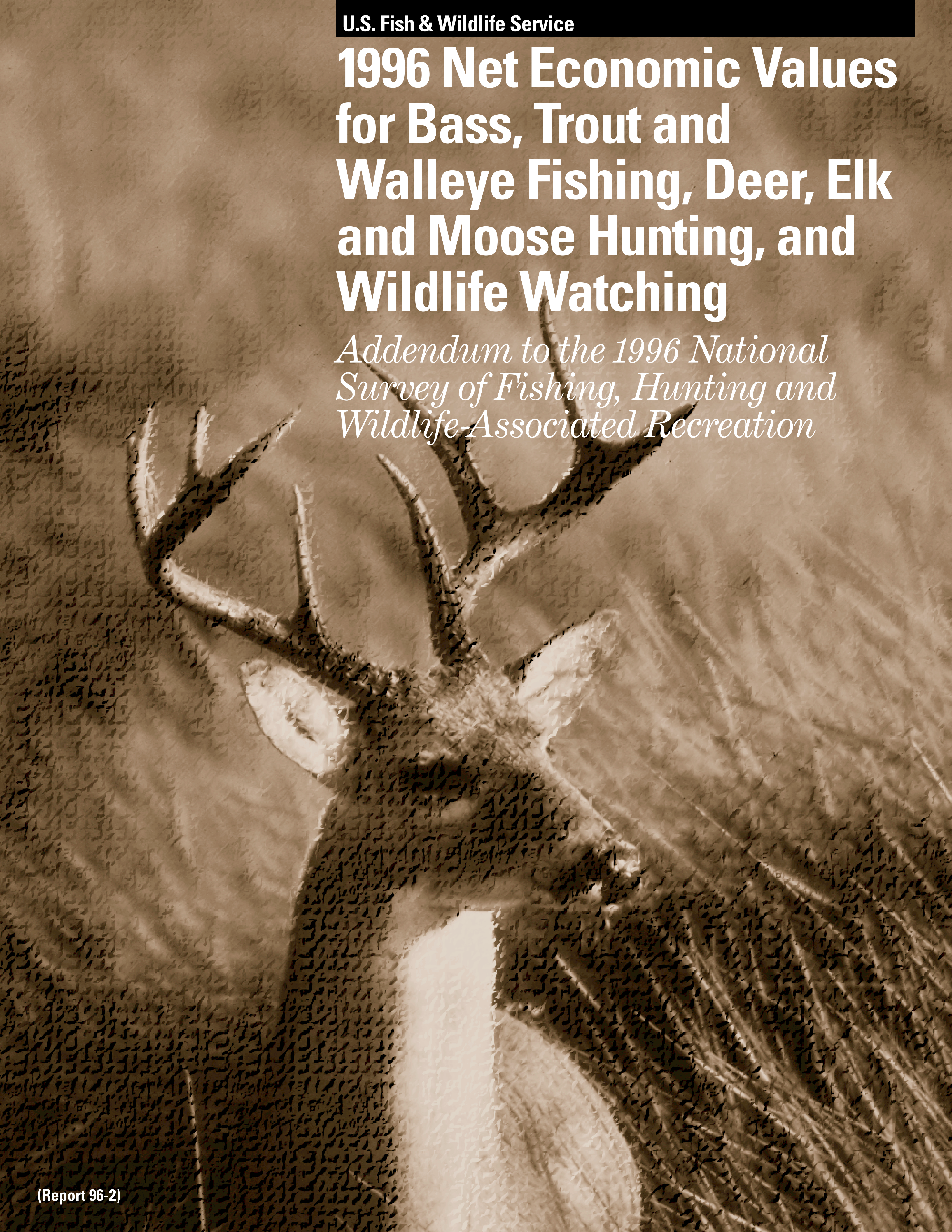
U.S. Fish & Wildlife Service

1996 Net Economic Values for Bass, Trout and Walleye Fishing, Deer, Elk and Moose Hunting, and Wildlife Watching

Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation



(Report 96-2)

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This report is intended to complement the National and State reports from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The conclusions are the authors and do not represent official positions of the U.S. Fish and Wildlife Service.

The authors acknowledge Martha Papp and Laura Teisl for their assistance with data analyses. Thanks also to the people who reviewed earlier drafts of this report.

Front Cover — USFWS photo: Tom Stehn

Contents

Abstract

Estimates of the net economic value for bass, trout and walleye fishing, deer, elk and moose hunting, and primary nonresidential wildlife watching based on contingent-valuation questions from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation are presented in this report for selected groupings of states.

States were classified as having primarily bass fishing, primarily trout fishing or primarily walleye fishing. Based on these classifications, anglers were asked to answer a contingent-valuation question for either their bass or their trout or their walleye fishing during 1996. Bass fishing refers to smallmouth and largemouth bass and excludes white bass, spotted bass, striped bass, striped bass hybrids, and rock bass. Trout fishing refers to all freshwater species commonly known as trout.

Likewise, states were classified as primarily deer hunting, primarily elk hunting or primarily moose hunting. Based on these classifications, hunters were asked contingent-valuation questions for their 1996 hunts.

People who took trips to watch wildlife at least one mile from their residence were asked a contingent-valuation question for these activities during 1996.

Net economic values are developed for current resource conditions, and marginal net economic values are also developed for changes in angler catch rates and changes in hunter harvest rates. The net economic values reported here are appropriate measures of economic value for use in cost-benefit analyses, damage assessments, and project evaluations.

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I. Introduction

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Survey hereafter) is the only source of data on human use of wildlife resources that is collected on a consistent, state-by-state basis. The first time net economic value data were collected was in the 1980 Survey, and this effort was repeated in the 1985, 1991 and 1996 Surveys. Estimates of net economic value for bass, trout and walleye fishing, deer, elk and moose hunting, and primary nonresidential wildlife watching derived from contingent-valuation questions in the 1996 Survey are presented in this report. Bass fishing refers to smallmouth and largemouth bass and excludes white bass, spotted bass, striped bass, striped bass hybrids, and rock bass. Trout fishing refers to all freshwater species commonly known as trout. Primary nonresidential wildlife watching refers to trips at least one mile from home taken for the primary purpose of observing, photographing, or feeding wildlife (wildlife watching hereafter).

In the 1991 Survey, states were assigned fishing status as either primarily bass fishing or primarily trout fishing. A person who lived in a bass state was asked a bass fishing valuation question and was not asked a trout valuation question, and vice versa for a person who lived in a trout state. In 1996, selected states in the upper Midwest were designated as walleye states. In 1991, all states were designated as deer hunting and in 1996 selected states in the northwest and northern Rocky Mountains were designated as elk states and Alaska was designated as a moose state. State species designations for fishing and hunting valuation questions are identified in Section IV.

An additional change between the 1991 and 1996 contingent-valuation sections of the Survey deals with respondents assigned residency status. When a person answered a valuation question in the 1991 Survey, their valuation response was assigned to their state of residence. Thus, a person from Michigan who hunted deer would have their deer valuation response assigned to Michigan even if they hunted deer in another state (e.g., mule deer in Colorado). In the 1996 Survey, valuation responses were assigned to the state where the activity occurred. Thus, with the example above, the valuation response by a person from Michigan who hunted deer in Colorado would be assigned to Colorado.

A third change between the 1991 and 1996 Surveys is the number of valuation questions respondents answer. In 1991, respondents could answer one question each for fishing, hunting and wildlife watching. In 1996, each respondent could answer up to four fishing valuation questions, four hunting valuation questions, and two wildlife watching valuation questions.

Using fishing as an example, if a respondent fished for the designated species in their state of residence, they were asked a valuation question for that species in their state of residence. A person from Georgia (a designated bass state), who fished for bass in Georgia, would be asked a bass valuation question for their bass fishing in Georgia. The survey also identified individuals who fished for bass, trout or walleye in designated bass, trout and walleye states other than their state of residence. If a respondent fished for a designated species they were asked a valuation question for that species. If a person fished for a species in two or more states outside their state of residence that were designated for the species, one of those states was randomly chosen and valuation questions were only asked for that state. The same pattern was used for the hunting and wildlife watching questions.

These changes were implemented to improve the usefulness of the valuation data for states. Including walleye fishing and elk and moose hunting valuation questions allowed states to obtain valuation data for the species they felt was most relevant for their management purposes. Clarifying the residence status of participants allowed for the development of valuation estimates that are specific to states where the activities occurred rather than being specific to residents of a state who may or may not have participated within their state of residency.

While these design advantages were implemented to improve the usefulness of the valuation data, reduced sample sizes and survey implementation procedures prevented us from developing state specific valuation estimates as was done in 1991. Rather, states had to be grouped in order to develop statistically significant estimates of value. These groupings are explained in Section IV.

In the following section we discuss the conceptual framework for net economic values of wildlife-related recreation, differentiating between net economic values and economic impacts. A discussion of the contingent-valuation questions and the procedures used to analyze the contingent-valuation data are presented in the third section. The groupings of states are presented in the fourth section. Net economic value estimates are reported in the fifth section. The sixth section contains a discussion of how to use the value data presented in this report and concluding comments are presented in the last section.

II. Measures of Economic Value

In 1996 more than 35 million Americans 16 years of age and older took trips to fish and spent more than $15 billion on trip-related expenditures. Expenditures are a useful indicator of the importance of sport fishing activities to local, regional, state and national economies, but expenditures (economic impacts) do not measure the economic benefit to individual participants. Net economic value, or consumer surplus, is the appropriate economic measure of the benefit to individuals from participation in wildlife-related recreation (Bishop, 1984; Freeman, 1993; Loomis et al., 1984; McCollum et al., 1992). Net economic value is measured as participants' "willingness to pay" above what they actually spend to participate. The benefit to society is the summation of willingness to pay across all individuals.

There is a direct relationship between expenditures and net economic value, as shown in Figure 1. A demand curve for a representative angler is shown in the figure. The downward sloping demand curve represents marginal willingness to pay per trip and indicates that each additional trip is valued less by the angler than the preceding trip. All other factors being equal, the lower the cost per trip (vertical axis) the more trips the angler will take (horizontal axis). The cost of a fishing trip serves as an implicit price for fishing since a market price generally does not exist for this activity. At $60 per trip, the angler would choose not to fish, but if fishing were free, the angler would take 20 fishing trips.

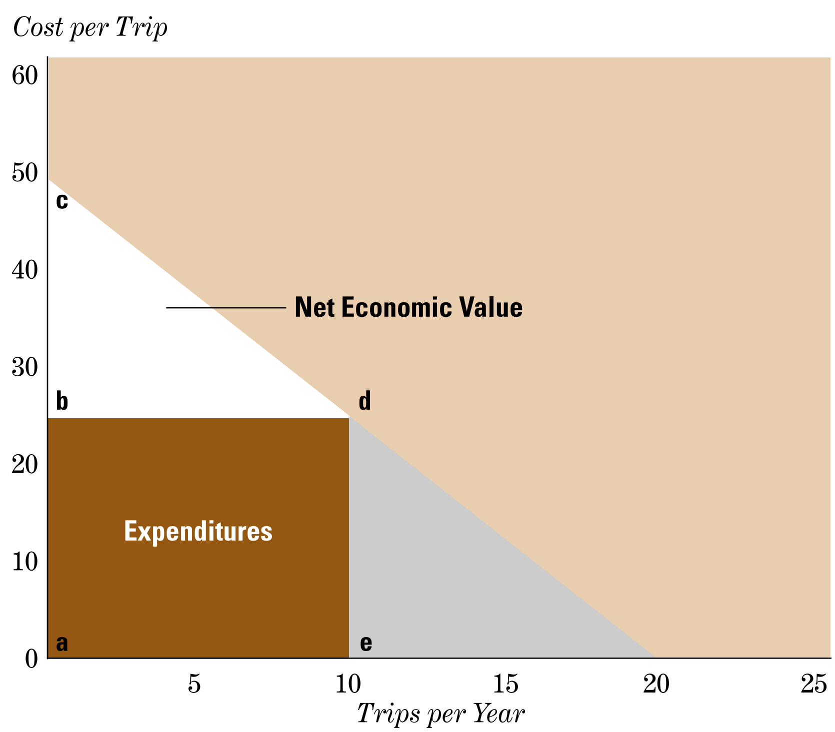
At a cost per trip of $25 the angler takes 10 trips, with a total willingness to pay of $375 (area acde in Figure 1). Total willingness to pay is the total value the angler places on participation. The angler will not take more than 10 trips because the cost per trip ($25) exceeds what he would pay for an additional trip. For each trip between zero and 10, however, the angler would actually have been willing to pay more than $25 (the demand curve, showing marginal willingness to pay, lies above $25).

The difference between what the angler is willing to pay and what is actually paid is net economic value. In this simple example, therefore, net economic value is $125 (($50 – $25) 10 ÷ 2) (triangle bcd in Figure 1) and angler expenditures are $250 ($25 × 10) (rectangle abde in Figure 1). Thus, the angler's total willingness to pay is composed of net economic value and total expenditures. Net economic value is simply total willingness to pay minus expenditures. The relationship between net economic value and expenditures is the basis for asserting that net economic value is an appropriate measure of the benefit an individual derives from participation in an activity and that expenditures are not the appropriate benefit measure.

