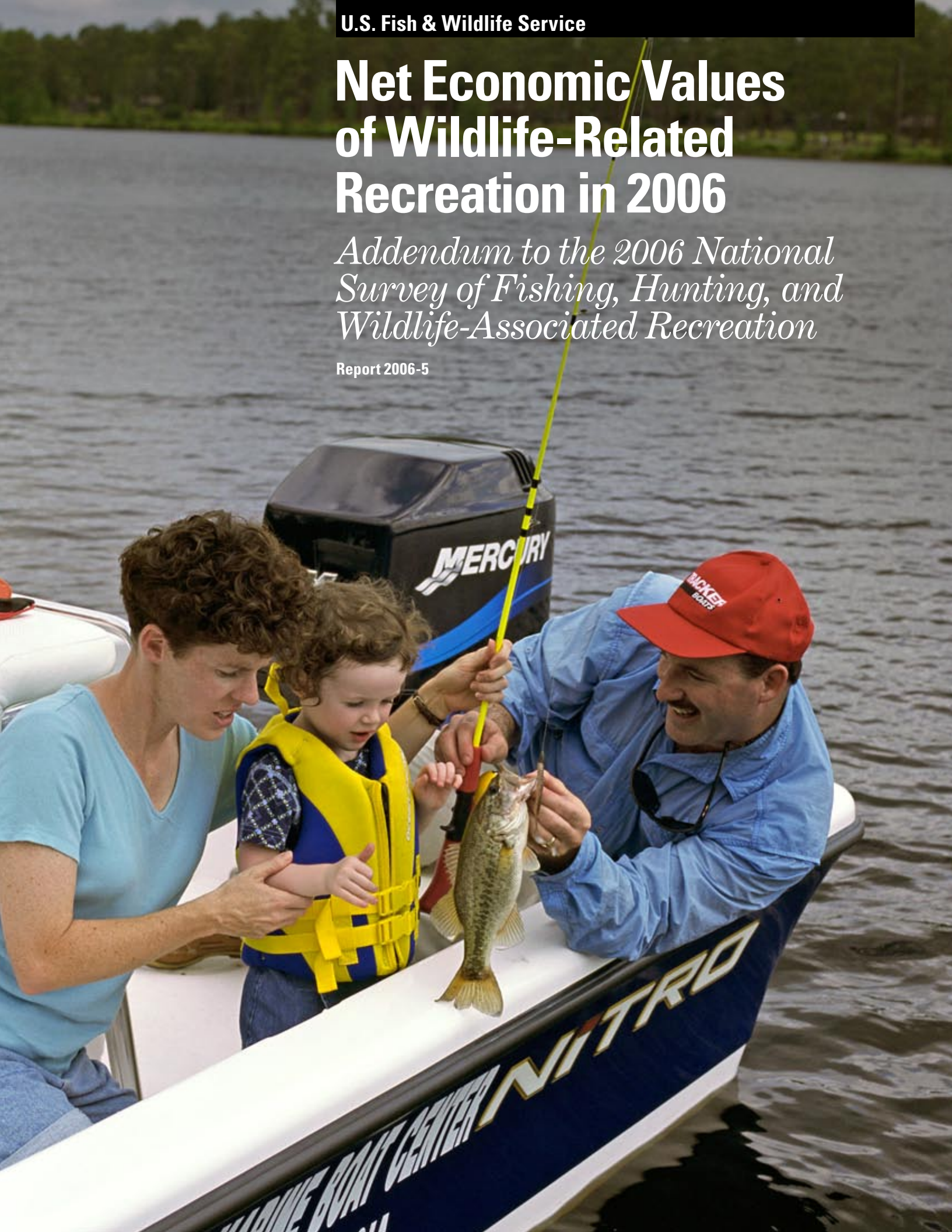
U.S. Fish & Wildlife Service

Net Economic Values of Wildlife-Related Recreation in 2006

Addendum to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

Report 2006-5



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July 2009

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This report is intended to complement the National and State reports from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The conclusions are the author's and do not represent official positions of the U.S. Fish and Wildlife Service.

Contents

Abstract

This report presents state estimates of the net economic values for smallmouth and largemouth bass, trout and walleye fishing, deer, elk and moose hunting, and away-from-home wildlife watching. These values are based on contingent valuation questions from the *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.*

Each state was classified as a bass, trout, or walleye state. Based on these classifications, anglers were asked to answer a contingent valuation question for their bass, trout, or walleye fishing during 2006.

Likewise, each state was classified as a deer, elk, or moose state. Based on these classifications, hunters were asked contingent valuation questions for their 2006 hunts.

People who took trips in 2006 to watch wildlife at least one mile from their residence were asked contingent valuation questions for this activity.

Net economic values are developed for current resource conditions. The net economic values reported here are appropriate measures of economic value for use in cost-benefit analyses, damage assessments, and project evaluations.

Steve Hillebrand/USFWS

I. Introduction

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (Survey hereafter) is a comprehensive source of data on people's use of wildlife resources that has been collected on a national level since 1955 and on a state level since 1975. The first time the Survey collected net economic value data was in 1980. The effort was repeated, with some changes, in the 1985, 1991, 1996, 2001, and 2006 Surveys.

This report presents estimates of net economic values for smallmouth and largemouth bass, trout and walleye fishing, deer, elk and moose hunting, and away-from-home wildlife watching. The report also compares the 2006 values with those of the 2001 Survey which used a similar contingent valuation method. 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. Away-from-home 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).

The 2001 and 2006 Surveys assigned a single fish and game species to be valued in each state. States were selected in the upper Midwest as walleye states and the rest of the states as either trout fishing or bass fishing states. Selected states in the Northwest and northern Rocky Mountains were designated as elk states, Alaska was designated a moose state, and the remainder of the states were deer states.

Away-from-home wildlife-watching valuation questions were asked in both Surveys. The payment vehicle of the contingent valuation approach was trip-related expenditures, so around-the-home wildlife watching could not be included.

Phyllis Cooper/USFWS

Responses were assigned to the state where the activity occurred. For example, the value of a person from Michigan who hunted deer in Utah would be assigned to Utah. The open-ended approach was used, in which the respondent was simply asked how much is too much to spend for a recreational trip.

