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Measuring the Existence Value of Wildlife: What Do CVM Estimates Really Show?

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I. INTRODUCTION

The increased use of benefit-cost analysis in environmental management decisions has stimulated considerable debate about wildlife valuation. One result is that wildlife are now thought to produce two types of economic value: (1) "use values" derived from hunting, fishing, and viewing; and (2) existence values accruing to both users and to those not actually "using" wildlife but who, nevertheless, have an interest in it. Attention has recently focused on the existence category, and preliminary evidence suggests that this might be the most important component of total value. Many problems persist, however, and existence value estimates are often viewed with skepticism.

Although there are several reasons for this, a fundamental problem is that many contingent valuation method (CVM) respondents may be unable or unwilling to give meaningful answers to questions about the value of wildlife. Proponents of environmental ethics, for example, argue that wildlife has an intrinsic right to exist, independent of human attitudes towards their existence. This has resulted in political confrontations such as those surrounding the snail darter and spotted owl. It also suggests that decisions about the existence of wildlife may involve moral principles not readily amenable to the pricing scheme used in contingent valuation.

This study examines the validity of the CVM for estimating the existence value of four wildlife species recently introduced or reintroduced to New England: the bald eagle, Atlantic salmon, wild turkey, and coyote.[1] Although the results are consistent with those obtained in previous studies, many respondents expressed moral beliefs and concerns about wildlife which raises several questions about the appropriate role of monetary existence value estimates in benefit-cost analysis.

II. CONCEPTUAL ISSUES

Weisbrod (1964) and Krutilla (1967) introduced the notion that economic value may accrue to individuals not actually "using" wildlife. Weisbrod suggested that in an uncertain world "nonusers" might pay an option price to retain the possibility of future use while Krutilla argued that people often value natural resources that they have no desire to ever actually use. Several motives for Krutilla's "existence value" have been suggested: some people may wish to leave an endowment or bequest to future generations, some may value the knowledge that the resource is available for the enjoyment of others, and some may believe that natural resources have intrinsic value independent of any direct benefit or harm to humans.

There is, however, substantial debate about the structure of individual preferences which give rise to existence value (see McConnell 1983 and Loomis 1988). Loomis (1988) suggests a general form of an interdependent utility function:

$$U_a = F_a(f_{1a}(X_a, R_a) + f_{2a}(Q_a, (R_b, Q_b))) \qquad [1]$$

where U_a is a weakly separable function relating the utility of individual a to a's own consumption of a bundle of private goods, X_a; a's use of the natural resource, R_a; knowledge that other people (represented by b) are able to use the resource, R_b; personal satisfaction from knowing that the resource exists, Q_a; and the knowledge that others derive satisfaction from knowing that the resource exists, Q_b.

The total resource value in this formulation consists of several self-interest and altruistic components which can be held simultaneously by each individual. These components can be aggregated into three main categories: (1) personal use values (including option value), (2) use by others (including bequest value), and (3) nonuse values. The condition of weak separability means that the marginal rates of substitution between goods purchased in the market, X, are independent of Q and consequently contingent valuation is the only technique capable of measuring existence values.

Among economists, concern about CVM has focused on potential measurement bias. However, more basic questions about the validity of the CVM are now being asked. Harris, Driver, and McLaughlin (1989), for example, recently examined the CVM from a psychological perspective and argued that,

> the typical approach to studying contingent values has been an indirect one of seeking to confirm a lack of bias in value measurements. . . . A more direct approach is needed to assess the extent to which the values obtained with the CVM meaningfully represent individuals' preferences. The lack of measurement bias is a necessary but insufficient condition for establishing the soundness and stability of the decisions obtained. (Harris et al. 1989, 214)

Harris et al. (1989) question the nature of decision making within the CVM and suggest criteria for judging decision-making quality. For example, do survey respondents adequately consider the prices of other market or nonmarket goods? Do they consider their income as a realistic constraint? Decision making is often stressful—does the CVM provide too much or too little stress? Are respondents familiar with the resource being valued? A related concern is that decisions made in the context of the CVM might be viewed by respondents as having little consequence. Freeman (in Cummings, Brookshire, and Schulze 1986, 50) argues that "in the CVM there is no cost to being wrong, and therefore, no incentive to undertake the mental effort to be accurate."