Expenditures are out-of-pocket expenses on items an angler purchases in order to fish. The remaining value, net willingness to pay (net economic value), is the economic measure of an individual's satisfaction after all costs of participation have been paid.

Summing the net economic values of all individuals who participate in an activity derives the value to society. For our example let us assume that there are 100 anglers who fish and all have demand curves identical to that of our typical angler presented in Figure 1. The total value of this sport fishery to society is $12,500 ($125 × 100).

Figure 1. Individual Angler's Demand Curve for Fishing Trips



USFWS photo: Robert Shallenberger

Note that we have purposely excluded angler expenditures from the computation of societal benefits. Because individuals spend all of their income, with savings being a form of expenditure, angler expenses are not counted as benefits from a national accounting perspective. Money that is not spent for fishing at a particular site will be spent for fishing at another site or might be spent on an entirely different activity (e.g., attending a baseball game). Thus, any change in expenditures is simply a transfer from one subgroup of society to another subgroup.

There are very limited conditions under which expenditures might be counted as benefits (McCollum et al., 1992). For example, assume that 50 resident anglers and 50 nonresident anglers fish a lake in Colorado. If fishing was not allowed at the lake, Colorado residents are likely to fish elsewhere in Colorado. Their expenditures are not lost from Colorado's economy; they are simply transferred to another geographic area of Colorado. If nonresidents, however, choose to fish in another state, their expenditures would be lost to Colorado's economy. In this case, nonresident expenditures constitute new money in Colorado's economy and their removal would be counted as a regional loss of $12,500 ($25 × 10 × 50).

Fishing, hunting and wildlife-watching expenditures are recorded in the National and State reports generated from the 1996 Survey. Economic impacts of fishing, hunting, and wildlife watching are documented in separate reports.[1] In this report we present net economic values, which are appropriate measures of value for any benefit-cost evaluation of a wildlife project. Net economic values can enter these analyses as either benefits gained for improvements or benefits lost due to decrements. Expenditures should only enter into analyses to the extent that projects are regional or local in nature, and expenditures by participants would clearly increase or decrease in the study area as a consequence of the proposed wildlife management decisions.

The example we developed for sport fishing could have been developed in the context of hunting or wildlife watching. The basic concept of net economic value is the same for all three activities.

[1] The Economic Importance of Sport Fishing, The Economic Importance of Hunting and the 1996 National and State Economic Impacts of Wildlife Watching are available from the U.S. Fish and Wildlife Service, Publication Unit, Route 1, Box 166, Shepherd Grade Road, Shepherdstown, WV 25443.

III. Estimating Net Economic Values

Net economic values are estimated using contingent valuation (Mitchell and Carson, 1989). Contingent valuation is a direct questioning approach by which individuals are asked to reveal the value they place on an item or activity within a survey setting. The contingent-valuation questions were asked using the dichotomous-choice format (Bishop, Heberlein, and Kealy, 1983; Cameron, 1988; Hanemann, 1984; McConnell, 1990). Respondents were asked whether they would pay a fixed dollar amount to participate in an activity. The dollar amounts and respondents' "yes/no" responses are used to infer the mean values respondents place on each activity.

Respondents were asked to report their total trip expenses to participate in an activity during 1996, which is the expenditure rectangle abde in Figure 1. Respondents' expenditures were used for what is called the payment vehicle in the contingent-valuation questions (Mitchell and Carson, 1989). The payment vehicle is the mechanism by which respondents can express the net economic value they place on the activity being evaluated.

Taking bass fishing as an example, respondents were asked to recall their total number of bass fishing trips, bass caught, average length of bass caught, and their total trip expenditures for 1996 before answering the contingent-valuation question. The wording of the valuation question was:

> Fishing expenses change over time. For example, gas prices rise and fall. Would you have taken any trips to fish PRIMARILY for largemouth or smallmouth bass during 1996 in [state of reference] if your total costs were $________ more than the amount you just reported?

Response categories were yes or no. Note: respondents were only asked to value fishing trips where bass fishing was the "primary" activity. The trout and walleye fishing questions were exactly the same except "trout" or "walleye" were substituted for "bass" in the question. Similar valuation questions were employed for deer, elk and moose hunting, and wildlife watching. The fishing, hunting and wildlife watching valuation sections of the 1996 Survey are replicated in Appendix A.

Dollar amounts in the valuation questions were developed using estimated probit equations from contingent-valuation responses to the 1991 Survey (Waddington, Boyle and Cooper, 1994, Appendix D) and the procedure developed by Copper (1993) for assigning dollar amounts to dichotomous-choice questions. Walleye fishing and elk and moose hunting values were not estimated in the 1991 surveys. In order to develop bid amounts for states where these activities were to be valued in 1996, the estimation results for the 1991 activity were used as a best approximation. For example, deer hunting was valued in Alaska in 1991 and moose were valued in 1996; the deer hunting valuation results were used to develop bids for the moose hunting valuation question. The same procedure applies to states where walleye fishing and elk hunting were valued in 1996.

Responses to the contingent-valuation questions are used to estimate probit equations as formulated by Cameron and James (1987). The estimation of these equations used respondents' "yes/no" responses as dependent variables, and the dollar stimulus and other independent variables. Explanatory variables included in the final estimation are presented in Table 1.

The fishing equations include the dollar amount from the valuation question (Bid), the number of fish the anglers caught (# Bass, # Trout or # Walleye) during 1996, and the average length of the fish caught during 1996. When states were grouped into regions for data analysis, some regions included both bass and trout states so a species variable (Species) distinguishes between these states. Walleye states were grouped as a unique region so there is no overlap with walleye states. The resident variable indicates whether the valuation response was for a resident (=1) or nonresident (=0) of the state the valuation response applies to.[2]

Table 1. Explanatory Variables in the Probit Equations

Fishing	Hunting	Wildlife Watching
Bid ($)	Bid ($)	Bid ($)
# Caught (Bass, Trout or Walleye)	# Bagged (Deer, Elk, Moose)	Private (=1)
Inches (Avg. Length)	Sex (Buck or Bull =1)	Public (=1)
Species (Trout=1)	Other Big Game (=1)	Photo (=1)
Resident (=1)	Resident (=1)	Fished (=1)
		Resident (=1)

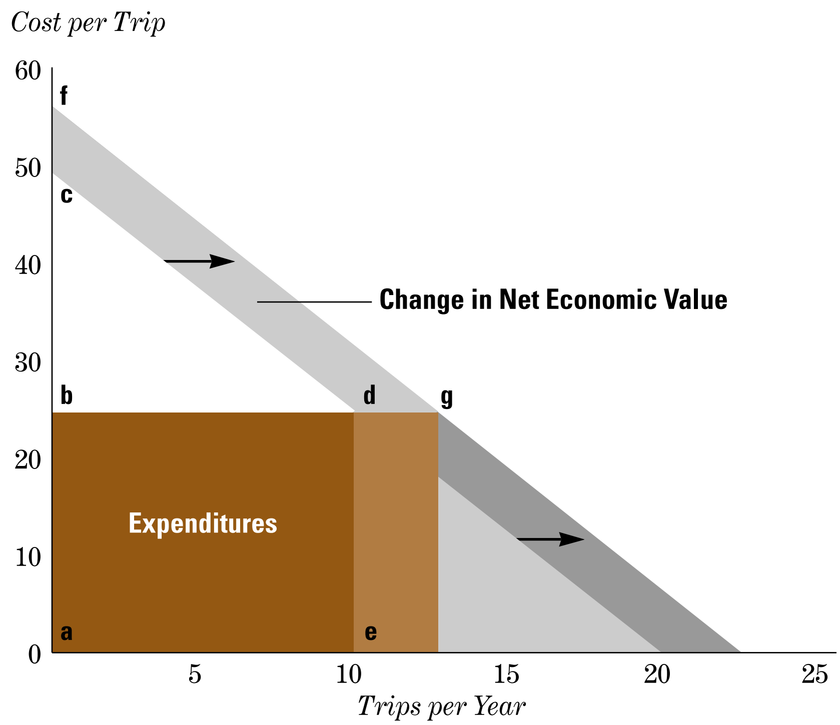
[1] Due to the small numbers of nonresident participants in many states, resident and nonresident data were grouped for the analyses.

The hunting equations include the bid variable, the number of deer a hunter harvested (# Bagged) during 1996, a dummy variable to indicate whether a hunter bagged a buck or bull (Sex), a dummy variable to indicate whether the individual hunted other big game during 1996 (Other Big Game), and the resident variable. Respondents were not asked if they harvested more than one elk or moose. # Bagged is a dummy variable that equals one if an animal was harvested in an elk or moose state. Moose hunting was only valued in Alaska and elk states constituted a unique region so there was no multiple species regions in the hunting data.

Similar variables are not appropriate for wildlife watching because resources are not being harvested and a single species is not as likely to be targeted. In turn, variables that characterize different types of wildlife watching and activities in which the individuals participated are included to assess whether these categorizations significantly affect estimated net economic values. Dummy variables are included to indicate whether individuals watch wildlife on private land (yes=1) or public land (yes=1). The omitted category is individuals who took trips to watch wildlife on both private and public land. Dummy variables indicating whether individuals photographed wildlife while on trips to watch wildlife (yes=1) and whether they were an angler (yes=1) are also included. The resident variable is also included here.

The "Number Caught" and "Bagged" variables are included in the fishing and hunting equations to allow computation of marginal values, the amount by which net economic value increases or decreases as the number of fish caught (big game harvested) increases or decreases. Similar interpretations apply for the other explanatory variables used in the equations. The purpose of including these variables is to allow the computation of marginal values for fish and wildlife projects that either increase harvest rates or protect resources to prevent declines in harvest rates. In many instances, all or nothing values, as shown in Figure 1, are not appropriate. Rather, a change in quality shifts the demand curve, thereby resulting in a change in net economic value (Figure 2). In these instances, the change in net economic value is the appropriate benefit measure.

Figure 2. Shift in Angler Demand Curve for Fishing Trips Due to an Increase in Catch Rate



For example, assume a management activity will increase catch rates for anglers by 10 percent. This change in the resource results in a shift of the demand curve upward and to the right, as presented in Figure 2. The benefit to the angler of this increase in catch rate is the area cfgd. Estimation of this area is possible by including harvest rates as explanatory variables in the estimated probit equations.

Responses to the contingent-valuation questions are analyzed by estimating probit equations using weighted maximum likelihood procedures (Cameron, 1988; Greene, 1992). Maximum likelihood estimation is used because the dependent variable is discrete (0/1) and the estimation is weighted because the Survey is conducted with a probability sample where observations have unequal probabilities of being selected into the sample. The estimated probit equations are used to derive estimates of average net economic value per year for each activity. Ninety percent confidence intervals are developed for these averages (Cameron, 1991). A discussion of the estimation procedures is presented in Appendix B.

IV. Species Designations of States and Groupings of States for Data Analyses

As noted above, valuation questions were added for walleye fishing and elk and moose hunting in the 1996 Survey. In addition, selected states had their bass or trout designations reversed; Massachusetts and Rhode Island were switched from being trout states to being bass states and New Jersey was switched from a bass state to a trout state. The species designations for the fishing valuation questions are presented in Figure 3 and the hunting species designations are presented in Figure 4.

While valuation estimates were reported by state for the 1991 Survey, and the 1996 Survey was customized to allow more species-specific valuation at the state level, several issues prevented us from reporting state-specific valuation estimates using contingent-valuation responses from the 1996 Survey.