The following section discusses the conceptual framework for net economic values of wildlife-related recreation, differentiating between net economic values and economic impacts. The third section describes the contingent valuation questions used in the Survey and steps that were taken in analyzing the data. The fourth section consists of value estimates for deer, elk and moose hunting, bass, trout and walleye fishing, and wildlife watching. This section also compares the 2006 estimates with those from 2001. The fifth section discusses how to use the value estimates presented, the sixth section presents regression analysis of quality-of-recreation questions, and the last section provides concluding comments.

II. Measures of Economic Value

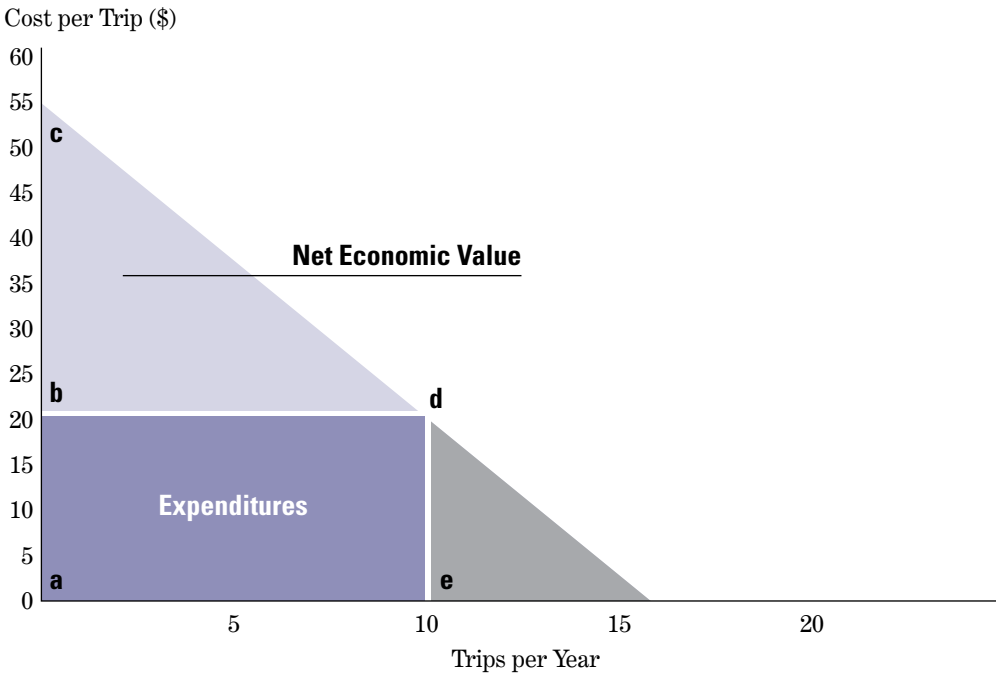
In 2006 87.5 million Americans 16 years old and older fished, hunted, photographed, fed, and closely observed wildlife in the U.S. These wildlife enthusiasts spent $37.4 billion on trips to participate in these activities. Expenditures are a useful indicator of the importance of wildlife-related recreation to local, regional, and national economies. However, they do not measure the economic benefit to either the individual participant or, when aggregated, to society.

Expenditures and net economic values are two widely used but distinctly different measures of the economic value of wildlife-related recreation. Net willingness to pay, or "consumer surplus," is the accepted measure of the economic value of wildlife-related recreation to the individual recreationist and to society. It is the appropriate measure of economic value for a wide range of analyses that seek to quantify benefits and costs.

Net economic value is measured as participants' willingness to pay for wildlife-related recreation over and 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 hunter is shown in the figure. An individual hunter's demand curve gives the number of trips the hunter would take per year for each different cost per trip. The downward sloping demand curve represents marginal willingness to pay per trip and indicates that each additional trip is valued less by the hunter than the preceding trip. All other factors being equal, the lower the cost per trip (vertical axis) the more trips the hunter will take (horizontal axis). The cost of a hunting trip serves as an implicit price for hunting since a market price generally does not exist for this activity. At $60 per trip, the hunter would choose not to hunt, but if hunting trips were free, the hunter would take 16 hunting trips.

At a cost per trip of $20 the hunter 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 hunter places on participation. The hunter will not take more than 10 trips because the cost per trip ($20) exceeds what he would pay for an additional trip. For each trip between zero and 10, however, the hunter would actually have been willing to pay more than $20 (the demand curve, showing marginal willingness to pay, lies above $20).

Figure 1. Individual Hunter's Demand Curve for Hunting Trips



The difference between what the hunter is willing to pay and what is actually paid is net economic value. In this simple example, therefore, net economic value is $175 (($55 – $20) × 10 ÷ 2) (triangle bcd in Figure 1) and hunter expenditures are $200 ($20 × 10) (rectangle abde). Thus, the hunter'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 the 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 a hunter purchases in order to hunt. 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 hunters who hunt at a particular wildlife management area and all have demand curves identical to that of our typical hunter presented in Figure 1. The total value per year of this wildlife management area to society is $17,500 ($175 × 100).

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

III. Contingent Valuation

Respondents to the 2006 Survey who had gone deer, elk or moose hunting, bass, trout, or walleye fishing, or wildlife watching were asked a series of contingent valuation (CV) questions as a basis for determining their net willingness to pay for those activities. Questions were designed to find the respondent's cost per trip in 2006 and at what cost per trip they would not have gone at all in 2006 because it would have been too expensive (Appendix A presents the hunting and wildlife watching CV questions, as examples).

Respondents first were asked to estimate the number of trips they had taken in 2006 to hunt or fish for the designated species. For wildlife watching the number of trips was obtained from an earlier section of the questionnaire. Respondents then were asked to consider expenses such as transportation, food and lodging, and to estimate what their cost had been in 2006 for a typical trip[1]. Then they were asked at what cost per trip they would not have gone at all because it was too expensive. The question stipulated that the cost of other kinds of recreational activities that could be considered substitutes would not have changed.

