	36.65	42.15
Charbonneau and Hay (1978) United States 1975 CVM	51.00	101.39	70.97
Brown et al. (1976) Oregon 1974 TCM	21.77	47.52	54.65
Gordon (1970) Idaho 1968 TCM	17.00	53.16	69.11
Mathews and Brown (1970) Washington 1967 CVM	38.75	127.26	127.26
Average total value 1983-1988 (3) 1968-1982 (6)	24.92 19.17 27.80	53.04 26.98 66.07	54.01 28.99 66.52

have increased since the study was completed, which would increase the value of fishing.

Strong (1983) used a zonal TCM to estimate the value of steelhead fishing in Oregon. The study reanalyzed data collected by Brown et al. (1980). The study adjusted for travel time but the sample did not include nonresidents of the state. Application of a semilog model resulted in an estimated value of $46 per day, increased by 15 percent for use of an instate sample.

Brown et al. (1980) applied a zonal TCM to estimate the value of steelhead fishing in Oregon and Washington. The study was based on a large mail survey of instate residents. The authors adjusted for travel time in Oregon and in one of three equations for Washington. The authors did not adjust for substitution. The average value of steelhead fishing in Oregon was $35 per 3.3 hour day compared to about $42 in Washington. Both values were increased by 15 percent to adjust for the instate sample.

Charbonneau and Hay (1978) reported the results of a CVM study of anadromous fishing in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individuals were asked to value their favorite and second favorite hunting and fishing activities. Because the value was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect values (Miller, 1980). The average value was $71 per day.

Brown et al. (1976) used the zonal TCM to reestimate data from an earlier study of fishing in Oregon (Brown et al. 1964). The authors adjusted for travel time but not for substitutes. The value of salmon fishing was about $55 per day, increased by 15 percent for use of an instate sample.

Gordon (1970) applied a variation of the zonal TCM to estimate the value of anadromous fishing in Idaho. The study did not adjust for travel time or substitution. The average value estimated as $69 per day was increased by 30 percent to adjust for the omission of travel time.

Mathews and Brown (1970) applied an open-ended CVM question to estimate the value of salmon fishing in the state of Washington. The study adjusted for the availability of substitutes. The average value was $127 per day.

WARM WATER FISHING

Hay (1988) reported the results of a CVM study of bass fishing by residents of each state. Data were obtained from the 1985 national survey of fishing and hunting which included iterative willingness to pay questions but not a protest question. The results were adjusted to detele zero values and those over $130 per day. The reported state values were averaged to obtain regional values, weighted on the basis of population 16 years of age and older and the proportion participating in bass fishing. The Forest Service regional values ranged from $8 to $23 per day.

Fiore and Ward (1987) used the zonal TCM to estimate the value of warm water fishing at Elephant Butte Reservoir in New Mexico. The study adjusted for travel time and substitution. The primary species caught was white bass. In addition, the reservoir had some large mouth bass, catfish and walleye. The average value of fishing was estimated as $31 per day.

Sorg et al. (1985) used a zonal TCM and an iterative bidding CVM to estimate the value of warm water fishing in the state of Idaho. The regional demand function adjusted for substitute sites and the value of travel time. The sample of anglers included residents and nonresidents. Average CVM values were $14 per day and $31 for the zonal TCM. The authors also reported a CVM value of $0.90 per additional fish caught.

Table 20. Warm Water Fishing Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day Reported	 Adjusted to 1987	 Adjusted for method
Hay (1988)			
Northern	7.69	8.13	8.13
Rocky Mountain	11.35	12.00	12.00
Southwestern	18.66	19.72	19.72
Intermountain	11.51	12.17	12.17
Pacific Southwest	22.00	23.25	23.25
Pacific Northwest	12.84	13.57	13.57
Southern	13.84	14.63	14.63
Eastern	13.49	14.26	14.26
Fiore & Ward (1987) New Mexico 1981 TCM	24.63	30.89	30.89
Sorg et al. (1985) Idaho 1982 CVM	11.94	14.08	14.08
Sorg et al. (1985) Idaho 1982 TCM	26.36	31.08	31.08
Miller (1984) Louisiana 1980 TCM	23.00	31.65	26.90
Menz & Wilton (1983) New York 1976 TCM	25.68	47.97	40.78
Palm & Malvestuto (1983) Georgia, Alabama 1976-1980 TCM	8.90	14.53	12.35
Vaughn & Russell (1982) U.S. 1979 TCM	9.74	14.61	14.61
Vaughn & Russell (1982) U.S. 1979 TCM	13.33	20.00	20.00
Vaughn & Russell (1982) U.S. 1979 CVM	15.00	22.50	22.50
Martin et al. (1982) Nevada 1978-1979 TCM	44.63	69.91	59.42
Bell (1981) Louisiana 1975 Hedonic	15.98	31.77	31.77
Ziemer et al. (1980) Georgia 1972 TCM	13.23	33.54	28.50
Charbonneau & Hay (1978) United States 1975 CVM	19.00	37.77	26.44
Martin et al. (1974) Arizona 1970 TCM	12.48	35.03	29.78
Gibbs (1974) Florida 1970 TCM	10.81	30.34	34.89
Average total value	16.79	25.37	23.55
1983-1988 (14)	16.56	20.57	19.56
1968-1982 (9)	17.13	32.83	29.77

Miller (1984) used the individual observation TCM to estimate a value for warm water fishing in the bottomland hardwoods of Louisiana. Data were obtained from the 1980 National Survey of Fishing and Hunting. The study adjusted for travel time but not for substitute sites. The average value estimated as about $27 per day was reduced by 15 percent to adjust for use of the individual observation approach.