The first issue is that the overall sample size of the Survey was smaller in 1996 than 1991, with the consequent reduction in state subsamples. This was done to reduce the cost of the survey. Second, the survey implementation procedure required that we develop bids for all potential respondents prior to the survey implementation. In the application of the survey, valuation questions and bids were only applied to people who actually qualified to answer the valuation questions. Thus, the actual allocation of bids to respondents (number of bids at each bid amount) was different than the original bid designs. Finally, the bid design procedure developed by Cooper (1993) tends to cluster bids near the median. With small sample sizes, bid allocations that do not represent the initial designs, and bid amounts clustered near the presumed median resulted in relatively flat contingent-valuation response functions to the bid amounts. The consequence was coefficients on the

Figure 3. State Species Designations for Fishing Valuation Questions

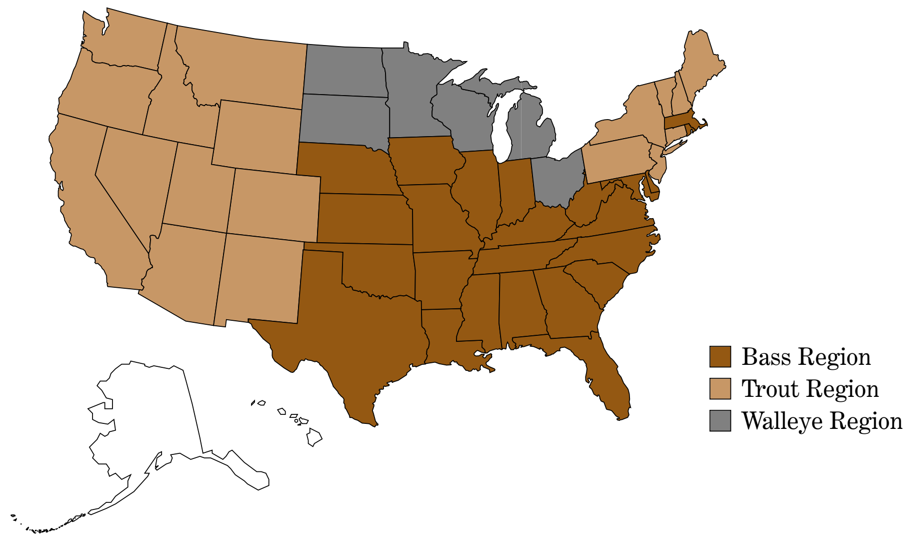
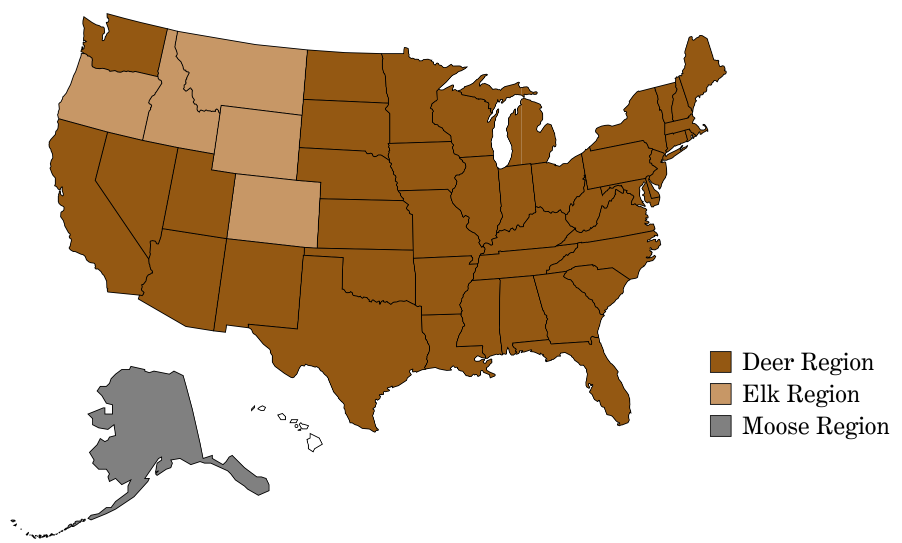


Figure 4. State Species Designation for Hunting Valuation Questions



bid variable that were insignificant for most states for fishing, hunting and wildlife watching. In turn, mean values for these states were either negative, included the origin in confidence intervals, or otherwise did not conform to standard theories. To address this problem, states were grouped for purposes of data analyses. Grouping states increases sample sizes for estimation and ameliorates the problems noted above.

Estimating values by states makes sense from an institutional perspective because each state has its own unique licensing and regulation structures for fishing and hunting and differing management strategies may affect wildlife viewing opportunities. No institutional or geographical guidance exists to suggest how states should be grouped for analysis purposes so we examined several groupings of states.

The first groupings are U.S. Fish and Wildlife Management Regions (Figure 5) and U.S. Bureau of Census Regions (Figure 6). These regions were used to analyze the fishing, hunting and wildlife watching data. Some of these groupings included bass states and trout states, which motivates the species variable in the fishing equations. The walleye states are always maintained as a distinct region (Figure 3).

For the hunting analysis the elk states are also maintained as distinct regions (Figure 4) and Alaska, the only state where moose is valued, is maintained as a distinct one-state region. These unique groupings imply that it is not necessary to have a variable designating walleye fishing or elk and moose hunting when analyzing the data using the U.S. Fish and Wildlife Regions and the U.S. Bureau of Census Regions.

In addition, representatives of the U.S. Fish and Wildlife Service proposed groupings of states for bass and trout fishing, deer hunting and wildlife watching that they thought might be more useful than the U.S. Fish and Wildlife Management Regions and U.S. Bureau of Census Region. These regions are denoted in Figures 7-10.

Figure 5. U.S. Fish and Wildlife Service Regions

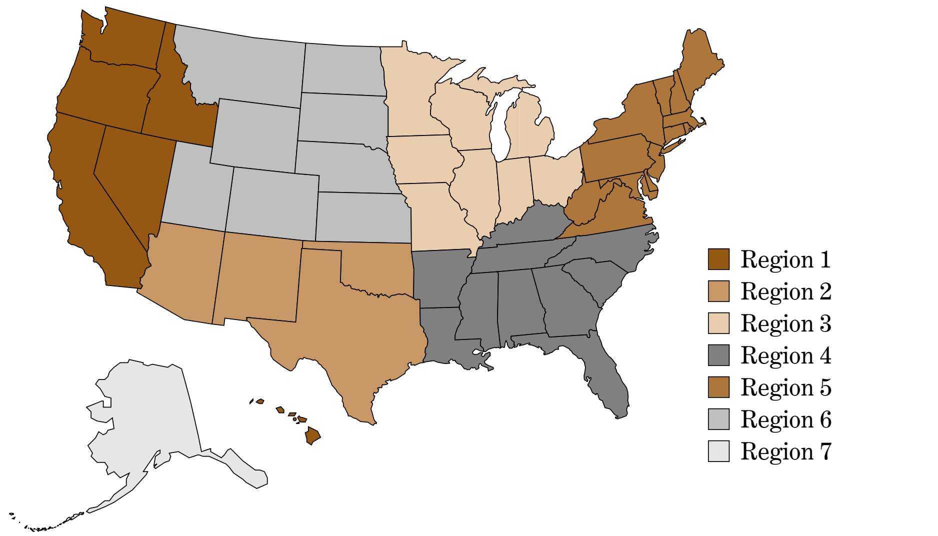


Figure 6. U.S. Bureau of Census Regions

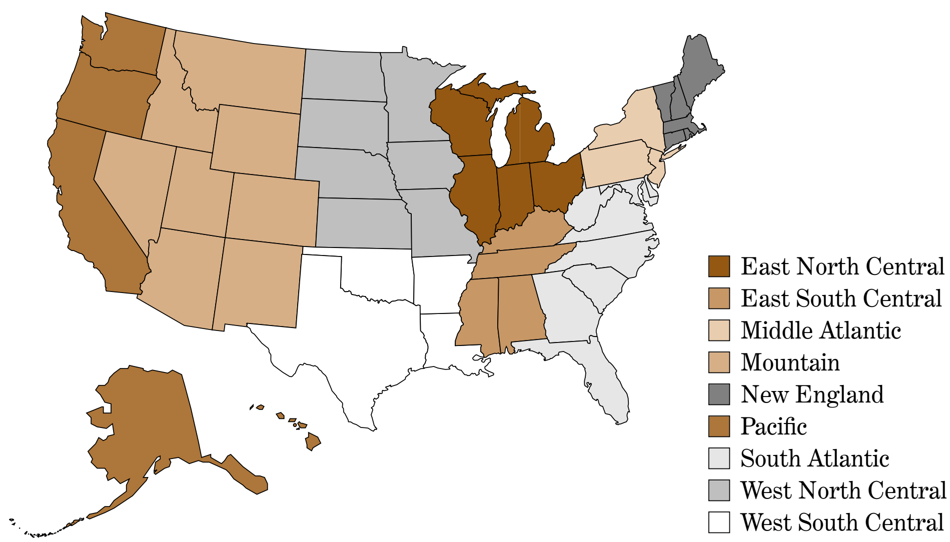


Figure 7. Bass Regions

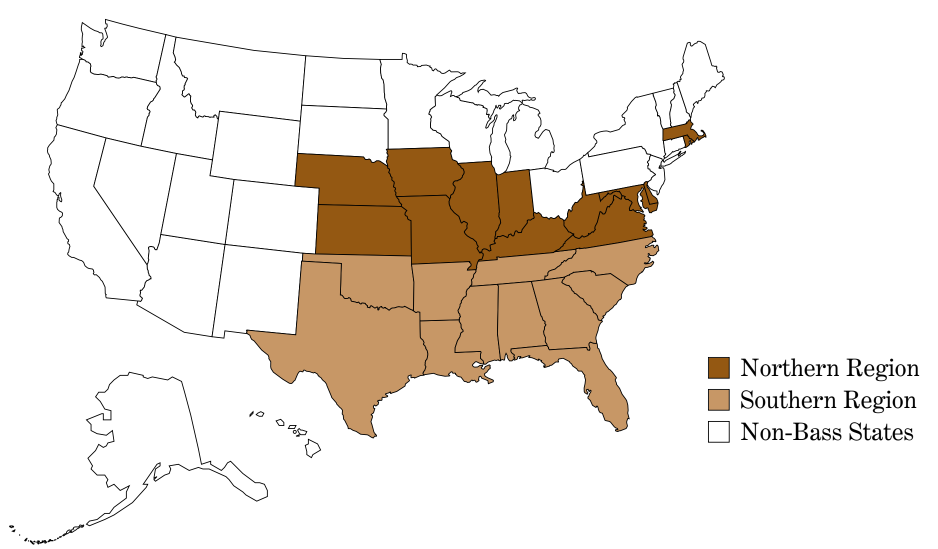


Figure 8. Trout Regions

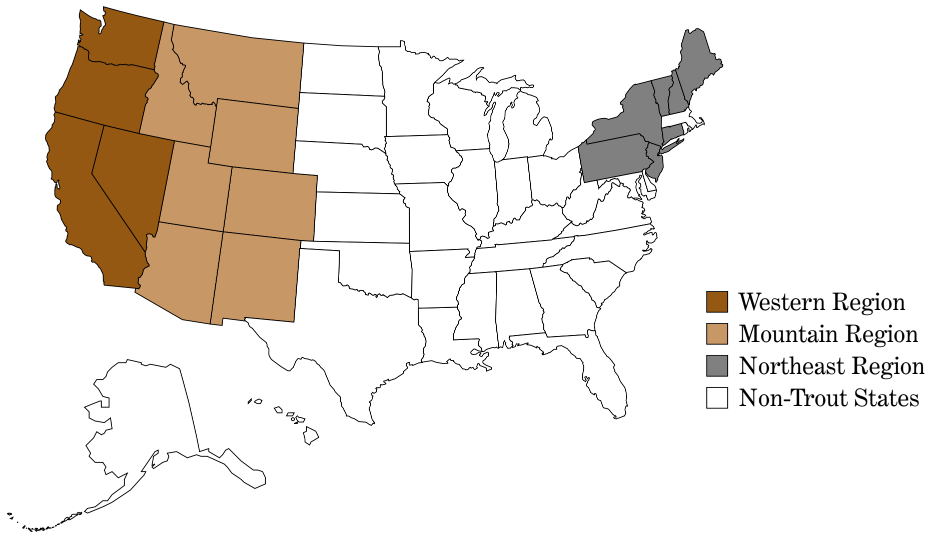


Figure 9. Deer Regions

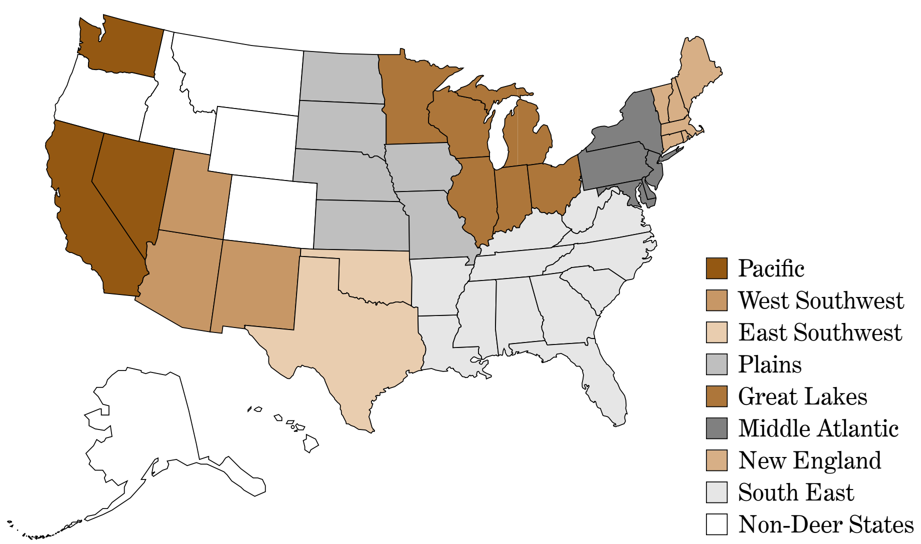
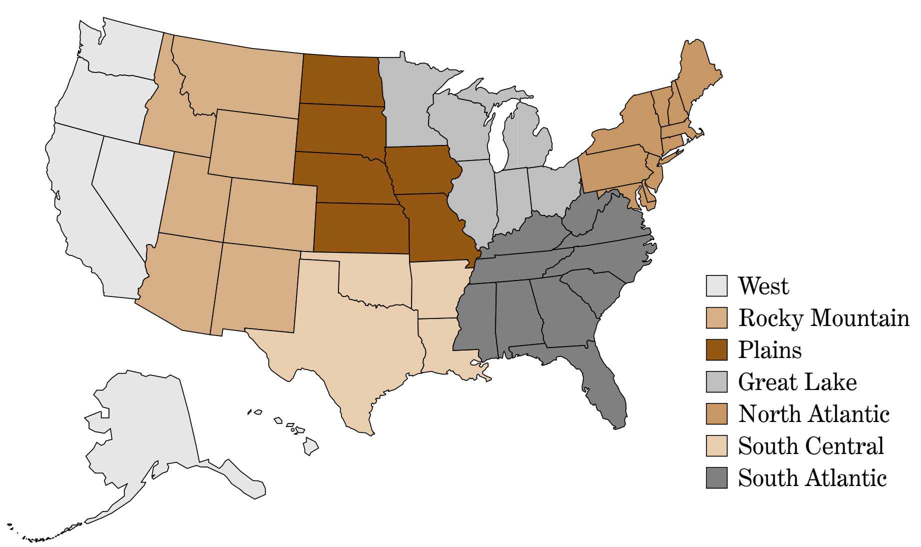


Figure 10. Wildlife Watching Regions



V. Estimated Net Economic Values

The U.S. Bureau of Census conducted the 1996 Survey for the U.S. Fish and Wildlife Service. The Bureau of Census collected the data primarily by telephone; respondents who could not be reached by phone were interviewed in-person. Three interviews were conducted at four-month intervals to reduce recall bias associated with asking respondents to report participation in an activity for an entire year. The response rate was 80 percent. Contingent-valuation data were collected in January 1997 for the 1996 calendar year.