A more difficult issue is that decisions about wildlife existence may invoke decision making based on ethical or moral principles (Kneese and Schulze 1985; Sagoff 1988). Harris et al. (1989) remind us that wildlife are often viewed as,

> either priceless or beyond market-like transactions because of spiritual or other factors, including perceptions that moral rights rather than exchangeable property right should predominate. (Harris et al. 1989, 222)

Stone (1974) advocates a system of legal rights for natural objects, and Elton (1958, 143–45) states that:

> There are some millions of people in the world who think that animals have a right to exist and be left alone, or at any rate that they should not be persecuted or made extinct as species. Some people will believe this even when it is quite dangerous to themselves.

If these views are common, many people may be unable or unwilling to assign meaningful economic value to the existence of wildlife.

Previous research provides little guidance. Cummings et al. (1986) argue that CVM accuracy is increased when participants are familiar with the commodity being valued, when they have had experience with making choices about the commodity, and when there is little uncertainty. None

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[1] Bald eagles, wild turkeys, and Atlantic salmon were once common in New England but they were essentially extirpated by human activity. Eagle restoration efforts have been quite successful and wild turkey populations have increased to the extent that hunting is now permitted. The first Atlantic salmon returning to the Connecticut River was spotted in 1974, but despite extensive restoration effort only about 100 returned in 1989. The coyote is not native to New England but is now relatively abundant.

of these conditions hold for most wildlife species, however.

Since wildlife existence is a public good, Mitchell and Carson (1986, 237–47) suggest CVM structures based on political markets which may imply a different set of operating conditions for the CVM. For example, in the political markets for public goods, outliers do not influence the results unduly, and respondents can abstain. However, neoclassical economic theory often fails to adequately explain individual choices about public goods. According to Margolis (1982, 17), "In the presence of public goods, the behavior of a self-interested 'economic man' conflicts with everyday observation." A familiar illustration is the inability of neoclassical theory to explain the fact that many people vote; why should the voter expend effort when there is very little chance that her/his vote will make a difference?

Many people may be motivated by social norms and a commitment to moral duty which drives a wedge between personal choice and personal welfare (Sen 1979; Elster 1989), and some individuals may have ethical commitments to wildlife (Edwards 1986). Gregory (1986) summarized evidence produced by both economists and psychologists indicating that many of the axioms of utility theory are "systematically and consciously violated" in the contingent valuation of public goods, and Holmes (1990) detected altruistic behavior in the referendum vote on California's Proposition 65. Moreover, preference reversals are common; individual choices between options are often different than that implied when they are asked to price the same options. According to Tversky and Thaler (1990), this cannot be attributed to intransitivity or to a violation of the independence axiom of expected utility theory. "Rather they seem to be driven by the discrepancy between choice and pricing which in turn is induced by scale compatibility" (p. 209).

Although several alternative theories of behavior such as prospect, fair-share, and lexicographic models have been developed,[2] there is little empirical evidence about the nature of decision making with respect to monetary commitment, the type and quality of decision-making process employed or the ability of CVM respondents to assign meaningful economic values to wildlife existence. These issues are examined below.

III. PROCEDURES

Two separate CVM mail surveys were used in this study. The first examined the economic value of the Atlantic salmon restoration program to Massachusetts residents. The second focused on the value of bald eagles, wild turkeys, and coyotes in New England. The salmon CVM survey was mailed to a random sample of one thousand Massachusetts residents and the bald eagle, wild turkey, coyote survey was sent to fifteen hundred New England households. Both surveys included introductory information, general questions about outdoor activities and the importance of wildlife, valuation questions, and follow-up questions to examine the nature and quality of each individual's decision-making process. Several attitude and opinion questions were included to evaluate the consistency of results obtained from the valuation questions. Dillman's (1978) Total Design Method was followed throughout.