Menz and Wilton (1983) used the individual observation TCM to estimate the value of the St. Lawrence River and eastern Lake Ontario bass fishery to residents of New York state. The study adjusted for travel time and substitution. The average value of $41 per day ranged from $35 for Lake Ontario to $48 for the St. Lawrence River. Both values were decreased by 15 percent to adjust for use of the individual observation approach.

Palm and Malvestuto (1983) applied an individual observation TCM to estimate the value of warm water fishing in West Point Reservoir, Georgia. The study appears to have adjusted for travel time and substitutes. The average value of warm water fishing was $12 per day. Values were estimated as about $9 for bank fishing and $18 for fishing from a boat. Values were $42 for bass fishing compared to $15 for crappie. All values were reduced by 15 percent to adjust for use of the individual observation approach.

Vaughan and Russell (1982) used a zonal TCM and open-ended CVM to estimate the national value for warm water fishing for catfish. The study adjusted for both travel time and substitutes. The average TCM values per day were $15 for hatchery fishing to $20 for wild fish. The CVM value averaged about $23 per day. These are corrected and updated values previously present in Sorg and Loomis (1984).

Martin et al. (1982) used an individual observation TCM to estimate the value of warm water fishing at Lake Mead located in Nevada and Arizona. The

study adjusted for substitutes and travel time. Large-mouth black bass fishing was declining in the lake and one of the objectives of the study was to estimate the proportion of the total value of the fishing that was contributed by large-mouth black bass fishing. The average daily value of fishing was about $59 adjusted downward by 15 percent to account for use of the individual observation approach.

Bell (1981) applied the hedonic method to estimate the value of warm water fishing in south central Louisiana. The study adjusted for travel time. Data were obtained from the 1975 National Survey of Hunting and Fishing and an Atchafalaya Basin users survey. The value was estimated as $32 per day.

The individual observation TCM was used by Ziemer et al. (1980) for valuation of warm water fishing in Georgia. The data were restricted to instate users. The study adjusted for travel time but not for substitution. The authors reported values per trip averaging 2 days in length. The resulting average value of $29 per day was decreased by 15 percent to adjust for use of the individual observation approach.

Charbonneau and Hay (1978) reported the results of a CVM study of bass and panfish fishing in the United States. Data were obtained from the 1975 national survey of fishing and hunting which included open-ended willingness to pay questions. Individuals were asked to value their favorite and second favorite hunting and fishing activities. Because the value was not reported by individuals ranking it third and below, the values were reduced by 30 percent. This was consistent with the results of other studies showing that preferences significantly affect values (Miller, 1980). The average value was $26 per day.

Martin et al. (1974) used the individual observation TCM to estimate the value of warm water fishing in Arizona. The sample was restricted to instate users. Adjustments were made for travel time and substitutes. The average

value was about $30 per day decreased by 15 percent to adjust for use of the individual observation approach. Warm water fishing was assumed to be primarily an instate activity.

A study by Gibbs (1974) in Florida, applied a variation of the individual observation TCM. The study used cost per day on site as the price variable. The authors did not adjust for travel time or substitutes. Warm water fishing was valued at $35 per day increased by 30 percent to adjust for omission of travel time and decreased by 15 percent for use of the individual observation approach.

SALT WATER FISHING

Hanemann et al. (1988) used a multinomial TCM model to estimate the value of sport fishing in southcentral Alaska. In 1986, there were 1,354,600 days of fishing in southcentral Alaska, accounting for 65 percent of the statewide total. Resident anglers accounted for more than 85 percent (1,153,600 days). Data were collected by mail from resident and nonresident anglers. The study, designed primarily to estimate the marginal value of a fish caught, adjusted for substitute sites and travel time. The average value was estimated as $204 per day and ranged from $154 for nonresidents to $220 for residents. While these values are the highest reported in the United States, many sites have unique qualities such as trophy-sized fish or wilderness experience. The most valuable: king salmon fishing on the Kenai river, halibut fishing at Kachemak Bay, red salmon fishing at the Russian river, and halibut fishing at Deep Creek Marine. This study includes values which should be included in Anadromous fishing.