Estimated probit equations for each activity by region are presented in Appendix C. Annual net economic values are computed from these equations. Net economic values per day are computed by dividing estimated net economic value per year by the average number of days individuals participated in the activity. Days of participation were collected in each of the three interviews and are summed to arrive at annual days of participation. Days of fishing (bass, trout and walleye) used in this computation represent days of fishing freshwater on non-Great Lakes waters only. Great Lakes fishing was dropped because there is a possibility of double counting days. Anglers could have fished in both non-Great Lakes waters and Great Lakes waters on the same day.[3] Hunting (deer, elk and moose) and wildlife watching days represent all days taken to participate in these activities. Wildlife watching is defined as any trip at least one mile from home taken for the primary purpose of observing, photographing, or feeding wildlife.

As noted above, the data were analyzed by grouping states into various regions. We focus the discussion in the text on the U.S. Fish and Wildlife Service Management Regions and report results for other regions in the tables.

USFWS photo

Fishing
Regional estimates of net economic value per year with ninety percent confidence intervals are shown in Table 2. Computed net economic values per day are reported in the last column of Table 2. Estimates by region are reported for bass, trout, and bass and trout combined. The species for which value estimates apply are denoted in the second column of the table. Regions for which value estimates are not reported had computed means that were negative. The computed mean for the walleye region was negative so we do not report a walleye value.

We suspect this negative estimate is due to the sampling issues discussed in the previous section and do not reflect negative or zero values for fishing.

Values for bass fishing range from $52 per year (Region 4) to $326 per year (Region 5 bass states) across the U.S. Fish and Wildlife Service Management Regions (Table 2). The corresponding net economic values per day are $3 and $19. Trout fishing values range from $79 per year (Region 5 trout states) to $375 per year (Region 7, Alaska), with per day values of $6 and $38. Although Regions 2 and 6 include both bass and trout states, only combined estimates are reported because the coefficients on the species variables in the probit equations for these regions were not significantly different from zero. The estimate for Region 2 should be interpreted with caution as the mean is very large, the bid coefficient was insignificant in the probit equation, and the confidence interval contains the origin.

Net economic value per year, average number of fish caught per angler per year, and the marginal value of catching an additional fish are presented in Table 3. The marginal values show the change in net economic value per year that would result from changing the average catch rate by one fish per year.

The coefficient on "fish caught" was significantly different from zero in the probit equations for five of the seven U.S. Fish and Wildlife Service Regions. The marginal net economic value of catching a fish ranges from $0.24 (Region 7) to $4.85 (Region 3).

[2] This procedure may tend to underestimate days of fishing resulting in overestimates of net economic values per day. Net economic values per year are not affected by this calculation.

Table 2. Net Economic Value for Fishing by Region

Region		Species Valued	Net Economic Value Per Year: Mean	Net Economic Value Per Year: Standard Error of the Mean	Net Economic Value Per Year: Ninety Percent Confidence Interval	Net Economic Value Per Day
U.S. Fish and Wildlife Service Regions						
1	(CA, ID, NV, OR, WA)	Trout	126	98	-35-287	12
2	(AZ, NM, OK, TX)	Bass & Trout[2]	1154	1203	-825-3133[1]	105
3	(IA, IL, IN, MO)	Bass	222	56	129-314	15
4	(AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	Bass	52	199	-275-378	3
5	(CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	Bass & Trout	150	41	83-217	10
	(DE, MA, MD, RI, VA, WV)	Bass	326	NA[3]	NA[3]	19
	(CT, ME, NH, NJ, NY, PA, VT)	Trout	79	NA[3]	NA[3]	6
6	(CO, KS, MT, NE, UT, WY)	Bass & Trout[2]	289	20	256-323	25
7	(AK)	Trout	375	11	357-394	38
U.S. Bureau of the Census Regions						
Pacific (AK, CA, OR, WA)		Trout	22	156	-234-279	2
Mountain (AZ, CO, ID, MT, NM, NV, UT, WY)		Trout	268	41	201-336	27
West North Central (IA, KS, MO, NE)		Bass	290	51	207-374	17
East North Central (IL, IN)		Bass	381	54	292-471	24
Middle Atlantic (NJ, NY, PA)		Trout	NA[4]	NA[4]	NA[4]	NA[4]
New England (CT, MA, ME, NH, RI, VT)		Bass & Trout[2]	156	106	-17-330	10
West South Central (AR, LA, OK, TX)		Bass	NA[4]	NA[4]	NA[4]	NA[4]
East South Central (AL, KY, MS, TN)		Bass	312	244	-89-713[1]	19
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)		Bass	NA[4]	NA[4]	NA[4]	NA[4]
U.S. Fish and Wildlife Service Bass Regions						
Northern (DE, IA, IL, KS, KY, MA, MD, MO, NE, RI, VA, WV)		Bass	262	35	205-320	16
Southern (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX)		Bass	NA[4]	NA[4]	NA[4]	NA[4]
U.S. Fish and Wildlife Service Trout Regions						
Western (CA, NV, OR, WA)		Trout	3	162	-263-270	0
Mountain (AZ, CO, ID, MT, NM, UT, WY)		Trout	269	45	195-342	27
Northeast (CT, ME, NH, NJ, NY, PA, VT)		Trout	53	59	-43-150	4
U.S. Fish and Wildlife Service Walleye Region						
Walleye Region (MI, MN, ND, OH, SD, WI)		Walleye	NA[4]	NA[4]	NA[4]	NA[4]

[1] Estimated bid coefficient is not significantly different from zero (see Table C-1).

[2] Separate bass and trout values are not reported because the variable on species was not significantly different from zero (see Table C-1).

[3] Standard errors and confidence intervals not reported for separate species in regions with estimated mean values for bass and trout.

[4] Value not reported because estimated mean is negative.

Table 3. Marginal Values for Catching an Additional Fish by Region

Region		*Species Valued*	*Net Economic Value Per Year*	*Average Number of Fish Caught*	*Marginal Value Per Fish*
U.S. Fish and Wildlife Service Regions					
1	(CA, ID, NV, OR, WA)	Trout	126	42	0.71
2	(AZ, NM, OK, TX)	Bass & Trout	1154[1]	35	NA[2,4]
3	(IA, IL, IN, MO)	Bass	222	33	4.85
4	(AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	Bass	52	59	3.81
5	(CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	Bass & Trout	150	42	2.96
	(DE, MA, MD, RI, VA, WV)	Bass	326	62	2.96
	(CT, ME, NH, NJ, NY, PA, VT)	Trout	79	37	2.96
6	(CO, KS, MT, NE, UT, WY)	Bass & Trout	289	47	2.65[2]
7	(AK)	Trout	375	39	0.24[2]
U.S. Bureau of the Census Regions					
Pacific (AK, CA, OR, WA)		Trout	22	44	0.71
Mountain (AZ, CO, ID, MT, NM, NV, UT, WY)		Trout	268	35	2.75
West North Central (IA, KS, MO, NE)		Bass	290	49	6.05
East North Central (IL, IN)		Bass	381	34	1.44
Middle Atlantic (NJ, NY, PA)		Trout	NA[3]	NA[3]	NA[3]
New England (CT, MA, ME, NH, RI, VT)		Bass & Trout	156[1]	41	3.86
West South Central (AR, LA, OK, TX)		Bass	NA[3]	NA[3]	NA[3]
East South Central (AL, KY, MS, TN)		Bass	312[1]	69	4.61
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)		Bass	NA[3]	NA[3]	NA[3]
U.S. Fish and Wildlife Service Bass Regions					
Northern (DE, IA, IL, KS, KY, MA, MD, MO, NE, RI, VA, WV)		Bass	262	49	3.60
Southern (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX)		Bass	NA[3]	NA[3]	NA[3]
U.S. Fish and Wildlife Service Trout Regions					
Western (CA, NV, OR, WA)		Trout	3	43	0.78
Mountain (AZ, CO, ID, MT, NM, UT, WY)		Trout	269	36	2.81
Northeast (CT, ME, NH, NJ, NY, PA, VT)		Trout	53	32	3.38
U.S. Fish and Wildlife Service Walleye Region					
Walleye Region[3] (MI, MN, ND, OH, SD, WI)		Walleye	NA[3]	NA[3]	NA[3]

[1] Estimated bid coefficient is not significantly different from zero (see Table C-1).

[2] Value not reported because coefficient on catch is not significantly different from zero.

[3] Value not reported because estimated mean value per year is negative.

[4] Value not reported because marginal value per fish is negative.

Deer Hunting

Regional estimates of net economic value per year with ninety percent confidence intervals for hunting are presented in Table 4. Computed net economic values per day are reported in the last column of Table 4.

Net economic values for five of the U.S. Fish and Wildlife Service Management Regions are reported. Net economic values range from $42 per year (Region 2) to $285 per year (Region 6). The corresponding values per day are $5 and $39. A net economic value for deer hunting is not reported for Region 1 because the mean economic value per year is negative. The interpretation of this negative mean is the same as discussed for the fishing results above.

Table 4. Net Economic Value for Hunting by Region

Region	Net Economic Value Per Year: Mean	Net Economic Value Per Year: Standard Error of the Mean	Net Economic Value Per Year: Ninety Percent Confidence Interval	Net Economic Value Per Day
U.S. Fish and Wildlife Service Regions				
1 (CA, NV, WA)	NA[2]	NA[2]	NA[1,2]	NA[2]
2 (AZ, NM, OK, TX)	42	1005	–1610-1696[1]	5
3 (IA, IL, IN, MI, MN, MO, OH, WI)	216	68	105-328	21
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	104	735	–1105-1313[1]	7
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	102	179	–192-395	9
6 (KS, ND, NE, SD, UT)	285	18	255-314	39
U.S. Bureau of the Census Regions				
Pacific (CA, WA)	NA[2]	NA[2]	NA[1,2]	NA[2]
Mountain (AZ, NM, NV, UT)	301	86	160-442	58
West North Central (IA, KS, MN, MO, NE, NE, SD)	205	45	132-278	26
East North Central (IN, IL, MI, OH, WI)	283	68	172-394	24
Middle Atlantic (NJ, NY, PA)	NA[3]	NA[3]	NA[1,3]	NA[3]
New England (CT, MA, ME, NH, RI, VT)	375	51	290-459	29
West South Central (AR, LA, OK, TX)	923	526	58-1787	69
East South Central (AL, KY, MS, TN)	334	196	11-657	23
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	NA[3]	NA[3]	NA[1,3]	NA[3]
U.S. Fish and Wildlife Service Deer Regions				
Pacific (WA, CA, NV)	NA[2]	NA[2]	NA[1,2]	NA[2]
West Southwest (AZ, NM, UT)	299	94	144-453	59
East Southwest (OK, TX)	238	889	–1223-1700[1]	20
Plains (IA, KS, MO, ND, NE, SD)	237	36	178-296	29
Great Lakes (IN, IL, MN, MI, OH, WI)	216	91	67-366	20
Middle Atlantic (DE, MD, NJ, NY, PA)	NA[2]	NA[2]	NA[1,2]	NA[2]
New England (CT, MA, ME, NH, RI, VT)	374	51	290-459	29
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	NA[2]	NA[2]	NA[1,2]	NA[2]
Other Big Game Species				
Elk Region (CO, ID, MT, OR, WY)	410	42	342-478	59
Moose Region (AK)	624	51	541-708[1]	61

[1] Estimated bid coefficient is not significantly different from zero (see Table C-2).