The bald eagle, wild turkey, and coyote sample was partitioned into five groups. Each received an identical questionnaire except for the valuation question. The first group received a valuation question about the bald eagle. The second group was asked about coyote control, the third examined the bald eagle and wild turkey combined, type four focused on coyote protection, and the final type concerned the wild turkey.

Most respondents had very limited contact with these species. Only 12 percent had ever seen Atlantic salmon in New England; 28 percent had seen bald eagle, 25 percent had seen wild turkey, and 24 percent had seen coyote. This has two implications. First, many survey respondents were probably not very familiar with the commodity being valued. Second, benefits were expected to be largely in the form of existence value which, following Loomis (1988) is broadly defined as the value derived from knowing that these species exist in New England.[3]

[2] For a discussion of prospect, fair-share, and lexicographic models see, Gregory (1986), Margolis (1982) and Edwards (1986), respectively.

A modified dichotomous choice method was used for valuation. In this approach individuals are assumed to have utility functions, V, which have as arguments income (Y), a state of nature with or without the wildlife species (S), and a set of conditioning factors (F):

$$V(S, Y; F). \qquad [2]$$

Each individual was confronted with the loss of the natural resource ($S = 0$), and a *specified* amount of money, N, which she/he could contribute toward continued existence of the resource. The amount, (N) was randomly selected within fixed intervals over a range of \$5 to \$150. For example, the bald eagle valuation question was specified as follows:

> Wildlife management efforts sponsored in part by state, federal and local governments have helped to return some wildlife species from the brink of extinction. The bald eagle and the wild turkey, for example, have both been brought back to New England. Suppose that budget cuts eliminate these programs and that a private trust fund for the management of the bald eagle is set up to preserve and protect the bald eagle population in New England. Please assume that the bald eagle will not continue to exist in New England unless this fund is created. Would you contribute N $ per year over the next five years to this fund?

A similar valuation question was used for the other species.

This formulation does not necessarily insure survival of the species and it may create incentives for free riding. An individual could, for example, refuse to pay, but everyone else might contribute.

Incentives for free riding in contingent valuation are often minimized by using payment vehicles, such as taxes, which exact payment from everyone. Taxation was not used in this study for several reasons. Given the prevailing political climate, tax vehicles might have created strong incentives for protest and nonresponse. Voluntary payments, on the other hand, closely correspond to commonly experienced methods of contributing to wildlife preservation. Also, little evidence of free riding behavior has been found in previous studies (see Cummings et al. 1986), and a donation vehicle is quite realistic in light of the budgetary problems facing many New England communities.

Results obtained from the donation vehicle must be carefully interpreted, however. Some respondents may view this valuation question more as a way to express a desire for wildlife preservation than as a measure of how much they would actually pay. Other responses may reflect the satisfaction of contributing to a "good cause" rather than the value of the resource itself. Therefore, respondents were asked a series of follow-up questions about why they would or would not be willing to contribute the specified amount.

All respondents were also given an opportunity to bid an amount less (or greater) than the stated value, N. Consequently, responses could be viewed as originating from either an open-ended or a close-ended dichotomous choice bidding format. Since different bidding formats can produce statistically different value estimates, both methods were used in this analysis. (See, e.g., Boyle and Bishop 1988; Seller, Stoll, and Chavas 1985; and Smith, Desvousges, and Fisher 1986).