Cameron and James (1987) applied the dichotomous choice CVM in personal interviews with marine sport fishermen in British Columbia. Individual

Table 21. Salt Water Fishing Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Hanemann et al. (1988) Alaska 1986 TCM Salmon, Halibut	149.25	153.73	153.73
Hanemann et al. (1988) Alaska 1986 TCM Salmon, Halibut	213.25	219.65	219.65
Cameron & James (1987) British Columbia 1984 CVM Salmon	48.83	53.37	53.37
Rowe et al. (1985) California, Oregon, Washington 1981 TCM General	56.80	71.23	60.55
Huppert & Thompson (1984) California 1979-80 TCM Party boats	13.00	18.69	18.69
Huppert & Thompson (1984) California 1979-80 TCM Party boats	20.00	28.76	28.76
SMS Research (1983) Hawaii 1983 CVM General	47.00	53.35	53.35
Brown et al. (1980) Oregon 1977 TCM Salmon	78.00	136.66	136.66
Brown et al. (1980) Washington 1977 TCM Salmon	75.00	131.40	131.40

Table 21. Salt Water Fishing Literature Review and Benefit Estimate, 1987 (continued)

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
McConnell (1979) Rhode Island 1978 TCM Flounder	30.34	49.55	42.12
McConnell (1979) Rhode Island 1978 TCM Flounder	67.06	109.51	93.08
Crutchfield & Schelle (1979) Washington 1978 CVM Salmon	18.00	29.39	29.39
Charbonneau & Hay (1978) U.S. 1975 CVM Offshore boat	73.00	145.12	101.58
Charbonneau & Hay (1978) U.S. 1975 CVM Surf	19.00	37.77	26.44
Charbonneau & Hay (1978) U.S. 1975 CVM Bays	22.00	43.74	30.62
Charbonneau & Hay (1978) U.S. 1975 CVM Pier	16.00	31.81	22.27
Charbonneau & Hay (1978) U.S. 1975 CVM General	22.00	43.74	30.62
Average total value 1983-1988 (7) 1968-1982 (10)	56.97 78.30 42.04	79.85 85.54 75.87	72.49 84.01 64.42

willingness to pay was $53 per day for salmon fishing. The value of catching an additional chinook salmon was estimated as $16.

Rowe et al. (1985) applied TCM single equation and multinomial choice models in a study of marine fishing on the Pacific coast. The modified individual observation TCM used data from mail and telephone surveys. The study reported average values per trip adjusted for travel time and substitution. Converted to a per fishing day, the single equation average value was estimated as $61. The value was decreased by 15 percent to adjust for use of the individual observation approach.

Huppert and Thomson (1984) applied a zonal TCM to estimate the demand for marine fishing from party boats off the coast of California. The study adjusted for travel time and substitution. The average value ranged from $19 to $29 with travel time at one-third to two-thirds of the wage rate.

SMS Research (1983) applied iterative CVM questions in a study of marine sport fishing in Hawaii. Adjusted for starting point, the average value was $53 per day.

Brown et al. (1980) used a zonal TCM to estimate the value of marine salmon fishing off the coast of Oregon and Washington. The results were based on a mail survey of instate residents. The study adjusted for travel time but not for substitution. The average value of salmon fishing in Oregon was $137 per day compared to $131 in Washington. Both values were increased by 15 percent to adjust for nonresident use.

Crutchfield and Schelle (1978) used open-ended CVM questions in a study of ocean fishing in the state of Washington. The average daily value was estimated as $29.

McConnell (1979) used the individual observation TCM and household production approach to estimate the value of salt water fishing for flounder

off Rhode Island. The study adjusted for travel time but not for substitutes. It did not include a quality variable. The average TCM value was $42 per day compared to $93 for the household production approach which adjusted for quality of the experience. The values were decreased by 15 percent to adjust for use of individual observations.

Charbonneau and Hay (1978) reported the results of a open-ended noniterative CVM study of salt water fishing in U.S. waters. Data were obtained from the 1975 National Survey of Hunting and Fishing. Individuals were asked to value their favorite and second favorite fishing activities. Compared to the 1980 survey of all users, the value of an individual's favorite activities perhaps should be adjusted down by 30 percent. The adjusted values were $102 for offshore fishing, $26 for surf, $31 for bays, $22 for pier, and averaged $31 for general saltwater fishing.

NONCONSUMPTIVE FISH AND WILDLIFE

There have been very few studies of the demand for nonconsumptive fish and wildlife recreation. However, with less than 1 percent (0.7) of total recreation use recorded in the National Forests, this category accounts for nearly 5 percent of the benefit estimates. Table 22 shows the average value as $22 per day. Most of the study sites have been located in southwestern states. There is a need for further research in other regions of the United States.

Loomis (1988) reported the preliminary results of a CVM study of the value of viewing deer in California. The mail sample of about 900 resident households answered an open-ended noniterative willingness to pay question concerning their nonconsumptive wildlife recreation trips in the state. The wildlife division funded the study emphasizing the viewing of deer. The method of payment was added trip costs which was easily understood and resulted in no

Table 22. Nonconsumptive Fish and Wildlife Literature Review and Benefit Estimate, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Loomis (1988) California 1987 CVM	22.12	22.12	22.12
Loomis (1988) California 1987 CVM	16.26	16.26	16.26
Hay (1988)			
Northern	20.08	21.23	21.23
Rocky Mountain	19.21	20.31	20.31
Southwestern	29.72	31.41	31.41
Intermountain	28.15	29.76	29.76
Pacific Southwest	32.00	33.82	33.82
Pacific Northwest	18.06	19.09	19.09
Southern	19.55	20.66	20.66
Eastern	18.94	20.02	20.02
King et al. (1987) Arizona 1985 CVM	6.10	6.45	12.90
Stoll & Johnson (1984) Texas 1982 CVM	4.47	5.27	5.27
Stoll & Johnson (1984) Texas 1982 CVM	16.87	19.89	19.89
Richards & King (1982) Arizona 1977 TCM	39.50	69.20	38.06
Average total value	20.79	23.96	22.20
1983-1988 (13)	19.35	20.48	20.98
1968-1982 (1)	39.50	69.20	38.06

significant rejection of the payment vehicle. Average values were $22 per day for primary purpose trips and $16 per day for all trips in which deer were viewed.