[2] Value not reported because estimated mean is negative.

[3] Value not reported because estimated mean was implausibly large (>$1,500)

The annual net economic value of elk hunting is $410 and the per day value is $59. The comparable numbers for moose hunting in Alaska (Region 7) are $624 per year and $61 per day. The marginal value of bagging an additional deer is highest in Region 2 ($417) and lowest in Region 6 ($39); the opposite of the annual net economic value estimates. A marginal value for bagging an elk is not reported because the coefficient on this variable was not significantly different from zero in the probit equation. The marginal value of bagging a moose in Alaska is $149.

Table 5. Marginal Value for Bagging an Additional Deer by Region

Region		*Net Economic Value Per Year*	*Average Number Bagged*	*Marginal Value Per Animal*
U.S. Fish and Wildlife Service Regions				
1	(CA, NV, WA)	NA[1,2]	NA[2]	NA[2]
2	(AZ, NM, OK, TX)	42	0.78	417
3	(IA, IL, IN, MI, MN, MO, OH, WI)	216	0.65	204[3]
4	(AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	104	1.05	168
5	(CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	102	0.63	372
6	(CO, KS, MT, ND, NE, SD, UT, WY)	285	0.63	39
U.S. Bureau of the Census Regions				
Pacific (CA, WA)		NA[1,2]	NA[2]	NA[2]
Mountain (AZ, NM, NV, UT)		301	0.30	347
West North Central (IA, KS, MN, MO, NE, NE, SD)		205	0.61	107
East North Central (IN, IL, MI, OH, WI)		283	0.68	188
Middle Atlantic (NJ, NY, PA)		NA[1,4]	NA[4]	NA[4]
New England (CT, MA, ME, NH, RI, VT)		375	0.28	NA[5,6]
West South Central (AR, LA, OK, TX)		923	0.85	NA[6]
East South Central (AL, KY, MS, TN)		334	1.08	148
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)		NA[1,4]	NA[4]	NA[4]
U.S. Fish and Wildlife Service Deer Regions				
Pacific (CA, NV, WA)		NA[1,2]	NA[2]	NA[2]
West Southwest (AZ, NM, UT)		299	0.27	796
East Southwest (OK, TX)		238	0.86	266
Plains (IA, KS, MO, ND, NE, SD)		237	0.69	138
Great Lakes (IN, IL, MI, MN, OH, WI)		216	0.64	200
Middle Atlantic (DE, MD, NJ, NY, PA)		NA[1,2]	NA[2]	NA[2]
New England (CT, MA, ME, NH, RI, VT)		374	0.28	NA[6]
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)		NA[1,2]	NA[2]	NA[2]
Other Big Game Species				
Elk Region (CO, ID, MT, OR, WY)		410	0.68	NA[5,6]
Moose Region (AK)		624[1]	0.42	149

[1] Estimated bid coefficient is not significantly different from zero (see Table C-2).
[2] Value not reported because estimated mean is negative.
[3] Coefficient on number bagged is not significantly different from zero.
[4] Value not reported because estimated mean was implausibly large (>$1,500)
[5] Estimated marginal value is not significantly different from zero.
[6] Value not reported because estimated marginal value is negative.

Wildlife Observation

Regional estimates of net economic value per year with ninety percent confidence intervals for wildlife watching are presented in Table 6. The last column of Table 6 contains computed net economic values per day for wildlife watching.

With respect to Fish and Wildlife Service Regions, estimates of net economic value per year range from $696 in Alaska (Region 7) to $92 in Region 5. The respective values per day are $34 and $9.

Table 6. Net Economic Value for Wildlife Watching

Region	*Net Economic Value Per Year*			
	Mean	*Standard Error of the Mean*	*Ninety Percent Confidence Interval*	*Net Economic Value Per Day*
U.S. Fish and Wildlife Service Regions				
1 (CA, HI, ID, NV, OR, WA)	234	134	14-454[1]	20
2 (AZ, NM, OK, TX)	251	135	29-473[1]	19
3 (IA, IN, IL, MI, MN, MO, OH, WI)	NA[2]	NA[2]	NA[2]	NA[2]
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	115	110	–65-296	10
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	92	63	–11-196	9
6 (CO, KS, MT, ND, NE, SD, UT, WY)	290	17	262-317	28
7 (AK)	696	63	593-799	34
U.S. Bureau of the Census Regions				
Pacific (AK, CA, HI, OR, WA)	263	122	63-464	19
Mountain (AZ, CO, IA, MT, NM, NV, UT, WY)	312	31	260-364[1]	31
West North Central (IA, KS, MN, MO, ND, NE, SD)	184	18	154-213	17
East North Central (IL, IN, MI, OH, WI)	NA[2]	NA[2]	NA[2]	NA[2]
Middle Atlantic (NJ, NY, PA)	NA[2]	NA[2]	NA[1,2]	NA[2]
New England (CT, MA, ME, NH, RI, VT)	191	37	131-251	16
West South Central (AR, LA, OK, TX)	315	40	249-382	24
East South Central (AL, KY, MS, TN)	112	106	–62-286	9
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	99	124	–105-304	10
U.S. Fish and Wildlife Service Suggested Groupings				
West (AK, CA, HI, NV, OR, WA)	259	119	64-455[1]	19
Rocky Mountain (AZ, CO, ID, MT, NM, UT, WY)	313	31	263-364	30
Plains (IA, KS, MO, ND, NE, SD)	199	15	175-224	17
Great Lake (IN, IL, MI, MN, OH, WI)	NA[2]	NA[2]	NA[2]	NA[2]
North Atlantic (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	18	121	–181-217	2
South Central (AR, LA, OK, TX)	315	40	249-382	24
South Atlantic (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	100	121	–100-299	10

[1] Estimated bid coefficient is not significantly different from zero (see Table C-3).

[2] Value not reported because estimated mean is negative.

VI. Using the Value Estimates

Three types of values have been reported, mean net economic values per year per participant, net economic values per day of participation, and marginal net economic values based on harvesting an additional fish or big game animal. Each of these values has a slightly different use and interpretation in conducting benefit and cost calculations of wildlife management and policy decisions.

Mean net economic values per year per participant can be thought of as “all or nothing values.” Take trout fishing in Region 5 as an example, with a mean value of $79 (Table 2). The $79 represents the mean value to a trout angler in Region 5 given the current resource condition and trout fishing regulations. This is an estimate of the net economic value portrayed in Figure 1. If the Region chose for some reason to prohibit trout fishing, $79 is an estimate of the average loss to an angler who fishes for trout. Thus, while mean net economic values per year per participant are interesting in terms of characterizing the current value of the resource and in calculating losses for a catastrophic change in the resource, they are not applicable for most management and public policy decisions faced by resource managers.

Management and policy decisions (actions) generally increase or decrease participation rates, or increase or decrease harvest rates, resulting in marginal changes in resource availability. Let us continue with the Region 5 example. Assume an environmental pollution accident results in the closure of a lake to fishing for a whole season. If a fishery manager knows the number of days of fishing that occur on the lake over the whole season, 1,200 for example, it is possible to develop a rough estimate of the fishery losses from the accident. This estimate is accomplished by multiplying the net economic value per day (Table 2) by the days of participation, resulting in $7,200 ($6 × 1200). As previously noted, net economic value per day is computed by dividing mean net economic value per year by the number of days of participation (Appendix D). Two caveats apply to this estimate of losses. If anglers shift their fishing effort to another lake and contingent valuation responses do not account for this substitution, then $7,200 is an overestimate of the losses. The second caveat relates to whether the accident diminishes fishing quality after the lake has been reopened to fishing, perhaps due to a reduction in the biomass of the fish stock. In this case the $7,200 is an underestimate of the loss and it is necessary to estimate the reduction in value due to the change in the quality of the fishery. This is an application where the marginal values can play a role.

Let us assume that trout fishing on the lake is closed for one year, substitution is reflected in the contingent valuation responses and the catch rate is reduced by 10 percent next year when the fishery is reopened. The fishery returns to normal in the third year. The loss in the first year is the $7,200. Assume 300 anglers fish the lake in the second year. The loss in the second year is $3,286 ($0.10 \times 37 \times 2.96 \times 300$). Referring to Figure 2, the 10 percent reduction would shift the demand curve to the left, portraying a loss in the net economic value. In this example the loss per angler is $10.95 ($0.10 \times 37 \times 2.96$). This loss is computed by multiplying the 10 percent reduction in catch rates by the average catch rate (37 trout per year per angler) by the marginal value of a trout ($2.96 per fish per angler) (Table 3). The total loss is $10,486 ($7,200 + $3,286).

Although unrealistic in its simplicity, the example does aid in the understanding of how to use the value estimates. Similar examples could be developed for actions that affect bass fishing, and can be to applied to deer hunting and wildlife watching. We do not report marginal values for wildlife watching. The key issues that must be understood are:

■ Each of the different values estimates has slightly different interpretations and uses;

USFWS photo: Ralph Town

■ If an action changes participation, it is necessary to consider the extent to which participants substitute to another site to fish or hunt. Failure to consider substitution will result in overestimation of resource losses; and

■ Using per participant value estimates to compute losses or benefits requires additional information, particularly on resource conditions and participation rates.

Thus, the value estimates reported here must be used with caution in order to avoid misuse of this information, which would result in incorrect estimates of aggregate costs or aggregate benefits.

VII. Concluding Comments

Net economic values represent the values above and beyond what participants actually spend to participate in an activity. This value information can be used to assess the current value of participation in these activities. Marginal values can be used to compute benefits or costs of increasing or decreasing the availability of selected wildlife resources. Marginal values provide a starting point for resource managers evaluating changes in resource availability, whether it is a planned improvement or an unforeseen change.

Given the groupings of data reported here, we suggest wildlife managers use estimates from groups that include their states. There is no clear guidance as to which groupings of states best represent value estimates. We leave this decision to wildlife managers to choose the grouping they feel best represents conditions in their state.

USFWS photo: Luther Goldman

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Appendix A

Contingent-Valuation Sections from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for Fishing (Bass, Trout, and Walleye), Hunting (Deer, Elk, and Moose), and Wildlife Watching

Fishing Economic Evaluation

In the next few questions, I will ask you about ALL your trips taken during the ENTIRE calendar year of 1996 to PRIMARILY fish for [trout/bass/walleye] in [state].

Sometimes you may take a [trout/bass/walleye] fishing trip where you are away from your home for one night or several nights. Other times, you may take a [trout/bass/walleye] fishing trip where you leave from and return to your home on the same day. In total, how many trips did you take to fish PRIMARILY for [trout/bass/walleye] during 1996 in [state]?

_______Trips taken (Allow 3 digits)

How many [trout/bass/walleye] did you catch during 1996 in [state]? We are asking for how trout/bass/walleye] you CAUGHT and we ARE NOT asking for how many [trout/bass/walleye] you KEPT.

_______ (Allow 4 digits)

What was the average length in inches of the [trout/bass/walleye] you caught during 1996 in [state]?

_______ Inches (Allow 2 digits)

Some [trout/bass/walleye] fishing trips cost more than others. For example, on a long trip you may spend money for food, travel, and lodging. On a short trip, where you may only fish for a few hours, you may only spend money for gas. How much did [your trip/an average trip] cost you during 1996 where you fished PRIMARILY for [trout/bass/walleye] in [state]?

$______ Cost per trip (Allow 6 digits)

Since you took [fill trips from above] [trout/bass/walleye] fishing trips and the average trip cost was $[fill average cost from above], this means that you spent about $[number trips • average cost per trip] in total for ALL of your trips during 1996 to fish PRIMARILY for [trout/bass/walleye] [state]. Would you say that this total cost is about right?

(1) ____Yes

(2) ____No

If No — How much would you say is the total cost of your [number of trips] trips to fish PRIMARILY for [trout/bass/walleye] during 1996 in [state]?

$______ Total Cost (Allow 8 digits)

Fishing expenses change over time. For example, gas prices rise and fall. Would you have taken any trips to fish PRIMARILY for [trout/bass/walleye] during 1996 in [state] if your total costs were $[bid value] more than the amount you just reported?

(1) ____Yes

(2) ____No

Hunting Economic Evaluation

In the next few questions, I will ask you about ALL your trips taken during the ENTIRE calendar year of 1996 PRIMARILY to hunt [deer/elk/moose] in [state].

Sometimes you may take [a/an] [deer/elk/moose] hunting trip where you are away from your home for one night or several nights. Other times, you may take [a/an] [deer/elk/moose] hunting trip where you leave from and return to your home on the same day. In total, how many trips did you take PRIMARILY to hunt [deer/elk/moose] during 1996 in [state]?

_______ Trips (Allow 3 digits)

Did you bag [buck deer/bull elk/bull moose] in 1996 in [state]?

(1) ____Yes

(2) ____No

(designated deer states only)

Some states allow hunters to bag more than one DEER. How many DEER did you bag during 1996 in [state]?

_______ Deer (Allow 2 digits)

Did you bag a [buck/bull elk/bull moose] in 1996 in [state]?