In dichotomous choice only those respondents who would pay the predetermined amount N were considered to be willing to pay. Respondents were assumed to agree to pay if, and only if, the expected value of utility when this donation is made equals or exceeds that when it is not. The expected value of utility when amount N is donated is given by:

[3] Bequest value is therefore included in this category (see Loomis 1988). Additional benefits in the form of recreational use value (hunting or viewing) may be derived from all species.

$$V_D = V(1, Y - N; F)P_1 + V(0, Y - N; F)P_2 \quad [3]$$

where P_1 and P_2 are the probabilities, assigned by each individual, that the species will or will not continue to exist, respectively. The expected value of utility when the donation is not made is:

$$V_{ND} = V(1, Y; F)P_3 + V(0, Y; F)P_4 \quad [4]$$

where $P_1 > P_3$ and $P_2 < P_4$. The individual is assumed to agree to donate amount N if, and only if:

$$V_D \geq V_{ND}. \quad [5]$$

Following Hanemann (1984), the willingness-to-pay probability is written as:

$$Pr = G(dV), \quad [6]$$

where G is the probability function for the random component of utility and dV is defined as the expected utility difference:

$$dV = V_D - V_{ND} \quad [7]$$

The probability that the individual will pay the specified amount N can then be approximated by $G(dV(N))$.

A respondent is assumed to be willing to pay amount N if her/his true expected equivalent surplus (E) is greater than or equal to N so that $G(dV(N))$ is the same as the probability that $N < E$. The value of the resource can then be approximated by the expected value of E, or by the median of the probability function.[4] Since each individual was allowed to bid an amount more or less than N, responses could also be treated as satisfying the condition that:

$$V(1, Y - A; F)P_1 + V(0, Y - A; F)P_2 = V(1, Y; F)P_3 + V(0, Y; F)P_4 \quad [8]$$

where the individual's payment A is a direct measure of expected equivalent surplus.

An approximation of utility difference, dV, was used for the empirical analysis:

$$dV = B_1 + B_2 \log N + B_3 \log Y + B_4 F, \quad [9]$$

where N is the predetermined bid amount, Y is household income, and F is a vector of conditioning factors which in the eagle, turkey, and coyote data included education, age and sex of the respondent, and an index of species importance as stated by the respondent. A set of dummy variables for membership in environmental organizations, for species type, for having made actual donations for wildlife preservation and for region of residence were also included (see Table 1). Slightly different factors were available from the salmon survey; dummy variables were included for membership in sports organizations (*SPT*), environmental organizations (*ENV*), for previous knowledge of the restoration program (*AWR*), and for those indicating a desire to fish for salmon in the future (*OPT*).

IV. RESULTS

The value of the dependent variable in dichotomous choice is either 0 or 1 and the logit model was used to obtain the dichotomous choice parameter estimates presented in Tables 2 and 3. The dependent variable in the open-ended format is the actual amount, A, that each respondent would pay. Since the range of this variable is limited (no bids below \$0 are allowed), the Tobit estimation procedure was used.[5]

The signs of most coefficients conform to prior expectations. Larger bids were more likely to be refused in the dichotomous choice (logit) models and differences between species are apparent. Because the variable representing importance of the species to the respondent ranged from one, very important, to four, not important, a negative relationship between willingness to pay and this variable was expected. Respondents indicating a desire to fish for Atlantic salmon in the future (*OPT*) were more likely to be willing to pay for salmon restoration, and a positive relationship was found between education and willingness to pay for bald eagles, wild turkeys, and coyotes.[6]

Wildlife value estimates are presented in Table 4. The dichotomous choice model results were obtained by numerically integrating the area under each estimated willingness-to-pay function over the range of offer amounts at the mean values of the independent variables. Average willingness to pay and Tobit model estimates were calculated from the open-ended response data.[7]

V. INTERPRETATION AND EVALUATION OF RESULTS

These results suggest that substantial existence value is associated with bald eagles, wild turkeys, and Atlantic salmon. The estimated values fall within the range of those reported elsewhere and seem "reasonable" when compared to previous research results. For example, relatively recent studies found average willingness-to-pay bids ranging between \$10.62 and \$75.31 for bald eagle preservation. Bids for a less well-known species, the striped shiner, ranged from \$1.00 to \$5.00 (Boyle and Bishop 1987), and Atlantic salmon existence values

[4] Although the median is sometimes preferred from a statistical perspective it disenfranchises those with the largest stake in the resource (Bowker and Stoll 1988).