In terms of Figure 1 the purpose of the question sequence is to have the respondent react as if he were moving up the demand curve, taking fewer trips as the cost per trip increased until he was priced out of the market at the cost per trip where the demand curve intersects the vertical axis. Assuming a linear demand curve, annual net economic value is then calculated using the difference between current cost ($20) and the maximum cost at the intercept ($55), and the number of trips taken in 2006 (10).

[1] Wildlife watchers were given the dollar figure per trip which they had reported earlier in the interview. If the respondent did not think this was accurate he or she could change it.

Using the example in Figure 1, annual net economic value is

$$\frac{(\$55 - \$20) \times 10}{2} = \$175$$

The average value per trip is that amount divided by the number of trips taken in 2006, or

$$\$175 \div 10 = \$17.50 \text{ per trip}$$

The valuation sequence was posed in terms of number of trips and cost per trip because respondents were thought more likely to think of their wildlife-related recreation in terms of trips rather than days, the unit most commonly used in project evaluation. The economic values reported here are in terms of days to facilitate their use in analysis.

The values are averages in two senses of the word. First, they are the arithmetic mean of the responses of all respondents in the sample, usually all those residing in a particular state who participated in the activity, e.g., all survey respondents who were Colorado residents and hunted elk in Colorado. Second, they are average values in that they are calculated for each respondent by dividing his total annual consumer surplus for an activity by the number of days he participated during 2006.

Zero and negative net willingness-to-pay responses were deleted from the analysis, as were unreasonably high willingness-to-pay responses. Likely explanations of zero and negative willingness to pay are that the question was misunderstood by the respondent, incorrectly recorded by the interviewer, or that the response was a protest against higher costs rather than a legitimate bid, perhaps motivated by fear of an increase in the cost of a hunting or fishing license. To the extent that legitimate zero responses were among those deleted, the resulting values will be overestimates.

Willingness to pay for wildlife-related recreation or, for that matter, anything a consumer buys, must be limited by an individual's income and/or wealth. A person clearly is not able to pay some multiple of his household's annual income for deer hunting, for example. In a less extreme situation, it is possible that a truly avid deer hunter would actually be willing to pay a significant portion of his income to continue hunting deer even though the costs of substitute activities such as small game hunting would be unchanged. Since the purpose of the analysis is to use the CV responses as representative of the typical recreationist in the group rather than calculating the sample's aggregate net economic value, mitigating the effect of those extreme values on the sample mean is essential. Observations were dropped from the samples if the annual net economic value for an activity exceeded ten percent of the individual's household income[2].

[2] Ten percent was chosen because a reading of recreation research found that the typical recreationist commonly spends more than five percent of their income, the cutoff point in the 2001 net economic value analysis. "By any measure, whether using complementary activities or the costs for access and equipment related expenditures, outdoor recreation is responsible for 2 to 6 percent of consumer expenditures and, very likely, accounts for at least as large a portion of an individual's leisure time." *Recreation Demand Models,* Daniel J. Phaneuf and V. Kerry Smith. Prepared for *Handbook of Environmental Economics.* K. Mäler and J. Vincent, Editors. Revision date January 29, 2004.

IV. Estimated Net Economic Values

Tables 1 through 7 give state by state mean and median net economic values for a day of deer, elk and moose hunting, bass, trout, and walleye fishing, and wildlife watching in 2006. They are based on the respondents' state of activity. Medians, the midpoint of the range of all values, are included because they are measures of central tendency that exclude the effects of outliers. A suggested rule of thumb is to use the mean as the preferred measure of recreation value and the median as a lower bound, for the most conservative uses of these values.

Bill Krohn/USFWS

Table 1. Deer Hunting Economic Values per Day: 2006
(2006 dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	78	38	98	50
Alabama	91	32	...	...
Arizona	117	70	...	...
Arkansas	90	47	...	...
California	105	36	...	...
Connecticut	48	47	...	...
Delaware	<<<	<<<	...	...
Florida	142	45	...	...
Georgia	55	18	59	32
Illinois	47	25	180	75
Indiana	65	22	...	...
Iowa	80	41	...	...
Kansas	52	44	...	...
Kentucky	77	32	...	...
Louisiana	102	28	...	...
Maine	51	30	...	...
Maryland	130	44	...	...
Massachusetts	146	73	...	...
Michigan	48	35	...	...
Minnesota	81	45	...	...
Mississippi	50	30	...	...
Missouri	76	45	101	50
Nebraska	106	48	...	...
Nevada	<<<	<<<	...	...
New Hampshire	48	35	...	...
New Jersey	<<<	<<<	...	...
New Mexico	89	50	...	...
New York	82	32	49	40
North Carolina	36	28	...	...
North Dakota	67	42	...	...
Ohio	66	27	...	...
Oklahoma	88	30	...	...
Pennsylvania	73	44	75	40
Rhode Island	29	31	...	...
South Carolina	49	25	...	...
South Dakota	96	38	...	...
Tennessee	68	25	...	...
Texas	105	62	...	...
Utah	88	44	...	...
Vermont	69	25	...	...
Virginia	40	25	...	...
Washington	67	33	...	...
West Virginia	90	42	25	13
Wisconsin	82	50	...	...

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table 2. Elk Hunting Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	81	38	95	50
Colorado	90	34	66	44
Idaho	51	31	...	...
Montana	80	40	...	...
Oregon	94	44	...	...
Wyoming	64	38	...	...

... Sample size less than 10.

Table 3. Moose Hunting Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Alaska	155	88	...	...

... Sample size less than 10.

Table 4. Bass Fishing Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	68	20	116	43
Alabama	40	18	34	14
Arkansas	27	20	82	67
Delaware	<<<	<<<	...	...
Florida	32	15	59	50
Georgia	56	12	...	...
Illinois	44	23	...	...
Indiana	61	22	...	...
Iowa	44	10	...	...
Kansas	45	20	...	...
Kentucky	59	32	...	...
Louisiana	43	17	...	...
Maryland	39	10	...	...
Massachusetts	73	25	...	...
Mississippi	89	18	...	...
Missouri	60	25	42	20
Nebraska	50	32	...	...
North Carolina	22	12	...	...
Oklahoma	58	19	39	40
Rhode Island	<<<	<<<	...	...
South Carolina	46	25	44	33
Tennessee	33	17	72	48
Texas	40	25	131	150
Virginia	<<<	<<<	92	49
West Virginia	63	35	...	...