(1) ____Yes

(2) ____No

Some [deer/elk/moose] hunting trips cost more than others. For example, on a long trip you may spend money for food, travel, and lodging. On a short trip, where you may only hunt for a few hours, you may only spend money for gas. How much did [your trip/an average trip] cost you during 1996 when you went PRIMARILY to hunt [deer/elk/moose] in [state]?

$______ per trip (Allow 6 digits)

Since you took [fill trips from above] [deer/elk/moose] hunting trips and the average trip cost was $[fill average cost from above], this means that you spent about $ [number trips * average cost per trip] in total for ALL of your trips during 1996 PRIMARILY to hunt [deer/elk/moose] in [state]. Would you say that this total cost is about right?

(1) ____Yes

(2) ____No

If No — How much would you say is the total cost of your [fill trips from above] trips taken during 1996 PRIMARILY to hunt [deer/elk/moose] in [state]?

$______ Total Cost (Allow 8 digits)

Hunting expenses change over time. For example, gas prices rise and fall. Would you have taken any trips PRIMARILY to hunt [deer/elk/moose] during 1996 in [state] if your total [deer/elk/moose] hunting costs were $ [bid value] more than the amount you just reported?

(1) ____Yes

(2) ____No

Wildlife Watching

In the next few questions, I will ask you about ALL your trips taken for the PRIMARY PURPOSE of observing, photographing, or feeding wildlife during the ENTIRE calendar year of 1996 in [state].

In your [current and previous interview] you reported taking [fill trips] [trip/trips] of at least one mile for the PRIMARY PURPOSE of observing, photographing, or feeding wildlife in [state]. Is that correct?

(1) ____Yes

(2) ____No

If No — How many trips of at least one mile did you take for the PRIMARY PURPOSE of observing, photographing, or feeding wildlife in [state] during 1996?

_______ (Allow 3 digits)

In your [current and previous interview], you reported that you spent $[fill trip expenditures] in total for [your trip/all of your trips] during 1996 where your PRIMARY PURPOSE was to observe, photograph, or feed wildlife in [state]. Would you say that this total cost is about right?

(1) ____Yes

(2) ____No

If No — How much would you say is the total cost of your [fill trips] [trip/trips] during 1996 where your PRIMARY PURPOSE was to observe, photograph, or feed wildlife in [state]?

$______ Total Cost (Allow 8 digits)

Wildlife watching expenses change over time. For example, gas prices rise and fall. Would you have taken any trips during 1996 for the PRIMARY PURPOSE of observing, photographing, or feeding wildlife in [state] if your total costs were $ [bid value] more than the amount you just reported?

(1) ____Yes

(2) ____No

Appendix B

Estimation Procedures and Standard Error Calculation for Net Economic Values

The procedures used to estimate the net economic values and standard errors that are presented in the main body of this report are described in this appendix. This discussion is divided into three sections: 1) estimation of net economic values (willingness to pay); 2) estimation of the probit coefficients; and 3) confidence interval estimation.

Estimation of the Net Economic Values

The net economic values presented in this report are derived using the censored normal probit approach (Cameron, 1988; 1991). Estimates of net economic values using this approach are identical to those derived using Hanemann's linear random utility model (Hanemann, 1984; 1989). A comparison of these two approaches is made in McConnell (1990).

The censored normal regression model assumes that WTP can be represented as

$$1)\quad \mathrm{WTP_i} = \mathrm{x_i'}\beta + \mathrm{u_i}$$

where WTP_i is the respondent's true unobserved value and the disturbance term u_i is identically and independently disturbed normally with mean 0 and dispersion parameter β. Because the censored normal approach allows WTP to be modeled as a linear function of the explanatory variables, β_i can be interpreted as the change in WTP for a unit change in x_i, which is an interpretation that cannot be made of conventional probit coefficients. Cameron (1991) details how the β coefficient vector (which excludes the bid coefficient) can be calculated from a conventional logit regression (which includes the bid vector as an explanatory variable). Taking the expected value of WTP in Equation (1) yields

$$2)\quad \mathrm{E(WTP|x_0)} = \mathrm{x_0'}\beta\,.$$

For this report, Gauss programs developed by Cooper were used to estimate the β's.

Estimation of the Probit Coefficients

The coefficients described in section III of this report are estimated using a maximum likelihood estimation routine.
The log-likelihood function is

$$3)\quad LnL = \sum_{i=1}^{N}\left\{y_i \ln\left[F(\mathrm{x_i'}\gamma^*)\right] + (1\text{-}y_i)\ln\left[1\text{-}\mathrm{F}(x_i'\gamma^*)\right]\right\}$$

where y_i, i=1,…,N, is the dependent dummy variable that is equal to 1 for a yes response and 0 for a no response, γ* is the conventional probit coefficient vector, and the normal cumulative density function is the probability that y_i=1 (Judge et al., 1985).

The data were adjusted by sampling weights to account for the fact that the survey sampled some regions at higher rates than others. Not doing so could lead to biased coefficient estimates. Multiplying the data by the weights gives greater weight to the observations from the regions with the lower probability of being selected and decreases the weight to the observations from the regions with higher probability of being selected. For estimation, the weights are multiplied by the sample size and divided by the sum of the weights so that the sum of the weights across the observations is the sample size (Greene, 1992). Performing weighted estimation without scaling the weight variable in this manner can result in very low standard errors, and thus, very high t-statistics for the estimated coefficients (Greene, 1992).

Confidence Interval Estimation

To tell us if the benefit measures are statistically different from zero as well as to allow statistical comparisons between the estimated benefit measures, it is necessary to construct confidence intervals around the benefit measures. In this paper, confidence intervals around the welfare benefit estimate are constructed using an analytic method (Cameron, 1991). Since WTP Equation (2) is linear, it is a simple matter to construct an interval estimate for E(WTP) (e.g., *see* Johnston, p. 1996). Cameron's (1991) procedure is used to transform the conventional probit coefficient vector $\hat{\gamma}^*$ into the β vector (essentially by dividing the explanatory variable coefficients by the negative of the bid coefficient) and the covariance matrix for $\hat{\gamma}^*$ into the covariance matrix Σg. Given Σg and Equation (1) and appealing to the central limit theorem, a (1-θ) × 100 percent confidence interval around $E(WTP|x_0)$ is

$$4)\quad CI_\theta[E(WTP|x_0)] = x_0'\beta \pm t_{\frac{1-\theta}{2}}\sqrt{x_0\textstyle\sum_\beta x_0}$$

Other methods for constructing confidence intervals are described in Cooper (1994).

Appendix C

Probit Equation Results

Table C-1. Probit Equation Results for Fishing

Region	*Constant*	*Bid*	*Catch (# Fish)*	*Inch (Length)*	*Resident*	*Species*	*n*	*Chi-squared*	*% Correct Predictions*
	Explanatory Variables								
U.S. Fish and Wildlife Service Official Regions									
1 (CA, ID, NV, OR, WA)	-0.1399 (0.2067)	-0.0010 (0.0002)	0.0007 (0.0003)	0.0546 (0.0113)	-0.3505 (0.1829)		665	762.97	63
2 (AZ, NM, OK, TX)	-0.7913 (0.3811)	-0.0004 (0.0006)	0.0010 (0.0008)	0.0750 (0.0143)	-0.5988 (0.2153)	0.2833 (0.1736)	356	436.20	63
3 (IA, IL, IN, MO)	-0.1572 (0.3330)	-0.0021 (0.0005)	0.0102 (0.0020)	0.0102 (0.0150)	0.2016 (0.2325)		374	418.33	72
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	-0.4888 (0.2260)	-0.0008 (0.0003)	0.0029 (0.0005)	0.0481 (0.0091)	-0.2342 (0.1235)		845	1015.48	67
5 (CT, DE, MA, MD, ME, MY, NH, NJ, PA, RI, VA, VT, WV)	0.4032 (0.2136)	-0.0021 (0.0003)	0.0061 (0.0008)	0.0235 (0.0085)	-0.4225 (0.1139)	-0.3431 (0.1017)	1118	1228.33	70
6 (CO, KS, MT, NE, UT, WY)	0.4048 (0.2674)	-0.0023 (0.0007)	0.0060 (0.0009)	0.0123 (0.0092)	-0.3777 (0.1038)	0.1488 (0.1274)	899	1140.54	65
7 (AK)	3.6076 (2.1062)	-0.0120 (0.0055)	0.0028 (0.0023)	0.0920 (0.0249)	-0.4183 (0.2978)		104	115.36	65
U.S. Bureau of the Census Regions									
Pacific (AK, CA, OR, WA)	-0.3482 (0.2713)	-0.0009 (0.0002)	0.0006 (0.0004)	0.0592 (0.0131)	-0.2750 (0.2443)		499	552.91	68
Mountain (AZ, CO, ID, MT, NM, NV, UT, WY)	0.2398 (0.1991)	-0.0011 (0.0005)	0.0030 (0.0005)	0.0257 (0.0076)	-0.4312 (0.0834)		1244	1626.55	61
West North Central (IA, KS, MO, NE)	0.0580 (0.3118)	-0.0017 (0.0005)	0.0101 (0.0021)	0.0172 (0.0154)	-0.2986 (0.2215)		322	386.15	66
East North Central (IN, IL)	0.9510 (1.1877)	-0.0051 (0.0021)	0.0074 (0.0024)	0.0009 (0.0230)	0.8202 (0.4861)		194	202.81	74
Middle Atlantic (NJ, NY, PA)	-0.2095 (0.3738)	-0.0019 (0.0006)	0.0071 (0.0021)	0.0152 (0.0178)	-0.2123 (0.2739)		245	251.15	72
New England (CT, MA, ME, NH, RI, VT)	0.0274 (0.3719)	-0.0015 (0.0008)	0.0059 (0.0012)	0.0292 (0.0113)	-0.4920 (0.1345)	0.0897 (0.1708)	612	721.97	68
West South Central (AR, LA, OK, TX)	-1.1346 (0.4599)	-0.0006 (0.0006)	0.0012 (0.0007)	0.0887 (0.0166)	0.1281 (0.2534)		262	307.54	68
East South Central (AL, KY, MS, TN)	0.0461 (0.6094)	-0.0009 (0.0010)	0.0044 (0.0010)	0.0315 (0.0146)	-0.4870 (0.1858)		378	466.56	64
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	-0.4282 (0.2512)	-0.0008 (0.0003)	0.0044 (0.0007)	0.0410 (0.0114)	-0.3610 (0.1586)		605	697.39	69

Table C1. Probit Equation Results for Fishing (continued)

Region	Constant	Bid	Catch (# Fish)	Inch (Length)	Resident	n	Chi-squared	% Correct Predictions
	Explanatory Variables							
New England (CT, ME, NH, NJ, NY, PA, VT)	0.0467 (0.2016)	-0.0020 (0.0004)	0.0068 (0.0013)	0.0177 (0.0104)	-0.3836 (0.1454)	657	715.67	71
Western Trout (AR, CA, NV, OR, WA)	-0.3197 (0.2787)	-0.0009 (0.0002)	0.0009 (0.0004)	0.0519 (0.0131)	-0.2401 (0.2607)	500	558.42	66
Mountain Trout (AZ, CO, ID, MT, NM, UT, WY)	0.1965 (0.2084)	-0.0010 (0.0005)	0.0029 (0.0006)	0.0275 (0.0081)	-0.4243 (0.0865)	1139	1491.58	62
Northern Bass (DE, IA, IL, IN, KS, KY, MA, MD, MO, NE, RI, VA, WV)	0.0365 (0.2038)	-0.0018 (0.0003)	0.0066 (0.0008)	0.0306 (0.0090)	-0.2433 (0.1250)	1088	1256.03	69
Southern Bass (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX)	-0.7107 (0.2321)	-0.0006 (0.0003)	0.0022 (0.0005)	0.0569 (0.0093)	-0.1221 (0.1346)	838	1016.00	66
Walleye (MI, MN, ND, OH, SD, WI)	0.1575 (0.0780)	-0.0003 (0.0002)	-0.0014 (0.0004)	-0.0006 (0.0010)	-0.0005 (0.0021)	516	665.41	72