Hay (1988) reported the results of a CVM study of nonconsumptive wildlife-related recreation by residents of each state. Data were obtained from the 1985 national survey of fishing and hunting which included iterative willingness to pay questions but not a protest question. The results were adjusted to delete zero values and values per day which exceeded five percent of before tax household income. Values per day exceeding $200 but less than five percent of income were converted to $200. The reported state values were averaged to obtain regional values, weighted on the basis of population 16 years of age and older and the proportion participating in primary nonconsumptive wildlife trips. The Forest Service regional values ranged from $19 to $34 per day.

King et al. (1987) applied the CVM to estimate the nonconsumptive use value of 70 desert bighorn sheep to residents of Tucson, Arizona. The method of payment used in asking the open-ended non-iterative willingness to pay question was an annual membership in a nonprofit foundation which would protect the habitat for bighorn sheep on Pusch Ridge, north of Tucson. The annual household value reported was adjusted to roughly approximate value per activity day, assuming one-fourth of the households with two persons take one trip per year. The median recreation use value was estimated as $13 per day.

Stoll and Johnson (1984) used the CVM to estimate the nonconsumptive use value of the Aransas Wildlife Refuge in south Texas. The main attraction was the presence of 139 whooping cranes, an endangered species. Refuge users were handed a self-administered mail-back questionnaire which included a dichotomous choice question. Method of payment was an annual entrance fee. Assuming one

visit per year, the recreation use value was estimated as $5 per day and option price, $20, including both expected consumer surplus of recreation use and option value.

Richards and King (1982) used the individual observation TCM to estimate the nonconsumptive use value of wildlife in southeastern Arizona. Visitors were handed a self-administered mail-back questionnaire onsite. The modified TCM equation explained the number of days per trip with price specified as onsite costs (lodging, food, guide service, etc.) plus the usual travel cost. The study included travel time at 100 percent of the wage rate and did not adjust for substitution. The value of nonconsumptive wildlife-based recreation was estimated as $38 per activity day. This estimate was decreased 30 percent to adjust travel time to 50 percent of the wage rate, and decreased 15 percent to adjust for use of the individual observation approach.

OTHER RECREATION ACTIVITIES

There have been few studies of other recreation activities such as individual and team sports, playing games, gathering forest products, viewing interpretive exhibits, attending programs, guided and unguided touring, guided and unguided walking, viewing interpretive signs, listening to audio programs, and receiving general information such as brochures. Together, these activities account for 4.2 percent of the total recreation use of the National Forests, compared to 3.1 percent of the benefit estimates. Table 23 shows the average value of gathering forest products, individual competitive running, and viewing interpretive exhibits as $18 per day. There is a need for future research on the benefits of these recreation activities.

Markstrom and Rosenthal (1987) applied a zonal TCM to firewood collection on the Roosevelt National Forest near the Denver metropolitan area. The authors adjusted for travel time and truncated the demand curve for

Table 23. Other Recreation Activities Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day		
	Reported	Adjusted to 1987	Adjusted for method
Gathering Forest Products			
Markstrom & Rosenthal (1987) Colorado 1982 TCM	13.62	16.06	16.06
Markstrom & Rosenthal (1987) Colorado 1982 TCM	23.88	28.15	28.15
Devlin (1985) Colorado 1983 TCM	12.24	13.89	11.80
Devlin (1985) Colorado 1983 CVM	10.22	11.60	11.60
Devlin (1985) Colorado 1983 CVM	13.34	15.14	15.14
Individual Sports			
Peterson & Arnold (1987) Colorado 1981-1984	15.00	17.36	17.36
Peterson & Arnold (1987) Colorado 1981-1984	37.50	43.39	43.39
Viewing Interpretive Exhibits			
Peterson et al. (1983) Dwyer et al. (1983) Illinois 1979 TCM	4.54	6.81	6.81
Peterson et al. (1983) Dwyer et al. (1983) Illinois 1979 TCM	12.71	19.07	19.07
Average total value (9) 1983-88	15.89	19.05	18.82

substitution. Values were reported in terms of dollars per cord of lodgepole pine and aspen collection analogous to values obtained through the residual value timber appraisal system. We converted their wood values to values per user day assuming a cut of three-fourth cord on single day trips in pickup trucks. Willingness to pay ranged from $16 in the short run with perfect substitutes to $28 in the long run with increasing scarcity of supply. Their follow-up study the next year reported identical values, indicating stability in nonmarket valuation.

Devlin (1985) compared the individual observation TCM and open-ended CVM values of firewood collection on the Roosevelt and Routt National Forests in northern Colorado. The TCM study was adjusted for travel time, income, and quality of wood, but not for substitution. Decreased by 15 percent to adjust for use of individual observations, the TCM value was about $12 per day, comparable to the two CVM values. Willingness to pay was estimated as $12 per day and willingness to drive additional miles was equivalent to $15.