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table 5. Trout Fishing Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	56	23	134	50
Alaska	56	25	...	...
Arizona	87	33	...	...
California	78	35	50	45
Colorado	52	22	140	62
Connecticut	43	15	...	...
Idaho	48	22	60	50
Maine	30	15	157	62
Montana	38	17	126	75
Nevada	50	28	...	...
New Hampshire	38	15	<<<	<<<
New Jersey	<<<	<<<	...	...
New Mexico	42	25	...	...
New York	47	12	83	50
Oregon	58	20	112	56
Pennsylvania	43	16	91	30
Utah	61	26	111	58
Vermont	29	17	...	...
Washington	49	25	...	...
Wyoming	50	25	76	60

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table 6. Walleye Fishing Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	63	27	110	50
Michigan	43	18	113	70
Minnesota	60	27	102	42
North Dakota	51	30	...	...
Ohio	66	30	...	...
South Dakota	71	36	25	12
Wisconsin	81	22	81	55

... Sample size less than 10.

Table 7. Wildlife Watching Economic Values per Day: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	57	21	122	45
Alabama	43	12	...	...
Alaska	36	14	105	114
Arizona	65	38	294	372
Arkansas	43	29	...	...
California	74	45	95	63
Colorado	44	20	<<<	<<<
Connecticut	50	22	...	...
Delaware	15	8	...	...
Florida	39	25	117	62
Georgia	44	38	...	...
Hawaii	66	14	...	...
Idaho	37	22	52	22
Illinois	34	19	67	30
Indiana	26	18	...	...
Iowa	32	14	345	644
Kansas	31	12	...	...
Kentucky	52	11	...	...
Louisiana	31	25	...	...
Maine	39	19	53	20
Maryland	19	14	...	...
Massachusetts	38	18	40	30
Michigan	49	17	54	15
Minnesota	27	22	...	...
Mississippi	63	28	...	...
Missouri	29	11	42	18
Montana	31	9	117	48
Nebraska	44	24	...	...
Nevada	44	10	85	75
New Hampshire	46	22	<<<	<<<
New Jersey	22	12	<<<	<<<
New Mexico	74	25	...	...
New York	50	26	69	25
North Carolina	38	14	53	25
North Dakota	<<<	<<<	...	...
Ohio	56	18	...	...
Oklahoma	33	21	...	...
Oregon	48	15	97	50
Pennsylvania	73	25	77	42
Rhode Island	18	8	...	...
South Carolina	32	15	36	41
South Dakota	38	25	120	184
Tennessee	53	25	58	25
Texas	52	25	...	...
Utah	37	14	71	52
Vermont	17	12	85	52
Virginia	28	11	20	17
Washington	39	25	165	76
West Virginia	26	24	...	...
Wisconsin	79	37	81	38
Wyoming	48	35	98	75

... Sample size less than 10.
<<< 95% confidence interval includes zero.

2001-2006 Comparisons of National Daily Net Economic Values

Comparisons of national deer hunting and bass and trout fishing values for 2001 and 2006 show similarity. Stable value estimates encourage use of these estimates in future analyses, since they have proven to be reliable indicators of value over time. All dollar values in this report are in 2006 dollars.

Table 8. State Resident Deer Hunting Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	78	40	78	38
Alabama	132	54	91	32
Arizona	100	49	117	70
Arkansas	76	21	90	47
California	...	...	105	36
Connecticut	56	27	48	47
Delaware	...	...	<<<	<<<
Florida	...	...	142	45
Georgia	55	21	55	18
Illinois	84	26	47	25
Indiana	62	32	65	22
Iowa	59	43	80	41
Kansas	43	29	52	44
Kentucky	62	29	77	32
Louisiana	82	34	102	28
Maine	81	36	51	30
Maryland	87	29	130	44
Massachusetts	55	25	146	73
Michigan	65	33	48	35
Minnesota	52	27	81	45
Mississippi	98	23	50	30
Missouri	46	23	76	45
Nebraska	88	57	106	48
Nevada	83	25	<<<	<<<
New Hampshire	46	22	48	35
New Jersey	...	...	<<<	<<<
New Mexico	50	29	89	50
New York	58	40	82	32
North Carolina	67	56	36	28
North Dakota	56	29	67	42
Ohio	91	55	66	27
Oklahoma	64	33	88	30
Pennsylvania	55	43	73	44
Rhode Island	...	...	29	31
South Carolina	64	29	49	25
South Dakota	86	51	96	38
Tennessee	63	27	68	25
Texas	114	51	105	62
Utah	66	32	88	44
Vermont	42	26	69	25
Virginia	122	60	40	25
Washington	62	36	67	33
West Virginia	68	29	90	42
Wisconsin	76	40	82	50

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table 9. State Resident Elk Hunting Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	109	40	81	38
Colorado	128	40	90	34
Idaho	56	49	51	31
Montana	122	32	80	40
Oregon	87	46	94	44
Wyoming	74	46	64	38

Table 10. State Resident Moose Hunting Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Alaska	160	108	155	88

Table 11. State Resident Bass Fishing Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	66	21	68	20
Alabama	35	16	40	18
Arkansas	73	23	27	20
Delaware	34	14	<<<	<<<
Florida	74	21	32	15
Georgia	63	29	56	12
Illinois	83	22	44	23
Indiana	54	25	61	22
Iowa	40	17	44	10
Kansas	23	13	45	20
Kentucky	82	24	59	32
Louisiana	83	21	43	17
Maryland	99	33	39	10
Massachusetts	41	17	73	25
Mississippi	33	13	89	18
Missouri	112	25	60	25
Nebraska	48	29	50	32
North Carolina	70	26	22	12
Oklahoma	39	16	58	19
Rhode Island	27	16	<<<	<<<
South Carolina	67	19	46	25
Tennessee	67	23	33	17
Texas	71	22	40	25
Virginia	66	18	<<<	<<<
West Virginia	30	21	63	35

<<< 95% confidence interval includes zero.