Table C-2. Probit Equation Results for Hunting

Region	Constant	Bid	# of Animals Bagged[1]	Sex of Animal Bagged	Hunt Other Big Game	Resident	n	Chi-squared	% Correct Prediction
	Explanatory Variables								
U.S. Fish and Wildlife Service Official Regions (Deer Hunting)									
1 (CA, NV, WA)	-1.3252 (1.6510)	-0.0003 (0.0008)	0.4180 (0.4863)	-0.4925 (0.5755)	0.3326 (0.3214)	0.6408 (1.5570)	109	109.43	73
2 (AZ, NM, OK, TX)	0.0281 (0.7567)	-0.0006 (0.0011)	0.2400 (0.0975)	-0.2528 (0.2583)	0.4715 (0.2083)	-0.2392 (0.4371)	222	283.21	65
3 (IA, IL, IN, MI, MN, MO, OH, WI)	0.1164 (0.2586)	-0.0014 (0.0004)	0.2781 (0.0717)	-0.1149 (0.1330)	0.3026 (0.1414)	-0.0079 (0.2030)	736	948.92	64
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	-0.4147 (0.3885)	-0.0004 (0.0006)	0.0694 (0.0350)	0.3464 (0.1247)	0.2548 (0.1089)	0.2212 (0.1477)	738	961.71	63
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	-0.1319 (0.1776)	-0.0007 (0.0003)	0.2600 (0.0589)	0.0682 (0.1173)	0.2966 (0.0794)	-0.1212 (0.1090)	1147	1461.04	63
6 (KS, ND, NE, SD, UT, WY)	2.0845 (0.4083)	-0.0040 (0.0008)	0.1582 (0.1365)	-0.0996 (0.1835)	0.3451 (0.2044)	-1.1252 (0.2953)	390	492.38	60
U.S. Bureau of the Census Regions (Deer Hunting)									
Pacific (CA, WA)	-0.3769 (2.4449)	-0.0004 (0.0010)	0.5061 (0.6398)	-0.7945 (0.7467)	0.4266 (0.3801)	-0.3033 (2.4121)	79	76.22	80
Mountain (AZ, NM, NV, UT)	0.9854 (0.3586)	-0.0012 (0.0005)	0.4064 (0.5962)	-0.4432 (0.6074)	-0.0674 (0.2691)	-0.7066 (0.2924)	209	277.07	58
West North Central (IA, KS, MN, MO, NE, NE, SD)	0.0844 (0.3226)	-0.0021 (0.0005)	0.2254 (0.0838)	-0.0651 (0.1440)	0.4560 (0.1463)	0.1627 (0.2650)	591	750.93	62

Table C2. Probit Equation Results for Hunting (continued)

Region	Explanatory Variables: Constant	Bid	# of Animals Bagged[1]	Sex of Animal Bagged	Hunt Other Big Game	Resident	n	Chi-squared	% Correct Prediction
East North Central (IN, IL, MI, OH, WI)	0.3336 (0.3352)	-0.0016 (0.0005)	0.2938 (0.0906)	-0.1648 (0.1688)	0.2059 (0.1934)	-0.0702 (0.2497)	457	590.38	65
Middle Atlantic (NJ, NY, PA)	-1.3150 (0.5457)	0.0001 (0.0010)	0.5447 (0.1617)	-0.1577 (0.2726)	0.4584 (0.1582)	0.4617 (0.2873)	301	350.62	70
New England (CT, MA, ME, NH, RI, VT)	0.5148 (0.2078)	-0.0012 (0.0003)	-0.1078 (0.1664)	0.2574 (0.2484)	0.5354 (0.1452)	-0.2291 (0.1513)	467	611.02	60
West South Central (AR, LA, OK, TX)	-1.0260 (0.7767)	0.0008 (0.0012)	0.1914 (0.0892)	0.0024 (0.2383)	0.4684 (0.2007)	0.0736 (0.3746)	244	313.43	61
East South Central (AL, KY, MS, TN)	-0.0367 (0.5009)	-0.0012 (0.0007)	0.1716 (0.0555)	0.2269 (0.1817)	0.2047 (0.1612)	0.1307 (0.1866)	375	454.20	67
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	-0.2535 (0.2548)	0.0001 (0.0004)	0.0311 (0.0401)	0.2727 (0.1331)	0.1768 (0.1090)	-0.1735 (0.1512)	619	834.23	61
U.S. Fish and Wildlife Service Deer Regions									
Pacific (CA, NV, WA)	-1.3255 (1.6513)	-0.0003 (0.0008)	0.4180 (0.4862)	-0.4926 (0.5755)	0.3326 (0.3214)	0.6410 (1.5574)	109	109.42	73
West Southwest (AZ, NM, UT)	1.4486 (0.4264)	-0.0011 (0.0007)	0.8973 (0.7388)	-0.8954 (0.7549)	-0.2050 (0.2972)	-1.2314 (0.3725)	179	229.16	60
East Southwest (OK, TX)	0.2233 (1.4276)	-0.0009 (0.0024)	0.2330 (0.1275)	-0.2353 (0.3493)	0.5679 (0.2822)	-0.2916 (0.5878)	121	152.86	66
Plains (IA, KS, MO, ND, NE, SD)	0.3818 (0.3222)	-0.0023 (0.0005)	0.3212 (0.0928)	-0.2260 (0.1512)	0.5163 (0.1401)	-0.0918 (0.2666)	496	615.39	63
Great Lakes (IN, IL, MI, MN, OH, WI)	0.1218 (0.3095)	-0.0013 (0.0005)	0.2563 (0.0827)	-0.0806 (0.1559)	0.2172 (0.1836)	-0.0089 (0.2361)	554	720.68	65
Middle Atlantic (DE, MD, NJ, NY, PA)	-1.1185 (0.3911)	-0.0000 (0.0006)	0.4417 (0.1318)	0.0022 (0.2233)	0.4205 (0.1366)	0.3221 (0.2287)	406	480.32	68
New England (CT, MA, ME, NH, RI, VT)	0.5148 (0.2078)	-0.0012 (0.0003)	-0.1078 (0.1664)	0.2574 (0.2484)	0.5354 (0.1452)	-0.2292 (0.1513)	467	611.02	60
South East (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	-0.3270 (0.2330)	-0.0003 (0.0004)	0.0836 (0.0315)	0.2761 (0.1055)	0.2200 (0.0896)	0.0434 (0.1175)	1013	1330.17	63
Other Big Game Species									
Elk Region (CO, ID, MT, OR, WY)	1.4414 (0.3910)	-0.0027 (0.0008)	-0.2220 (0.1461)	0.6356 (0.1831)	0.5716 (0.1620)	-0.6592 (0.2573)	421	515.75	60
Moose Region (AK)	3.7033 (3.7240)	-0.0066 (0.0054)	0.9864 (0.4582)	-0.4053 (0.5117)	0.2666 (0.3191)		75	86.53	65

[1] Respondents were asked if they bagged a moose or elk but not the number bagged so for the elk and moose regions this variable equals 0 or 1, where 1 means they bagged an animal.

Table C3. Probit Equation Results for Wildlife Watching

State or Region	*Explanatory Variables* Constant	Bid	Private	Public	Photo	Fish	Resident	*n*	*Chi-squared*	*% Correct Prediction*
Fish and Wildlife Service Official Regions										
1 (CA, HI, ID, NV, OR, WA)	0.6029 (0.3373)	-0.0010 (0.0008)	-0.5449 (0.4070)	-0.5671 (0.1166)	0.3726 (0.1203)	-0.1685 (0.1223)	-0.3064 (0.1383)	525	664.96	63
2 (AZ, NM, OK, TX)	0.6371 (0.4276)	-0.0011 (0.0009)	0.7802 (0.2059)	0.1455 (0.1539)	-0.1032 (0.1388)	0.1867 (0.1434)	-0.7507 (0.1696)	384	481.81	59
3 (IA, IL, IN, MI, MN, MO, OH, WI)	-0.0998 (0.1940)	-0.0013 (0.0004)	-0.0919 (0.1698)	-0.2689 (0.1164)	0.5794 (0.1067)	0.0280 (0.1078)	-0.0749 (0.1367)	661	780.68	68
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	0.4154 (0.2113)	-0.0012 (0.0005)	-0.3268 (0.1461)	-0.3363 (0.0865)	0.2827 (0.0830)	-0.1319 (0.0836)	-0.2531 (0.0883)	1009	1299.01	66
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	0.3737 (0.1653)	-0.0017 (0.0004)	-0.1645 (0.1578)	-0.5617 (0.0827)	0.3525 (0.0794)	0.0413 (0.0834)	-0.1186 (0.0920)	1113	1341.13	63
6 (CO, KS, MT, ND, NE, SD, UT, WY)	0.8407 (0.3285)	-0.0034 (0.0011)	-0.1168 (0.2669)	-0.2290 (0.0990)	0.7831 (0.1030)	0.0436 (0.1001)	-0.4358 (0.1015)	740	896.26	64
7 (AK)	-1.9932 (1.176)	-0.0024 (.0013)	1.5095 (1.3290)	-0.4675 (.2808)	0.9690 (.7155)	-0.3196 (.2796)	-0.5567 (.3261)	99	122.03	72
U.S. Fish and Wildlife Service Suggested Groupings										
West (AK, CA, HI, NV, OR, WA)	0.6282 (0.2941)	-0.0009 (0.0006)	-0.4863 (0.3866)	-0.5694 (0.1126)	0.3934 (0.1200)	-0.1871 (0.1185)	-0.3736 (0.1283)	562	699.71	63
Rocky Mountain (AZ, CO, ID, MT, NM, UT, WY)	0.5542 (0.2012)	-0.0016 (0.0005)	0.4448 (0.3818)	-0.1599 (0.9869)	0.4115 (0.1032)	0.1546 (0.1022)	-0.5180 (0.9915)	724	912.12	61
Plains (IA, KS, MO, ND, NE, SD)	0.7780 (0.2694)	-0.0048 (0.0008)	-0.6316 (0.2560)	-0.1819 (0.1372)	1.0914 (0.1316)	-0.0399 (0.1299)	-0.1864 (0.1416)	478	525.85	67
Great Lake (IN, IL, MI, MN, OH, WI)	-0.3452 (0.2428)	-0.0008 (0.0004)	0.0201 (0.1962)	-0.2624 (0.1385)	0.4896 (0.1266)	-0.0140 (0.1292)	-0.0126 (0.1733)	468	538.66	68
North Atlantic (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	0.2961 (0.1900)	-0.0013 (0.0005)	-0.2194 (0.1742)	-0.6480 (0.0913)	0.4218 (0.0875)	0.1067 (0.0921)	-0.2012 (0.1022)	930	1097.83	63
South Central (AR, LA, OK, TX)	1.0617 (0.4491)	-0.0025 (0.0009)	0.5734 (0.1989)	0.0612 (0.1772)	-0.0458 (0.1519)	0.1795 (0.1506)	-0.6087 (0.2027)	317	397.08	60
South Atlantic (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	0.3444 (0.2052)	-0.0011 (0.0005)	-0.2939 (0.1516)	-0.3049 (0.0837)	0.2563 (0.0807)	-0.1824 (0.0824)	-0.1633 (0.0863)	1052	1364.65	65

Table C3. Probit Equation Results for Wildlife Watching (continued)

State or Region	*Constant*	*Bid*	*Private*	*Public*	*Photo*	*Fish*	*Resident*	*n*	*Chi-squared*	*% Correct Prediction*
	Explanatory Variables									
U.S. Bureau of the Census Regions										
Pacific (AK, CA, HI, OR, WA)	0.6469 (0.3115)	-0.0009 (0.0006)	-0.4869 (0.4028)	-0.5757 (0.1190)	0.3824 (0.1270)	-0.1731 (0.1251)	-0.3887 (0.1352)	505	629.00	63
Mountain (AZ, CO, IA, MT, NM, NV, UT, WY)	0.5191 (0.1877)	-0.0015 (0.0004)	0.4340 (0.3738)	-0.1671 (0.0949)	0.4248 (0.0990)	0.1292 (0.0983)	-0.4896 (0.0955)	781	985.76	61
West North Central (IA, KS, MN, MO, ND, NE, SD)	0.5383 (0.2472)	-0.0043 (0.0007)	-0.1466 (0.2161)	-0.1744 (0.1252)	0.9200 (0.1193)	-0.1467 (0.1163)	0.0213 (0.1290)	564	647.28	66
East North Central (IL, IN, MI, OH, WI)	-0.1311 (0.2700)	-0.0009 (0.0004)	-0.1047 (0.2160)	-0.2675 (0.1530)	0.4957 (0.1397)	0.0731 (0.1450)	-0.1886 (0.1973)	382	438.74	69
Middle Atlantic (NJ, NY, PA)	0.8203 (0.8015)	-0.0033 (0.0022)	-0.0712 (0.3739)	-0.4750 (0.2281)	0.5061 (0.2180)	0.1602 (0.2258)	-0.3606 (0.2978)	166	183.48	64
New England (CT, MA, ME, NH, RI, VT)	0.9103 (0.2688)	-0.0029 (0.0008)	-0.1950 (0.2572)	-0.7464 (0.1183)	0.4186 (0.1166)	-0.2305 (0.1331)	-0.2301 (0.1191)	547	649.26	64
West South Central (AR, LA, OK, TX)	1.0617 (0.4491)	-0.0025 (0.0009)	0.5734 (0.1989)	0.0612 (0.1772)	-0.0458 (0.1519)	0.1795 (0.1506)	-0.6087 (0.2027)	317	397.08	60
East South Central (AL, KY, MS, TN)	0.2586 (0.3445)	-0.0018 (0.0011)	-0.1777 (0.2269)	-0.2231 (0.1523)	0.5262 (0.1433)	-0.2377 (0.1442)	-0.0990 (0.1571)	349	423.85	64
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	0.3755 (0.1989)	-0.0010 (0.0005)	-0.2253 (0.1815)	-0.3930 (0.0916)	0.1900 (0.0891)	-0.1166 (0.0913)	-0.1593 (0.0944)	854	1113.84	65