[5] OLS results were essentially identical.

[6] The coefficients on the initial bid amount, N, were not statistically significant in the open-ended Tobit models which suggests that starting point bias may not be a problem in the procedure used here.

[7] Details are available from the authors.

TABLE 1
DEFINITION OF VARIABLES FOR BALD EAGLE, COYOTE, AND WILD TURKEY ANALYSIS[a]

Variable	Definition
D1 – D4	Dummy variables for survey type. *D1* = Bald Eagle; *D2* = Coyote Control; *D3* = Bald Eagle and Wild Turkey; *D4* = Coyote Protection
Log *N*	Log of Payment
Region	Dummy variable for region of residence; 1 if Southern New England, 0 otherwise
Importance	Index of species importance to respondent
Membership	Dummy variable for membership in environmental organizations; 1 if member, 0 otherwise
Donation	Dummy variable; 1 if respondent made a donation for wildlife preservation during the previous year, 0 otherwise
Sex	Dummy variable; 1 if male, 2 if female

[a] All other variables are as defined in the text above.

TABLE 2
BALD EAGLE, WILD TURKEY AND COYOTE PARAMETER ESTIMATES

	Model	
Variable	Dichotomous Choice Logit	Open-Ended Tobit[a]
D1	1.56	.67
	(2.56)	(3.24)
D2	−1.34	−.61
	(1.19)	(2.39)
D3	1.13	.11
	(1.87)	(.51)
D4	−.73	−.38
	(.81)	(1.57)
Log *N*	−.98	−.01
	(4.18)	(.08)
Region	.91	.46
	(1.71)	(2.62)
Importance	−.98	−.39
	(2.58)	(3.26)
Membership	.06	.18
	(.12)	(.92)
Donation	.52	.48
	(.99)	(2.69)
Sex	−.43	−.005
	(1.01)	(.04)
Age	−.03	−.006
	(2.03)	(1.22)
Education	.80	.32
	(2.79)	(3.36)
Log Income	−.69	−.27
	(1.62)	(1.74)
Constant	−1.60	−1.95
	(2.26)	(1.74)
Squared Correlation		.19
Correct Predictions (%)	90	—
Maddala R^2	.18	—
N	339	339

[a] Normalized coefficients. Absolute asymptotic *t*-values in parentheses.

TABLE 3
SALMON PARAMETER ESTIMATES

Variable	Model: Dichotomous Choice Logit	Model: Open-Ended Tobit[a]
Log *N*	−1.626	.009
	(3.05)	(.21)
Importance	−.474	−.355
	(1.01)	(2.19)
Sex	.658	.401
	(.92)	(1.78)
Age	−.011	−.045
	(.09)	(1.06)
Log Income	1.50	.091
	(2.34)	(1.71)
AWR	.881	.060
	(1.44)	(.29)
SPT	.558	.866
	(.84)	(3.19)
ENV	−.223	−.012
	(.36)	(.07)
OPT	1.65	.507
	(2.14)	(2.23)
Correct Predictions (%)	91	—
Maddala R^2	.22	—
N	169	169

[a]Normalized coefficients. Absolute asymptotic *t*-values in parentheses.

of $10 to $30 above the willingness to pay for fishing licenses were estimated by Kay, Brown, and Allee (1987).

As expected, the coyote is a controversial animal having negative, as well as positive, existence value. There was little difference in the average willingness to pay for coyote protection and control (see Table 4), and when asked if "the coyote should be completely protected," 39 percent of survey respondents agreed and 40 percent disagreed.

Analysis of the follow-up questions suggested that many respondents were motivated by altruism and ethical considerations. Seventy-nine percent of respondents to the salmon survey agreed with the statement that, "All species of wildlife have a right to exist independent of any benefit or harm to people," and 70 percent of respondents gave this as one of three most important reasons for the existence of bald eagles, wild turkeys, and coyotes in New England. Only 6 percent of salmon survey respondents selected either a current or future use value as the most important reason for salmon restoration, and only 12 percent of those responding to the bald eagle, wild turkey, and coyote survey selected either current or future use as the most important reason for preservation of these species in New England.