Table 12. State Resident Trout Fishing Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	68	23	56	23
Alaska	97	34	56	25
Arizona	59	33	87	33
California	70	36	78	35
Colorado	63	23	52	22
Connecticut	42	21	43	15
Idaho	72	21	48	22
Maine	84	27	30	15
Montana	42	19	38	17
Nevada	50	23	50	28
New Hampshire	40	17	38	15
New Jersey	64	34	<<<	<<<
New Mexico	90	25	42	25
New York	43	14	47	12
Oregon	46	17	58	20
Pennsylvania	71	17	43	16
Utah	75	19	61	26
Vermont	33	17	29	17
Washington	<<<	<<<	49	25
Wyoming	55	24	50	25

<<< 95% confidence interval includes zero.

Table 13. State Resident Walleye Fishing Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	54	22	63	27
Michigan	31	17	43	18
Minnesota	59	24	60	27
North Dakota	46	17	51	30
Ohio	51	29	66	30
South Dakota	36	19	71	36
Wisconsin	36	19	81	22

Table 14. State Resident Wildlife Watching Economic Values per Day: 2001 and 2006
(2006 Dollars)

	2001		*2006*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	44	18	57	21
Alabama	43	17	43	12
Alaska	136	46	36	14
Arizona	43	29	65	38
Arkansas	23	9	43	29
California	46	25	74	45
Colorado	34	25	44	20
Connecticut	23	14	50	22
Delaware	...	...	15	8
Florida	47	19	39	25
Georgia	55	55	44	38
Hawaii	39	33	66	14
Idaho	30	11	37	22
Illinois	19	11	34	19
Indiana	40	11	26	18
Iowa	31	11	32	14
Kansas	39	11	31	12
Kentucky	32	9	52	11
Louisiana	35	15	31	25
Maine	47	25	39	19
Maryland	80	26	19	14
Massachusetts	24	9	38	18
Michigan	41	14	49	17
Minnesota	<<<	<<<	27	22
Mississippi	...	...	63	28
Missouri	22	22	29	11
Montana	22	11	31	9
Nebraska	70	23	44	24
Nevada	49	23	44	10
New Hampshire	43	18	46	22
New Jersey	40	21	22	12
New Mexico	48	30	74	25
New York	26	14	50	26
North Carolina	68	21	38	14
North Dakota	36	13	<<<	<<<
Ohio	25	14	56	18
Oklahoma	23	17	33	21
Oregon	34	21	48	15
Pennsylvania	40	11	73	25
Rhode Island	<<<	<<<	18	8
South Carolina	33	14	32	15
South Dakota	24	21	38	25
Tennessee	35	16	53	25
Texas	42	17	52	25
Utah	34	16	37	14
Vermont	25	13	17	12
Virginia	74	23	28	11
Washington	59	26	39	25
West Virginia	25	23	26	24
Wisconsin	42	25	79	37
Wyoming	41	21	48	35

… Sample size less than 10.
<<< 95% confidence interval includes zero.

V. Using the Value Estimates

When and how can these values be used? These numbers are appropriate for any project evaluation that seeks to quantify benefits and costs. They can be used to evaluate management actions that increase or decrease participation. Two types of willingness-to-pay values are reported in this analysis, mean net economic values per day per participant and net economic values per year of participation. 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 Montana as an example, with a mean value of $348 (Table B-5 in Appendix B). The $348 represents the mean value to a resident trout angler in Montana given the current resource condition and trout fishing regulations. This is like the estimate of net economic value portrayed in Figure 1. If a wildlife refuge in Montana changes its policies and allows 100 more trout anglers to visit per year, the total value to society due to this policy change would be $34,800 ($348 × 100) per year (assuming all visitors are state residents). This value, however, assumes that these 100 anglers could and would fish for trout only at this refuge and that they would take a certain number of trips to this refuge. 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 actions generally increase or decrease participation. Let us continue with the Montana 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 state resident fishing that occur on the lake over the whole season, 1,200 for example, it is possible to develop an estimate of the fishery losses from the accident. This estimate is accomplished by multiplying the net economic value per day ($38 from Table 5) by the days of participation, resulting in $45,600 ($38 × 1,200). If the refuge had data on the number of in-state and out-of-state visitors then the numbers could be adjusted to reflect their appropriate value.

Two caveats exist to the examples above: (1) if recreationists can shift their activity to another location then the values are an over-estimate; and (2) if a loss of wildlife habitat causes an overall degradation in the number of game, fish, or wildlife and in the quality of wildlife-related recreation then the values are an under-estimate.

Ruth Nissen/USFWS

The key issues that must be understood are:

- Each of the different value estimates has slightly different interpretations and uses;
- If an action changes participation, it is necessary to consider the extent to which participants substitute another site to fish, hunt, or wildlife watch. 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, which would result in incorrect estimates of aggregate costs or aggregate benefits.

VI. Regression Results

Bag and size of catch questions were included in the question sequence to measure quality of the recreation. The intent was to see if there was a positive correlation between hunting success, as measured by whether or not an animal was bagged, and economic value. For fishing, it was to see if there was a positive correlation between catching bigger fish and economic value. A simple model was used, which was not fully specified.

The hunting equation for deer, elk, and moose was Annual Value = 31.4 × (the number of hunting trips) + 182.2 × (1 if bagged game, 0 if did not) + 277. Getting an animal increased the annual value by 1.6.

The fishing regression assumed that fish were caught. If no fish were caught, the observation was deleted from the regression.

For trout, the equation was Annual Value = 11.6 × (the number of fishing trips) + 11.1 × (the average length of fish caught, in inches) + 135.8. Catching fish measuring an average of 24 inches increased the annual value of fishing by 1.8 compared to catching fish measuring an average of 6 inches, and by 1.4 compared to catching fish measuring an average of 12 inches.

For bass, the equation was Annual Value = 13.8 × (the number of fishing trips) + 20.3 × (the average length of fish caught, in inches) + 72.9. Catching fish measuring an average of 24 inches increased the annual value of fishing by 2.6 compared to catching fish measuring an average of 6 inches, and by 1.7 compared to catching fish measuring an average of 12 inches.