Peterson and Arnold (1987) applied the zonal TCM to runners who completed the annual pikes peak marathon in the Pike National Forest from 1981 to 1984. The authors adjusted for travel time and participation by out-of-state residents. There is no equivalent substitute for running in the marathon. Assuming two days per trip, values averaged $17 per day for runners in the ascent race and about $43 for the round-trip race up and down the mountain.

Peterson et al. (1983) and Dwyer et al. (1983) applied a zonal TCM to estimate the value of viewing interpretive exhibits at parks in the Chicago area. The recreation activity can occur either indoors or outdoors. In either case, its purpose is to obtain information to enhance appreciation of forest environments. The study sites were conservatories with indoor botanical gardens where various rooms simulate different climatic-vegetation complexes.

The study adjusted for travel time, substitution, and quality characteristics of the sites. It demonstrated that TCM can be applied to urban recreation sites. Willingness to pay ranged from $7 at Morton Arboretum to $13 at Garfield Park Conservatory and $19 at Lincoln Park Conservatory. The average value was $13 per activity day.

WILDERNESS

There have been an increasing number of recreation demand studies of wilderness use in recent years. With 4.2 percent of total recreation use of the National Forests, wilderness accounted for 5.2 percent of the benefit estimates. Table 24 shows the average value of wilderness recreation as $25 per day. Two recent studies in eastern states have reported lower values related to limitations of the research methods used. In the future, there is a need for additional research on the nonmarket value of wilderness recreation.

Prince (1988) applied the CVM in a self-administered survey of onsite users of Ramseys Draft Wilderness Area in George Washington National Forest, Virginia. It is reported to be the nearest wilderness area to Washington, D.C. The study was explained and questionnaires were distributed to hikers as they entered the site. They were requested to fill out the questionnaire before leaving. The study used an iterative willingness to pay question. The method of payment was a per diem hiking fee to be used exclusively to manage recreation use of the wilderness area. Preliminary results indicate that the value of recreation use adjusted for congestion averaged $13 per 8.3 hour day.

Peterson et al. (1988) applied a zonal TCM to estimate the value of canoe camping at the Boundary Waters Canoe Area, a wilderness located in northern Minnesota. The data consist of the population obtaining entry permits from a 12-state area, accounting for 52 percent of total use. Travel time was valued at 50 percent of per capita income in 150 zones (zip codes). Substitution was

Table 24. Wilderness Literature Review and Value Estimates, 1987

Author Study location Date of survey Method	Value per activity day Reported	 Adjusted to 1987	 Adjusted for method
Prince (1988) Virginia 1984 CVM	12.00	13.12	13.12
Peterson et al. (1988) Minnesota 1980 TCM	6.34	8.72	8.72
Peterson et al. (1988) Minnesota 1980 TCM	19.64	27.02	27.02
Leuschner et al. (1987) North Carolina 1983 TCM	2.15	2.44	9.50
Rosenthal & Walsh (1986) Colorado 1981 CVM	8.64	10.83	10.83
Rosenthal & Walsh (1986) Colorado 1981 CVM	14.91	18.70	18.70
Barrick (1986) Wyoming 1982 CVM	6.40	7.55	11.34
Walsh et al. (1985) Colorado 1983 TCM	22.00	24.97	24.97
Walsh et al. (1985) Colorado 1983 CVM	24.00	27.24	27.24
Walsh & Gilliam (1982) Colorado 1979 CVM	10.31	15.47	15.47
Walsh & Gilliam (1982) Colorado 1979 CVM	18.29	27.44	27.44
Walsh et al. (1981) Colorado 1980 TCM	14.00	19.26	19.26
Loomis (1979; 1980) Utah 1979 TCM	11.50	17.25	22.44
Brown & Plummer (1979) Washington, Oregon 1976 TCM	43.75	81.73	106.26
Smith & Kopp (1980) California 1972 TCM	8.03	20.36	26.43
Average total value 1983-1988 (9) 1968-1982 (6)	14.80 12.90 17.65	21.47 15.62 30.25	24.58 16.83 36.22

represented by the price of a trip to Algonquin Provincial Park in Canada. Estimates of value averaged $17 and ranged from $9 per day of Marshallian consumers surplus to $27 per day welfare change based on conditional discreet choice.

Leuschner et al. (1987) applied a zonal TCM to compare demand for private and public backcountry areas. Both sites are located in the southern Appalachian Mountains of northwestern North Carolina within 15 miles of each other. Grandfather Mountain is privately owned and charges $2.50 per day user fee and $5 per backpacker staying overnight. Linville Gorge is managed by the U.S. Forest Service and does not charge user fees. Mail surveys were used to obtain the necessary information. Substitutes were not significant and the sample was not restricted to instate users. The reported values were adjusted for the assumption of low direct trip cost and travel time. The average value of about $10 appears to be an underestimate despite these adjustments.

Rosenthal and Walsh (1986) applied the CVM to onsite interviews with hikers and backpackers in existing and potential wilderness areas of the Arapaho-Roosevelt National Forest in Colorado. The method of payment was direct trip cost and the value question was iterative. The availability of substitutes outside of the National Forest without added payment was made clear by the interviewers. Reported values ranged from $11 per RVD in a primitive zone located more than 3 miles from road to $19 in the semi-primitive zone located 0.5-3.0 miles from a road.