When asked to divide their total wildlife payment into the categories of option and existence values, salmon survey respondents allocated only 15 percent to option value. Respondents to the bald eagle, wild turkey, and coyote survey allocated approximately 48 percent of their total payment to an intrinsic category: "because animals have a right to exist"; 34 percent was allocated to bequest value; and only 7 percent was allocated to a present or future use category.

However, analysis of the follow-up questions suggested that many respondents probably did not give the valuation question much thought: 52 percent of respondents to the salmon survey felt that their responses would not matter in future policy

TABLE 4
ESTIMATED EQUIVALENT SURPLUS, DOLLARS PER PERSON PER YEAR

Model	Bald Eagle	Wild Turkey	Coyote Control	Coyote Preservation	Salmon
Logit[a]	28.25	7.11	2.08	3.65	6.25
Tobit[b]	19.90	9.60	3.40		6.95
Average Willingness to Pay	19.28	11.86	4.20	5.35	7.93

[a]Mean value.
[b]Coyote control and preservation were not analyzed separately.

decisions.[8] This is clearly cause for concern; it may indicate that respondents did not take the survey seriously.

Analysis of the questions about attitudes, opinions, and relative importance of wildlife produced evidence of several other problems with this CVM. Over 80 percent of survey respondents said that bald eagles, wild turkeys, and Atlantic salmon are either very or somewhat important to them. However, a majority of respondents, approximately 62 percent, would not pay any money for the existence of bald eagles or wild turkeys in New England and 64 percent would not pay for salmon restoration.[9]

When asked why, only 6 percent of those not willing to pay said that these species were worth nothing to them. Forty percent of those refusing to pay for bald eagles or wild turkeys protested the payment vehicle used in this CVM; they stated that these species should be preserved but that the money should come from taxes or license fees.[10] Twenty-five percent protested for ethical reasons, claiming that wildlife values should not be measured in dollar terms.[11]

Self-selection and nonresponse bias are also potential problems. Loomis (1987) reports CVM response rates as low as 25 percent, and 40–60 percent is about average for academic surveys of the general population. The response rate to this study was only approximately 30 percent and a simple test for nonresponse bias in which 10 percent of salmon survey nonrespondents were contacted by telephone produced inconclusive results. Survey respondents were, however, more affluent and had more education than average for New England residents. Hunters and people belonging to environmental organizations were also over-represented.

A more fundamental issue concerns the type of decision-making process used by those who were willing to pay. Edwards (1986), for example, suggests the need to distinguish between respondents with egoistic and ethical preferences. Egoists are assumed to be motivated by self-interest and indifferent to alternative choices which yield equal levels of personal utility. This assumption lies behind the methodology used in this and most existence value studies.

Ethicists, on the other hand, are assumed to be motivated by "genuine altruism" which, according to Edwards (1986) reflects a commitment to the existence of wildlife "rooted in what one thinks as being right or wrong from a moral or ethical point of view regardless of how one's own welfare might be affected" (Edwards 1986, 147). An ethicist might therefore state preferences according to a lexicographic rule whereby indifference and trade-offs between money and wildlife are undefined.[12]

One possibility is depicted by the lexicographic preference map in Figure 1 in which Y^* represents a minimum level of income below which more income is always preferred to wildlife and above Y^* wildlife are always preferred to income.[13] If the initial situation is at point A, this individual is willing to pay the *same* amount ($Y_0 - Y^*$) to avoid *any* reduction in the wildlife population. On the other hand at B, willingness to pay is undefined. In either case, willingness to pay does not measure equivalent surplus.

In this study, ethical concerns about wildlife existence were expressed by many

[8]This may, however, indicate little incentive for strategic behavior. Note, also, that 69 percent of salmon survey respondents disagreed with the statement that "people will not give truthful information in imaginary situations."