Kevin Tennyson/USFWS

VII. Concluding Comments

Contingent valuation questions in the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation provide a nationwide data base for estimating net economic recreation values for selected wildlife-related recreation activities on a state-by-state basis. The data and the values they produce are important because they measure recreationists' net willingness to pay for such activities, the conceptually correct measure of economic value for a wide range of analyses and project evaluations. Because they are available for individual states, the values allow for differences in recreation values in various parts of the country. For many kinds of analysis, using values that reflect wildlife-related recreation in the state in question rather than some other state or a national average gives the analysis a better and more convincing empirical base.

In this age of cost-benefit analysis these estimates can be used to justify the value of wildlife-related recreation. Be it deer hunting, trout fishing, or wildlife watching, the numbers prove that Americans benefit greatly from wildlife.

Al Milliken/USFWS

Appendix A. Survey Contingent Valuation Questions

State Resident Hunting Questions
In the next few questions, I will ask you about ALL your trips taken during the ENTIRE calendar year of 2006 to PRIMARILY hunt for [fill GAME] in [fill RESIDENT STATE].

How many trips lasting a single day or multiple days did you take to hunt PRIMARILY for [fill GAME] during 2006 in [fill RESIDENT STATE]?

Think about what it costs you for a TYPICAL [fill GAME] hunting trip. Include expenses for things such as gasoline and other transportation costs, food, and lodging.

Remember to include ONLY YOUR SHARE of expenses.

How much did a TYPICAL hunting trip cost you during 2006 when you hunted PRIMARILY for [fill GAME] in [fill RESIDENT STATE]?

Did you bag a [fill GAME] in [fill RESIDENT STATE] in 2006?

Still thinking about a TYPICAL [fill GAME] hunting trip in [fill RESIDENT STATE]…

What is the cost that would have prevented you from taking even one such trip? In other words, if the trip cost was below this amount, you would have gone [fill GAME] hunting in [fill RESIDENT STATE], but if the trip cost was above this amount, you would not have gone.

Keep in mind that the cost per trip of other kinds of hunting, fishing and recreational activities would not have changed.

So, in other words, $[fill amount] would have been too much to pay for one TYPICAL [fill GAME] hunting trip last year in [fill RESIDENT STATE]?

If "No,"

How much would have been too much to pay for one TYPICAL [fill GAME] hunting trip last year in [fill RESIDENT STATE]?

State Resident Wildlife Watching Questions
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 2006 in [fill RESIDENT STATE].

In your previous and current interviews you reported taking [fill total] trips for the PRIMARY PURPOSE of observing, photographing, or feeding wildlife in [fill RESIDENT STATE]. Is that correct?

If "No,"

How many trips did you take for the PRIMARY PURPOSE of observing, feeding or photographing wildlife in [fill RESIDENT STATE] during 2006?

In your previous and current interviews, you reported that you spent on average $[fill amount] per trip during 2006 where your PRIMARY PURPOSE was to observe, photograph or feed wildlife in [fill RESIDENT STATE]. Would you say that cost is about right?

If "No,"

How much would you say is the average cost of your [fill total] trips during 2006 where your PRIMARY PURPOSE was to observe, photograph, or feed wildlife in [fill RESIDENT STATE]? If you went with family or friends, include ONLY YOUR SHARE of the cost.

Still thinking about your [fill total] trips to observe, photograph, or feed wildlife in [fill RESIDENT STATE]…

What is the cost that would have prevented you from taking even one such trip? In other words, if the trip cost was below this amount, you would have gone observing, photographing, or feeding wildlife in [fill RESIDENT STATE], but if the trip cost was above this amount, you would not have gone.

Keep in mind that the cost per trip of other kinds of recreation would not have changed.

So, in other words, $[fill amount] would have been too much to pay to take even one trip to observe, photograph, or feed wildlife in 2006 in [fill RESIDENT STATE]?

If "No,"

How much would have been too much to pay to take even one trip to feed, photograph, or observe wildlife in 2006 in [fill RESIDENT STATE]?

Appendix B. 2006 Annual Net Economic Value Tables: State Residents and Nonresidents

Table B-1. Deer Hunting Economic Values per Year: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	657	250	526	250
Alabama	757	320	...	...
Arizona	639	300	...	...
Arkansas	805	360	...	...
California	<<<	<<<	...	...
Connecticut	493	238	...	...
Delaware	672	350	...	...
Florida	1,413	400	...	...
Georgia	673	90	409	200
Illinois	508	150	<<<	<<<
Indiana	563	168	...	...
Iowa	543	273	...	...
Kansas	439	210	...	...
Kentucky	500	350	...	...
Louisiana	1,015	300	...	...
Maine	449	250	...	...
Maryland	654	270	...	...
Massachusetts	1,200	450	...	...
Michigan	426	216	...	...
Minnesota	507	150	...	...
Mississippi	700	375	...	...
Missouri	537	270	262	250
Nebraska	594	180	...	...
Nevada	549	200	...	...
New Hampshire	558	188	...	...
New Jersey	565	330	...	...
New Mexico	358	168	...	...
New York	705	270	283	90
North Carolina	579	125	...	...
North Dakota	422	240	...	...
Ohio	613	300	...	...
Oklahoma	844	300	...	...
Pennsylvania	759	280	311	125
Rhode Island	321	125	...	...
South Carolina	532	250	...	...
South Dakota	531	150	...	...
Tennessee	574	175	...	...
Texas	827	350	...	...
Utah	440	188	...	...
Vermont	717	200	...	...
Virginia	530	212	...	...
Washington	436	180	...	...
West Virginia	685	350	<<<	<<<
Wisconsin	638	188	...	...

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table B-2. Elk Hunting Economic Values per Year: 2006

(2006 Dollars)

	State Residents		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	523	300	921	350
Colorado	391	400	651	350
Idaho	251	210	...	...
Montana	643	300	...	...
Oregon	608	300	...	...
Wyoming	466	251	...	...

... Sample size less than 10.

Table B-3. Moose Hunting Economic Values per Year: 2006

(2006 Dollars)

	State Residents		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Alaska	1,206	475	...	...

... Sample size less than 10.