Barrick (1986) applied an open-ended CVM question in a study of the recreation use value of Washakie Wilderness Area adjacent to Yellowstone National Park in Wyoming. A mail survey was sent to individuals who registered at trailheads and who were personally requested to participate. The method of payment was a contribution to a fund established with a reputable organization

that would guarantee protection. Users reported maximum use value per year. This was increased by 50 percent in an attempt to adjust for possible aggregation bias. The value was conservatively estimated as $11 per activity day.

In a closely related study, Walsh et al. (1985) estimated the recreation use value of 11 potential wild and scenic rivers in the state of Colorado. Most of the study rivers are located in existing or potential wilderness areas. The resident household mail survey applied the individual observation TCM and open ended CVM to estimate the value of fishing, nonmotorized boating, and related recreation activities. The CVM method of payment was direct trip costs. The pooled TCM study adjusted for travel time and substitutes. CVM values averaged $27 per day compared to a TCM value of $25. The TCM result was not adjusted because a decrease of 15 percent to adjust for use of the individual observation approach would be offset by a 15 percent increase to account for higher nonresident values.

Walsh and Gilliam (1982) applied the CVM to estimate the value of hiking and backpacking in Indian Peaks Wilderness Area, Colorado. It is a large alpine area within 65 miles of the Denver metropolitan area. The onsite personal interviews used an iterative format. They reported values associated with a range of congestion and adjusted the values for mean congestion levels. Values were $15 per day for hiking and $27 for backpacking.

Walsh et al. (1981) calculated a statewide average value for wilderness and roadless area recreation using the individual observation TCM. This was based on a sample of state residents. Travel time, substitutes, tastes-preferences, and income were statistically significant. Average value was estimated as $19 per day. The estimate was not adjusted because a 15

percent increase for nonresident use would be offset by a 15 percent decrease for use of the individual observation approach.

Loomis (1979, 1980) estimated the hiking and backpacking values associated with two administratively designated primitive areas in southern Utah. Using the zonal TCM, the values were $16 per visitor day for Grand Gulch and $30 per visitor day for Paria Canyon. The overall average value was $22. All estimates were increased by 30 percent to adjust for the omission of travel time. Because these were high desert primitive areas, the justification for using these studies rests on the concept of Recreation Opportunity Spectrum (ROS) zones. Recreation opportunities that share the same ROS classification provide a similar experience even if the ecosystem is different. Further research in this region is needed.

Brown and Plummer (1979) used a zonal TCM to estimate the recreation use value of wilderness areas in Washington and Oregon. The data included both instate and out-of-state residents, however, the study did not adjust for travel time. The values per day were $97 for Glacier Peak, $90 for Goat Rocks, $107 for Diamond Peak, and $132 for Eagle Cap. This resulted in an overall average of $106. All estimates were increased by 30 percent to adjust for omission of travel time. These values reflect an upper limit truncation to insure single purpose trips; values without truncation were higher.

Smith and Kopp (1978) used the zonal TCM to estimate the recreation use value of the Ventana Wilderness in California. This is a relatively small wilderness area 135 miles from San Francisco and more than 250 miles from Los Angeles. The study used one-way distance and did not adjust for travel time. In a footnote to the longer version of the Smith and Kopp (1980) paper, the authors indicated that adjusting to round trip mileage doubles the benefit estimates. On a per visitor day basis, using data provided by the District

Ranger, the value was $26, increased by 30 percent to adjust for the omission of travel time.

SUMMARY AND CONCLUSION

This report addressed the problem of information transfer, that is, the possibility of adjusting past studies to estimate benefits for long-run policy analysis. The process involves developing an understanding of the variables that explain the observed differences in benefit estimates. As a first step, we updated and evaluated a previous literature review that adjusted reported values before presenting summary statistics. The travel time adjustment was supported by the regression results and the adjustments for sample truncation and use of the individual observation approach were somewhat low. Overall, they did not significantly change average benefit estimates because of offsetting effects.

Newer methods of controlling for the effects of these and other variations in the estimates give reason to believe that it may be possible to resolve many of the problems of information transfer. These include adjusting for variation in the treatment of monetary and time cost of travel, substitution, site quality, and the functional form used in TCM applications. CVM problems include adjusting for variations in the method of payment, functional form used to analyze dichotomous choice questions, and information on resource quality, uncertainty, and substitution possibilities. In both the TCM and CVM approaches, the link between consumer theory and statistical estimation is being improved via use of discrete choice and qualitative response models with maximum likelihood statistical techniques.

The challenge is to learn how to adjust the TCM to treat the unique characteristics of demand for resource-based sites, and how to adjust previous studies to approximate the demand for new or proposed resource-based sites. A

number of reforms in method should be considered before the agency could reasonably apply this information to policy decisions. For some activities, insufficient studies have been completed to understand the variables explaining the observed differences in benefit estimates. This knowledge would be essential to adjust existing benefit estimates to fit the requirements imposed by new situations addressed in policy analysis.

In the future, more research projects should provide for the translation of findings to answer long-run policy questions. Most of the studies reviewed here were designed to answer a specific question at a particular recreation site. As a result, certain types of research on some recreation activities have claimed substantial amounts of public support although they offer little prospect of affecting a basic change in recreation opportunities for the future. In those instances, there may be new lines of emphasis which promise larger returns. The new problem becomes to design dual purpose studies, with a direct use in policy application at the study sites and an indirect use to answer policy questions at other times and places.