[9]Approximately 60 percent said that the existence of coyote is either very or somewhat important to them. However, only about 25 percent of respondents were willing to pay for coyote protection or control.

[10]This may reflect the potential incentive for free riders in the donation payment vehicle used here.

[11]The estimated equivalent surplus values increased by as much as 40 percent when protest responses were removed from the data set. However, when responses by those who may not have taken the survey seriously were *also* removed, equivalent surplus values were virtually identical to those reported in Table 4.

[12]In a lexicographic rule, one alternative is always ranked above another. Indifference and trade-offs are undefined because no two alternatives can be of equal rank.

[13]This is only one of many possibilities. Edwards (1968, 148) notes that "thresholds could exist whereby preference switches between egoistic and ethical interests. This might happen when a population of a species is reduced to the endangered level."

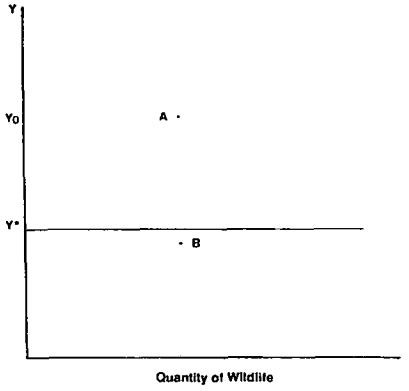

FIGURE 1
LEXICOGRAPHIC PREFERENCE MAP

respondents, the possibility of lexicographic behavior could not be ruled out, and many respondents failed to make "rational" trade-offs between money and wildlife. For example, 44 percent of all respondents agreed with the statement that "preservation of wildlife should not be determined by how much money can be spent" and 67 percent of all respondents agreed that, "As much wildlife as possible should be preserved no matter what the cost."

Additional evidence about respondents' decision-making behavior was gathered by asking them to agree or disagree with each of the following statements about tradeoffs:

1. As long as I have enough money to live on, wildlife preservation is more important to me than having more money.
2. Wildlife preservation and money are both important to me; but decisions have to be made and more money could make up for the loss I would feel if there were less wildlife.
3. No matter how much money I have, having more money will always be more important to me than wildlife preservation.

Forty-four percent of those who were willing to pay for bald eagles, wild turkeys, or coyotes agreed with (1) and 56 percent disagreed with (2). Two-thirds of salmon survey respondents said trade-offs between money and wildlife did not describe their decision-making behavior, and 70 percent of all respondents gave answers which appeared inconsistent with either the neoclassical or lexicographic models of behavior.[14] However, 80 percent of the remainder gave responses that were consistent with lexicographic preference orderings.

Taken together, this evidence raises several questions about the meaning and validity of the resulting value estimates. Some of our concerns are related to the donation payment vehicle. Randall (1986, 114–22) argues that WTP estimates are based on the value of the commodity being offered, the process by which it is provided, and the method of payment, so that the valuation of the good itself often cannot be separated from the issues associated with its provision. Following this argument, the monetary existence values reported here could be interpreted in several ways: they might measure the value of wildlife existence, they may simply reflect the amount of money which could be raised through private donations, or they might indicate the value of contributing to a "good cause."[15]

A more fundamental issue concerns whether or not respondents made meaningful trade-offs, and our results suggest that the majority of respondents who were willing to pay used decision-making processes inconsistent with the neoclassical paradigm of trade-offs between money and wildlife.

[14] Respondents were assumed to behave lexicographically if they disagreed with (2) and agreed with either (1) or (3).

[15] Evidence obtained from follow-up questions showed that 32 percent of the respondents to the bald eagle, wild turkey, and coyote survey had actually made donations for wildlife preservation during the previous year; the average being approximately $77. Each respondent was also asked, "Suppose that you received a $1,000 gift. Considering your existing financial obligations, how much of it, if any, would you contribute toward wildlife management in New England?" Fifty-four percent said that they would donate an average of approximately $109. About $50 was allocated to the bald eagle and $38 was "given" for wild turkey management. The WTP results (about 38 percent of respondents WTP between $28 and $19 for bald eagles, $11.86 to $7.11 for wild turkeys, and $7.93 to $6.25 for Atlantic salmon) seem "reasonable" in this context. However, questions about the extent to which these results measure the actual value of existence remain unanswered.