Table B-4. Bass Fishing Economic Values per Year: 2006

(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	490	150	452	200
Alabama	597	300	112	100
Arkansas	318	200	265	252
Delaware	1,019	490	...	...
Florida	440	100	194	200
Georgia	426	90	...	...
Illinois	367	150	...	...
Indiana	453	150	...	...
Iowa	361	100	...	...
Kansas	390	112	...	...
Kentucky	452	225	...	...
Louisiana	605	225	...	...
Maryland	226	60	...	...
Massachusetts	419	200	...	...
Mississippi	532	162	...	...
Missouri	844	250	232	100
Nebraska	582	170	...	...
North Carolina	341	150	...	...
Oklahoma	434	175	288	100
Rhode Island	325	125	...	...
South Carolina	473	175	220	115
Tennessee	355	140	609	380
Texas	338	150	568	600
Virginia	584	200	380	245
West Virginia	730	210	...	...

... Sample size less than 10.

Table B-5. Trout Fishing Economic Values per Year: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	337	130	472	200
Alaska	334	112	...	...
Arizona	475	200	...	...
California	305	175	305	175
Colorado	296	140	477	300
Connecticut	278	75	...	...
Idaho	315	110	219	100
Maine	247	76	949	250
Montana	348	120	409	250
Nevada	335	180	...	...
New Hampshire	284	75	<<<	<<<
New Jersey	361	75	...	...
New Mexico	271	100	...	...
New York	242	112	258	200
Oregon	319	125	630	210
Pennsylvania	306	75	294	60
Utah	558	150	340	200
Vermont	305	188	...	...
Washington	410	112	...	...
Wyoming	466	135	341	150

... Sample size less than 10.
<<< 95% confidence interval includes zero.

Table B-6. Walleye Fishing Economic Values Per Year: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	578	200	516	250
Michigan	259	188	497	350
Minnesota	548	200	379	225
North Dakota	395	150	...	...
Ohio	911	160	...	...
South Dakota	625	275	114	50
Wisconsin	636	375	500	200

... Sample size less than 10.

Table B-7. Wildlife Watching Economic Values Per Year: 2006
(2006 Dollars)

	State Resident		*Out-of-Stater*	
State	*Mean*	*Median*	*Mean*	*Median*
Aggregate	407	96	433	174
Alabama	<<<	<<<	...	...
Alaska	328	182	621	568
Arizona	582	175	531	450
Arkansas	247	80	...	...
California	524	150	297	275
Colorado	353	100	373	240
Connecticut	481	138	...	...
Delaware	278	38	...	...
Florida	267	92	307	120
Georgia	315	75	...	...
Hawaii	297	100	...	...
Idaho	264	180	500	345
Illinois	240	93	139	65
Indiana	218	75	...	...
Iowa	246	80	449	644
Kansas	311	84	...	...
Kentucky	271	46	...	...
Louisiana	<<<	<<<	...	...
Maine	286	90	218	60
Maryland	106	35	...	...
Massachusetts	324	72	53	35
Michigan	<<<	<<<	<<<	<<<
Minnesota	207	72	...	...
Mississippi	354	111	...	...
Missouri	191	49	188	142
Montana	105	63	521	238
Nebraska	293	40	...	...
Nevada	323	50	196	100
New Hampshire	362	106	182	56
New Jersey	192	75	91	28
New Mexico	329	100	...	...
New York	442	158	263	75
North Carolina	244	66	442	125
North Dakota	...	...	...	...
Ohio	235	90	...	...
Oklahoma	438	210	...	...
Oregon	334	55	487	254
Pennsylvania	437	173	267	155
Rhode Island	126	40	...	...
South Carolina	210	50	337	162
South Dakota	329	120	287	368
Tennessee	230	95	259	174
Texas	467	83	...	...
Utah	226	51	414	258
Vermont	<<<	<<<	288	158
Virginia	126	66	81	70
Washington	411	75	396	200
West Virginia	196	150	...	...
Wisconsin	649	138	234	78
Wyoming	264	130	300	275

… Sample size less than 10.
<<< 95% confidence interval includes zero.

Appendix C. 2001 and 2006 Annual Net Economic Value Tables

Table C-1. State Resident Deer Hunting Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		*2006*		*2006/2001*
State	*Mean*	*Median*	*Mean*	*Median*	*Ratio of Means*
Aggregate	583	222	657	250	1.1
Alabama	1,252	513	757	320	0.6
Arizona	562	196	639	300	1.1
Arkansas	605	251	805	360	1.3
California	...	...	<<<	<<<	N.A.
Connecticut	603	428	493	238	0.8
Delaware	...	...	672	350	N.A.
Florida	...	...	1,413	400	N.A.
Georgia	1,126	410	673	90	0.6
Illinois	<<<	<<<	508	150	N.A.
Indiana	698	285	563	168	0.8
Iowa	239	154	543	273	2.3
Kansas	350	128	439	210	1.3
Kentucky	373	205	500	350	1.3
Louisiana	520	342	1,015	300	2.0
Maine	780	249	449	250	0.6
Maryland	562	143	654	270	1.2
Massachusetts	350	182	1,200	450	3.4
Michigan	521	285	426	216	0.8
Minnesota	271	137	507	150	1.9
Mississippi	1,067	171	700	375	0.7
Missouri	438	114	537	270	1.2
Nebraska	575	214	594	180	1.0
Nevada	366	114	549	200	1.5
New Hampshire	458	120	558	188	1.2
New Jersey	...	...	565	330	N.A.
New Mexico	204	114	358	168	1.8
New York	650	456	705	270	1.1
North Carolina	1,062	570	579	125	0.5
North Dakota	327	143	422	240	1.3
Ohio	422	205	613	300	1.5
Oklahoma	762	428	844	300	1.1
Pennsylvania	317	128	759	280	2.4
Rhode Island	...	...	321	125	N.A.
South Carolina	953	342	532	250	0.6
South Dakota	544	205	531	150	1.0
Tennessee	474	239	574	175	1.2
Texas	762	399	827	350	1.1
Utah	308	143	440	188	1.4
Vermont	531	217	717	200	1.3
Virginia	799	285	530	212	0.7
Washington	333	171	436	180	1.3
West Virginia	483	160	685	350	1.4
Wisconsin	637	264	638	188	1.0