APPENDIX A

NATIONAL RECREATION USE DEFINITIONS

National Recreation Use Categories Reported	Definitions
1. Camping, picnicking, swimming	
Camping, general day:	All nonspecific daytime use, general leisure, and activities relating to camping in temporary shelters. This is basically time spent in the proximity of camp that cannot be readily defined in other activity codes.
Camping, auto:	Night use (approximately 9:00 pm to 9:00 am) of persons camping in temporary shelters carried on or incorporated in the transportation vehicle. Includes camping in station wagons, vans, pickup campers, RV's, buses, trucks, etc. Record 12 visitor-hours (1 RVD) for each person using such shelter for all or most of the night-time period.
Camping, trailer:	Night use of persons camping in temporary shelters towed behind the transportation vehicle. Includes travel trailers, fold-out or pop-up tent trailers.
Camping, tent:	Night use of persons camping in tents, lean-to's, shelters, or other accommodations that are not part of a vehicle. Includes all camping with no formal shelter (i.e., sleeping bag).
Picnicking:	Eating meals in a Forest environment for pleasure and relaxation. (Incidental meals eaten while participating in other major activities such as hunting, fishing and hiking, should be reported as part of those activities).
Swimming and waterplay:	Swimming, diving, beach play, sunbathing, and related activities. Includes bathing in hot springs, competitive swimming events, and use of floating devices.
Diving:	Skin and scuba diving (includes snorkeling) for the purpose of viewing, photographing, hunting or exploring underwater areas.
Waterskiing amd other water sports:	Waterskiing, ski jumping, kiting, platter-riding, surfing, and similar activities which take place outside of boats.

National Recreation Use Categories Reported	Definitions
2. Mechanized travel and viewing scenery	
Automobile:	Driving or riding in motorized vehicles with at least four wheels. Includes all common passenger carrying vehicles such as cars, pick-ups, vans and campers.
Motorcycles and scooters:	Driving or riding motorized vehicles with less than four wheels.
Ice and smow craft:	Using tracked, propeller-driven, or spiked-wheel motorized equipment specifically designed for ice and snow travel.
Specialized landcraft (AVT's):	Driving or riding in vehicles with wheels (at least four), tracks or other suspension systems designed specifically for off-road use. Includes swamp and dune buggies, tracksters, and similar specialized vehicles.
Train and bus touring:	Riding in buses, trains, cog railways, and similar mass vehicles carrying people on, or to, National Forest lands for recreation purposes.
Tour boat, ship, ferry:	Travel on commercial watercraft operating on tour boats or providing service primarily for visitors to view scenery on, or gain access to, National Forest lands.
Boat, powered:	Driving or riding in small pleasure carft, houseboats, airboats, and similar craft for pleasure. Includes the activity of launching boats at boating sites.
Aircraft, motorized:	Flying or riding in powered wing or rotor aircraft to gain access to National Forest lands or waters for recreation purposes.
Aerial trams and lifts:	Riding aerial devices to view scenery on, or gain access to, National Forest lands. Includes alpine sliding and other off-season riding of ski lifts and trams at winter-sports sites. Includes winter use of trams and lifts for skiing access under winter sports.

National Recreation Use Categories Reported	Definitions
2. Mechanized travel and Viewing Scenery (Continued):	
Aircraft, nonmotorized:	Use of hang-gliders, parachutes, winged gliders, balloons or similar airborne structures that are launched, landed or otherwise dependent on the characteristics of National Forest lands for people to participate in the sport.
Bicycle:	Riding nonmotorized vehicles with three wheels or less.
Viewing scenery:	Viewing outstanding scenes, landscapes or other natural features from observation points, turnouts, vista points or other areas where visitors generally stop for a period of time.
Viewing activities (Spectator):	Viewing other people participating in a wide variety of activities on National Forest lands. Typical examples are spectators viewing winter-sports activities, boating activities, hang-gliders, mountain climbers, or organized games. Also includes viewing of other Forest-related activities which may enhance or broaden the visitors recreation experience, such as watching timber harvest or road construction activities, slash disposal operations, cattle drives, fire-fighting and smoke-jumping.
Viewing works of humankind:	Visting and/or viewing human-made features such as dams, bridges, buildings and fish hatcheries, on National Forest lands.
Nature study (Hobby, Education):	Includes rockhounding, caving, photography, and collection of plants, insects, driftwood or fossils. Also includes, study of natural history, archaeology, and a vocational study of the earth, its geology, history, peoples, and its flora and fauna.
3. Hiking, horseback riding and water travel	
Hiking and walking:	Foot travel (including jogging) for pleasure or access. Includes sightseeing while traveling, and rest or leisure stops that are not significant enough to report as specific activities.