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Appendix D

Average Days of Participation

Table D1. Average Days per Year for Fishing

Region		*Species Valued*	*Average Days/Year*
U.S. Fish and Wildlife Service Regions			
1	(CA, ID, NV, OR, WA)	Trout	10.7
2	(AZ, NM, OK, TX)	Bass & Trout	11.0
	(OH, TX)	Bass	11.4
	(AZ, NM)	Trout	10.8
3	(IA, IL, IN, MO)	Bass	14.4
4	(AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	Bass	16.4
5	(CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	Bass & Trout	15.0
	(DE, MA, MD, RI, VA, WV)	Bass	16.8
	(CT, ME, NH, NJ, NY, PA, VT)	Trout	13.7
6	(CO, KS, MT, NE, UT, WY)	Bass & Trout	19.3
	(KS, NE)	Bass	19.3
	(CO, MT, UT, WY)	Trout	10.1
7	(AK)	Trout	10.0
U.S. Bureau of the Census Regions			
Pacific (AK, CA, OR, WA)		Trout	11.3
Mountain (AZ, CO, ID, MT, NM, NV, UT, WY)		Trout	10.1
West North Central (IA, KS, MO, NE)		Bass	17.4
East North Central (IL, IN)		Bass	15.6
Middle Atlantic (NJ, NY, PA)		Trout	13.0
New England (CT, MA, ME, NH, RI, VT)		Bass & Trout	15.6
(MA, RI)		Bass	18.4
(CT, ME, NH, VT)		Trout	14.2
West South Central (AR, LA, OK, TX)		Bass	13.8
East South Central (AL, KY, MS, TN)		Bass	16.3
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)		Bass	16.1
U.S. Fish and Wildlife Service Bass Regions			
Northern (DE, IA, IL, IN, KS, KY, MA, MD, MO, NE, RI, VA, WV)		Bass	16.2
Southern (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX)		Bass	15.7
U. S. Fish and Wildlife Service Trout Regions			
Western (AR, CA, NV, OR, WA)		Trout	11.3
Mountain (AZ, CO, ID, MT, NM, UT, WY)		Trout	10.1
Northeast (CT, ME, NH, NJ, NY, PA, VT)		Trout	13.7
U.S. Fish and Wildlife Service Walleye Regions			
Walleye Region (MI, MN, ND, OH, SD, WI)		Walleye	16.3

Table D2. Average Days per Year for Hunting

Region	*Average Days/Year*
U.S. Fish and Wildlife Service Regions	
1 (CA, NV, WA)	7.9
2 (AZ, NM, OK, TX)	8.9
3 (IA, IL, IN, MI, MN, MO, OH, WI)	10.3
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	15.8
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	11.8
6 (CO, KS, MT, ND, ND, SD, UT, WY)	7.4
U.S. Bureau of the Census Regions	
Pacific (CA, WA)	8.8
Mountain (AZ, NM, NV, UT)	5.2
West North Central (IA, KS, MN, MO, NE, NE, SD)	7.8
East North Central (IL, IN, MI, OH, WI)	11.8
Middle Atlantic (NJ, NY, PA)	10.0
New England (CT, MA, ME, NH, RI, VT)	12.9
West South Central (AR, LA, OK, TX)	13.4
East South Central (AL, KY, MS, TN)	14.7
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	14.2
U.S. Fish and Wildlife Service Deer Regions	
Pacific (CA, NV, WA)	7.9
West Southwest (AZ, NM, UT)	5.1
East Southwest (OK, TX)	12.2
Plains (IA, KS, MO, ND, NE, SD)	8.3
Great Lakes (IN, IL, MI, MN, OH, WI)	10.7
Middle Atlantic (DE, MD, NJ, NY, PA)	10.8
New England (CT, MA, ME, NH, RI, VT)	12.9
South East (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	14.6
Other Game Species	
Elk Region (CO, ID, MT, OR, WY)	6.9
Moose (AK)	10.2

Table D3. Average Days per Year for Wildlife Watching

Region	Average Days/Year
U.S. Fish and Wildlife Service Regions	
1 (CA, ID, NV, WA, OR)	11.5
2 (AZ, NM, OK, TX)	12.9
3 (IA, IL, IN, MI, MN, MO, OH, WI)	11.1
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	11.2
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	10.8
6 (CO, KS, MT, ND, NE, SD, UT, WY)	10.5
7 (AK)	20.2
U.S. Bureau of the Census Regions	
Pacific (AK, CA, HI, OR, WA)	13.9
Mountain (AZ, CO, IA, MT, NM, NV, UT, WY)	10.2
West North Central (IA, KS, MN, MO, ND, NE, SD)	11.1
East North Central (IL, IN, MI, OH, WI)	12.6
Middle Atlantic (NJ, NY, PA)	8.5
New England (CT, MA, ME, NH, RI, VT)	11.6
West South Central (AR, LA, OK, TX)	13.4
East South Central (AL, KY, MS, TN)	12.2
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	10.0
U.S. Fish and Wildlife Service Suggested Regions	
West (WA, CA, OR, NV, HI, AK)	13.3
Rocky Mountain (ID, MT, WY, UT, CO, AZ, NM)	10.3
Plains (ND, SD, NE, KS, IA, MO)	11.4
Great Lake (MN, WI, IL, IN, MI, OH)	12.1
North Atlantic (MD, DE, PA, NJ, NY, CT, RI, MA, VT, NH, ME)	11.0
South Central (AR, LA, OK, TX)	13.4
South Atlantic (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	10.4

Appendix E

Censored Probit Marginal Coefficients

Table E1. Censored Probit Marginal Coefficients for Fishing

Region	*Catch (# Fish)*	*Inch (Length)*	*Resident*	*Species*
U.S. Fish and Wildlife Service Regions				
1 (CA, ID, NV, OR, WA)	0.71	55.28	–354.72	
2 (AZ, NM, OK, TX)	–2.58	–199.22	1590.90	–752.72
3 (IA, IL, IN, MO)	4.84	4.85	96.14	
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	3.81	64.04	–311.53	
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	2.96	11.39	–204.84	–166.38
(DE, MA, MD, RI, VA, WV)	2.65	5.40	–165.65	
(CT, ME, NH, NJ, NY, PA, VT)	0.24	7.66	–34.81	
U.S. Bureau of the Census Regions				
Pacific (AK, CA, OR, WA)	0.71	66.09	–306.92	
Mountain (AZ, CO, ID, MT, NM, NV, UT, WY)	2.75	23.11	–388.10	
West North Central (IA, KS, MO, NE)	6.05	10.29	–178.53	
East North Central (IL, IN)	1.44	0.17	160.69	
Middle Atlantic (NJ, NY, PA)	3.69	7.96	–110.95	
New England (CT, MA, ME, NH, RI, VT)	3.86	18.99	–319.62	58.26
West South Central (AR, LA, OK, TX)	4.61	33.39	–516.53	
East South Central (AL, KY, MS, TN)	1.66	135.81	196.09	
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	5.86	54.97	–483.59	
U.S. Fish and Wildlife Service Fishing Regions				
New England (CT, ME, NH, NJ, NY, PA, VT)	3.38	8.84	–192.02	
Western (AR, CA, NV, OR, WA)	0.78	59.15	–273.62	
Mountain (AZ, CO, ID, MT, NM, UT, WY)	2.81	26.50	–409.57	
All Bass States	3.32	45.19	–166.75	
Northern (DE, IA, IL, IN, KS, KY, MA, MD, MO, NE, RI, VA, WV)	3.60	16.55	–131.68	
Southern (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX)	3.53	92.32	–198.09	
Walleye (MI, MN, ND, OH, SD, WI)	–4.67	–2.16	–1.78	

Table E2. Censored Probit Marginal Coefficients for Hunting

Region	*# Animals Bagged*[1]	*Sex of Animal Bagged*	*Hunt Other Big Game*	*Resident*
U.S. Fish and Wildlife Service Regions				
1 (CA, NV, WA,)	1274.69	–1501.83	1014.19	1953.82
2 (AZ, NM, OK, TX)	417.07	–439.38	819.35	–415.59
3 (IA, IL, IN, MI, MN, MO, OH, WI)	203.91	–84.23	221.88	–5.82
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	168.19	840.21	617.84	536.53
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	372.00	97.53	424.46	–173.43
6 (CO, KS, MT, ND, NE, SD, UT, WY)	39.14	–24.64	85.38	–278.39
U.S. Bureau of the Census Regions				
Pacific (CA, WA)	1211.85	–1902.42	1021.36	–726.12
Mountain (AZ, NM, NV, UT)	346.91	–378.32	–57.55	–603.14
West North Central (IA, KS, MN, MO, NE, NE, SD)	107.11	–30.91	216.67	77.31
East North Central (IL, IN, MI, OH, WI)	188.00	–105.42	131.70	–44.94
Middle Atlantic (NJ, NY, PA)	–5967.36	1727.83	–5022.36	–5058.04
New England (CT, MA, ME, NH, RI, VT)	–86.37	206.13	428.77	–183.48
West South Central (AR, LA, OK, TX)	–256.32	–3.26	–627.20	–98.58
East South Central (AL, KY, MS, TN)	147.83	195.46	176.35	112.60
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	–251.16	–2204.97	–1429.17	1402.94
U.S. Fish and Wildlife Service Suggested Deer Regions				
Pacific (CA, NV, WA)	1274.50	–1501.90	1014.14	1954.54
West Southwest (AZ, NM, UT)	795.51	–793.82	–181.74	–1091.74
East Southwest (OK, TX)	265.90	–268.54	648.13	–332.75
Plains (IA, KS, MO, ND, NE, SD)	138.22	–97.27	222.21	–39.51
Great Lakes (IN, IL, MI, MN, OH, WI)	199.95	–62.85	169.38	–6.91
Middle Atlantic (DE, MD, NJ, NY, PA)				
New England (CT, MA, ME, NH, RI, VT)	–86.36	206.16	428.80	–183.55
South East (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)	300.16	991.70	790.24	156.01
Other Game Species				
Elk Region (CO, ID, MT, OR, WY)	–82.59	236.51	212.68	–245.26
Moose (AK)	148.66	–61.08	40.18	

1 Respondents were asked if they bagged a moose or elk but not the number bagged so for the elk and moose regions this variable equals 0 or 1, where 1 means they bagged an animal.

Table E3. Censored Probit Marginal Coefficients for Wildlife Watching

Region	*Private*	*Public*	*Photo*	*Fish*	*Resident*
U.S. Fish and Wildlife Service Regions					
1 (CA, ID, HI, NV, WA, OR)	–539.66	–561.69	368.99	–166.91	–303.51
2 (AZ, NM, OK, TX)	705.53	131.58	–93.33	168.80	–678.88
3 (IA, IL, IN, MI, MN, MO, OH, WI)	–70.38	–205.87	443.63	21.47	–57.32
4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)	–282.73	–290.94	244.60	–114.10	–218.98
5 (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV)	–96.89	–330.76	207.57	24.30	–69.87
6 (CO, KS, MT, ND, NE, SD, UT, WY)	–34.46	–67.56	231.05	12.85	–128.57
7 (AK)	–626.24	193.93	–401.99	132.60	230.94
U.S. Bureau of the Census Regions					
Pacific (AK, CA, HI, OR, WA)	–533.15	–630.43	418.79	–189.52	–425.66
Mountain (AZ, CO, IA, MT, NM, NV, UT, WY)	293.63	–113.06	287.43	87.42	–331.29
West North Central (IA, KS, MN, MO, ND, NE, SD)	–33.98	–40.44	213.29	–34.02	4.95
East North Central (IL, IN, MI, OH, WI)	–116.52	–297.62	551.55	81.29	–209.89
Middle Atlantic (NJ, NY, PA)	–2614.27	–4191.33	4179.42	2008.81	–1954.76
New England (CT, MA, ME, NH, RI, VT)	–68.24	–261.14	146.45	–80.64	–80.49
West South Central (AR, LA, OK, TX)	233.36	24.90	–18.66	73.06	–247.74
East South Central (AL, KY, MS, TN)	–98.58	–123.76	291.91	–131.85	–54.89
South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV)	–220.78	–385.24	186.18	–114.25	–156.12
U.S. Fish and Wildlife Service Suggested Regions					
West (AK, CA, HI, NV, OR, WA)	–534.73	–626.12	432.63	–205.79	–410.88
Rocky Mountain (AZ, CO, ID, MT, NM, UT, WY)	283.54	–101.93	262.31	98.55	–330.17
Plains (IA, KS, MO, ND, NE, SD)	–132.24	–38.08	228.51	–8.36	–39.04
Great Lake (IN, IL, MI, MN, OH, WI)	26.57	–347.36	648.23	–18.55	–16.64
North Atlantic (CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)	–167.61	–495.00	322.17	81.50	–153.69
South Central (AR, LA, OK, TX)	233.36	24.90	–18.66	73.06	–247.74
South Atlantic (AL, FL, GA, KY, MS, NC, SC, TN, VA, WV)	–267.22	–277.20	233.01	–165.79	–148.49

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