... Sample size less than 10.
<<< 95% confidence interval includes zero.
N.A. Not Available

Table C-2. State Resident Elk Hunting Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	*Mean*	*Median*	*Mean*	*Median*	*Ratio of Means*
Aggregate	538	200	523	300	1.0
Colorado	287	200	391	400	1.4
Idaho	334	171	251	210	0.8
Montana	546	171	643	300	1.2
Oregon	629	228	608	300	1.0
Wyoming	547	200	466	251	0.9

Table C-3. State Resident Moose Hunting Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	*Mean*	*Median*	*Mean*	*Median*	*Ratio of Means*
Alaska	1,010	513	1,206	475	1.2

Table C-4. State Resident Bass Fishing Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	*Mean*	*Median*	*Mean*	*Median*	*Ratio of Means*
Aggregate	597	200	490	150	0.8
Alabama	449	171	597	300	1.3
Arkansas	789	257	318	200	0.4
Delaware	<<<	<<<	1,019	490	N.A.
Florida	651	456	440	100	0.7
Georgia	303	228	426	90	1.4
Illinois	599	274	367	150	0.6
Indiana	441	228	453	150	1.0
Iowa	197	48	361	100	1.8
Kansas	226	86	390	112	1.7
Kentucky	571	171	452	225	0.8
Louisiana	667	228	605	225	0.9
Maryland	494	328	226	60	0.5
Massachusetts	364	171	419	200	1.2
Mississippi	283	103	532	162	1.9
Missouri	700	228	844	250	1.2
Nebraska	404	171	582	170	1.4
North Carolina	603	201	341	150	0.6
Oklahoma	561	160	434	175	0.8
Rhode Island	309	120	325	125	1.1
South Carolina	682	171	473	175	0.7
Tennessee	547	285	355	140	0.6
Texas	815	228	338	150	0.4
Virginia	881	144	584	200	0.7
West Virginia	268	128	730	210	2.7

<<< 95% confidence interval includes zero.
N.A. Not Available

Table C-5. State Resident Trout Fishing Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	Mean	Median	Mean	Median	Ratio of Means
Aggregate	393	137	337	130	0.9
Alaska	469	171	334	112	0.7
Arizona	316	171	475	200	1.5
California	357	171	305	175	0.9
Colorado	388	137	296	140	0.8
Connecticut	268	120	278	75	1.0
Idaho	353	114	315	110	0.9
Maine	474	154	247	76	0.5
Montana	459	139	348	120	0.8
Nevada	451	137	335	180	0.7
New Hampshire	396	214	284	75	0.7
New Jersey	457	143	361	75	0.8
New Mexico	448	137	271	100	0.6
New York	326	251	242	112	0.7
Oregon	246	100	319	125	1.3
Pennsylvania	557	171	306	75	0.5
Utah	342	114	558	150	1.6
Vermont	285	114	305	188	1.1
Washington	409	114	410	112	1.0
Wyoming	531	171	466	135	0.9

Table C-6. State Resident Walleye Fishing Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	Mean	Median	Mean	Median	Ratio of Means
Aggregate	504	185	578	200	1.1
Michigan	<<<	<<<	259	188	N.A.
Minnesota	648	317	548	200	0.8
North Dakota	351	143	395	150	1.1
Ohio	230	114	911	160	4.0
South Dakota	420	171	625	275	1.5
Wisconsin	429	143	636	375	1.5

<<< 95% confidence interval includes zero.
N.A. Not Available

Table C-7. State Resident Wildlife Watching Economic Values per Year: 2001 and 2006
(2006 Dollars)

	2001		2006		2006/2001
State	*Mean*	*Median*	*Mean*	*Median*	*Ratio of Means*
Aggregate	376	108	407	96	1.1
Alabama	520	114	<<<	<<<	N.A.
Alaska	991	270	328	182	0.3
Arizona	366	200	582	175	1.6
Arkansas	219	125	247	80	1.1
California	270	128	524	150	1.9
Colorado	296	114	353	100	1.2
Connecticut	315	103	481	138	1.5
Delaware	...	...	278	38	N.A.
Florida	410	75	267	92	0.7
Georgia	453	108	315	75	0.7
Hawaii	<<<	<<<	297	100	N.A.
Idaho	107	40	264	180	2.5
Illinois	528	96	240	93	0.5
Indiana	514	103	218	75	0.4
Iowa	341	114	246	80	0.7
Kansas	<<<	<<<	311	84	N.A.
Kentucky	215	57	271	46	1.3
Louisiana	209	114	<<<	<<<	N.A.
Maine	489	123	286	90	0.6
Maryland	473	180	106	35	0.2
Massachusetts	198	51	324	72	1.6
Michigan	540	271	<<<	<<<	N.A.
Minnesota	439	86	207	72	0.5
Mississippi	...	...	354	111	N.A.
Missouri	124	48	191	49	1.5
Montana	215	71	105	63	0.5
Nebraska	241	114	293	40	1.2
Nevada	568	68	323	50	0.6
New Hampshire	498	137	362	106	0.7
New Jersey	257	86	192	75	0.7
New Mexico	378	200	329	100	0.9
New York	824	120	442	158	0.5
North Carolina	<<<	<<<	244	66	N.A.
North Dakota	271	97	...	...	N.A.
Ohio	202	63	235	90	1.2
Oklahoma	245	59	438	210	1.8
Oregon	280	68	334	55	1.2
Pennsylvania	357	97	437	173	1.2
Rhode Island	<<<	<<<	126	40	N.A.
South Carolina	275	88	210	50	0.8
South Dakota	207	86	329	120	1.6
Tennessee	229	103	230	95	1.0
Texas	193	120	467	83	2.4
Utah	290	80	226	51	0.8
Vermont	165	113	<<<	<<<	N.A.
Virginia	<<<	<<<	126	66	N.A.
Washington	409	144	411	75	1.0
West Virginia	389	201	196	150	0.5
Wisconsin	334	137	649	138	1.9
Wyoming	466	120	264	130	0.6

… Sample size less than 10.
<<< 95% confidence interval includes zero.
N.A. Not Available

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