National Recreation Use Categories Reported	Definitions
3. Hiking, horseback riding and water travel (Continued):	
Mountain climbing:	Climbing in areas recognized by skilled climbers as offering special opportunities for this activity. If climbing skills and equipment are not required, report as hiking.
Horseback riding:	Using animals for mounted travel irrespective of the type of animal ridden.
Canoeing:	Riding in canoes, kayaks, and other lightweight craft propelled with paddles. Includes launching.
Sailing:	Riding in sailboats, prams, or other wind-propelled watercraft. Includes launching.
Other watercraft (Rowing, Drifting, Rafting):	Riding in nonmotorized watercraft such as rowboats, rafts, innertubes. Includes launching.
4. Winter sports	
Ice skating:	Includes all activities related to skating on frozen surfaces.
Sledding, tobogganing tubing:	On prepared slopes maintained for this activity.
Skiing, downhill:	Skiing on developed sites or dispersed areas using Alpine (downhill) skiing equipment. Includes all associated activities such as eating, resting, waiting, and use of uphill devices (lifts, tows, helicopter, snowmobile tow, etc.). Report non-skiers under appropriate activities; i.e., Viewing, Snow Play, Off-season Use of Lifts.
Snow play:	Includes a wide variety of winter sports activities which usually take place on unprepared and undifferentiated slopes. Includes coasting and sliding on sleds, platters and innertubes; snow sculpture, snow-balling, and general play.
Cross-country skiing, snowshoeing:	Skiing on dispersed areas or developed sites using Nordic (cross-country) skiing equipment or snowshoes. Includes all associated activities such as eating, sightseeing, and resting enroute.

National Recreation Use Categories Reported	Definitions
5. Resorts, cabin, and organization camping	
Organization camping, general day:	All non-specific daytime use, general leisure, and activities occurring on organization sites, that cannot be readily defined in other activity.
Organization camping, night:	Overnight use of organization camps. Record 12 visitor hours (1 RVD) for each occupant between 9:00 pm and 9:00 am.
Resort and commercial public service, general:	All nonspecific daytime activities and general leisure at hotels, lodges, resorts, and other public service sites (i.e., stores, restaurants, filling stations, etc.)
Resort lodging:	Overnight use of hotels, lodges, motels, hostels, cabins, etc. Record 12 visitor hours (1 RVD) for each person using shelter between approximately 9:00 pm and 9:00 am the following day.
Recreation cabin use:	Includes day and night use of permitted recreation residences or Forest Service owned cabins. One person present for 24 hours will be reported as 2 RVD's.
6. Hunting	
Hunting, big game:	Hunting for and harvesting big game such as deer, elk, moose, and bear.
Hunting, small game:	Hunting for and harvesting small game such as rabbit, squirrel, and oppossum, including noncommercial harvest of fur bearers.
Hunting, upland birds:	Hunting for an harvesting upland birds, pigeons, turkey, etc.
Hunting, waterfowl:	Hunting for and harvesting waterfowl.
Trapping:	Trapping of animals for sport and commercial purposes.

National Recreation Use Categories Reported	Definitions
7. Fishing	
Fishing, cold water:	Fishing in waters where conditions will support trout species.
Fishing, warm water:	Fishing in waters where conditions will not support trout species, but are sufficient for species such as bass, perch, and catfish.
Fishing, anadromous:	Fishing for anadromous fish in fresh water.
Fishing, salt water:	Fishing in oceans and estuaries.
Fishing, ice:	Fishing through ice on frozen bodies of water.
8. Non-consumptive fish and wildlife:	Use for the specific purpose of watching, photographing, and/or studying fish and wildlife in their natural environment.
9. All other recreation use	
Team sports:	Participating in team activities such as football, baseball, volleyball, etc.
Individual sports:	Golf, tennis, archery, target practice, horse shoes and similar sports.
Games and play:	Playing games such as cards, checkers, tag, hide and seek; throwing frisbees, playing catch, dancing, or using playground equipment.
Gathering forest products:	Noncommercial and permitted harvesting of products as a recreation activity. Includes cutting Christmas trees; mushrooming; firewood cutting; picking fruits, nuts, and berries; gathering greenery for wreaths, etc.
Viewing interpretive exhibits:	Viewing prepared exhibits (either indoors or outdoors) designed to provide the recreation visitor with information, interpretation and/or appreciation of National Forest environments.

National Recreation Use Categories Reported	Definitions
9. All other recreation use (Continued):	
Attending talks and programs:	Attending presentations (either indoors or outdoors) designed to provide the recreationist with a more complete and clear understanding of the local environment. Includes slide and motion picture programs.
Touring, guided:	Touring, other than by foot, where interpretation is provided by a guide other than a commercial outfitter or packer.
Touring, unguided:	Touring, other than by foot, where interpretation is provided by means of VIS media.
Walking, guided:	Pedestrian travel where interpretation is provided by a guide.
Walking, unguided:	Pedestrian travel where interpretation is provided by means of VIS media.
Viewing interpretive signs:	Viewing interpretative signs designed to enhance the visitor's knowledge and appreciation of the environment. These signs are generally installed at sites or areas off major VIS sites.
Listening to audio programs:	Listening to audio programs with no other media present.
General information:	Other informational or interpretive activities. Includes maintaining brochures and receiving general orientation.
10. Wilderness use:	Includes hiking and walking; horseback riding; general day camping; tent camping; picnicking; cross-country skiing; snowshoeing; hunting, big game hunting, small game hunting, upland birds; fish, birds, and wildlife study; hobby and education nature study; and mountain climbing. See above use categories for definitions of these use activities.

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