VI. CONCLUSIONS

The scope of wildlife valuation has expanded considerably and total economic value is now thought to include current use, option, and several types of existence value. This study suggests that existence value may be quite large relative to use values. When asked to divide their payment into use and existence value categories, respondents assigned only 7 percent to a current use or option category. Thirty-four percent was allocated to bequest value, and an intrinsic value category, "because animals have a right to exist independent of any benefit or harm to people," received 48 percent.

However, many questions remain and the results of this study strike at the most basic assumptions underlying the CVM; many respondents appeared to behave "irrationally." Eighty percent of survey respondents said that bald eagles, wild turkeys, and Atlantic salmon are important to them, but when confronted with contingent valuation the majority refused to pay. They were either uncertain about their valuation, believed that wildlife should not be valued in dollar terms, or protested the donation payment vehicle. Moreover, most of those who *would pay* exhibited behavior which appears inconsistent with the neoclassical theory underlying the CVM. In essence this CVM may have asked people to choose between ordinary goods (income) and a moral principle. Harper (1989), and Opaluch and Segerson (1989) argue that such choices are likely to produce conflict and ambivalence and the resulting behavior (protest, avoidance, use of lexicographic rules) is likely to be inconsistent with the usual preference assumptions.

These results have several implications for applied benefit-cost analysis. First, we believe that the CVM may not provide a valid measure of existence value and we therefore argue that benefit-cost analysis should generally not be used to make decisions about the existence of wildlife. A substantial body of literature supports this conclusion. The potential for CVM self-selection and nonresponse bias is high, CVM results are often sensitive, and existence values are likely to be quite volatile. Randall and Stoll (1983) for example, note that the snail darter had no economic value prior to its discovery. Thus, small changes in information or knowledge may produce large shifts in existence value. Brown and Goldstein (1984) remind us of a closely related consideration. Since the direction of evolution is unknown we cannot know in advance which species to save and which to sacrifice. Consequently, the concept of a safe minimum standard, which focuses attention on the costs of avoiding extinction, may be more promising than the benefit-cost approach to public decision making.

Another implication is that alternative models of individual decision making may be needed for existence value analysis. Very little is known about the process used by individuals in making choices about public goods which involve ethical commitments and moral considerations. Therefore, it is important to know how individuals interpret CVM questions; existence value studies should include follow-up questions to examine the quality and nature of respondents' decision-making processes; questions about motivation should be used to cross-check the valuation results; and nonmonetary preference scales for existence should be used in conjunction with the economic valuation question.

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Hunters' Demand for Species Variety

J. Walter Milon and Roger Clemmons

Sport hunting is a popular recreation activity yet relatively little is known about the determinants of hunters' behavior. As an activity, sport hunting may focus on a single target species or it may include a variety of animal and bird species pursued in different seasons and locations. Hunters who pursue several groups of species or a number of species within a group purchase more species variety than hunters who only hunt a single species.

The demand for species variety is one dimension of recreation quality that has not been addressed in previous research.[1] Typically the quality of recreation has been identified with quantitative measures of site characteristics (e.g., acreage, facilities, harvest rates). Within this framework, the pursuit of different fish and wildlife species is classified as independent recreation activities (e.g., duck hunting trips, deer hunting trips) or as an aggregate, homogeneous activity (e.g., total hunting or fishing trips). This approach is useful for evaluating the contribution of individual characteristics to recreation quality. But, it cannot help to explain the socioeconomic factors and interdependencies between species that determine the number of species a hunter, angler, or nonconsumptive user will decide to pursue. This aspect of quality is important because the recreationist's overall level of utility is influenced by the simultaneous choice of target species during the year. Public policies that change the economic constraints or accessibility to particular species can lead to reallocation of effort to pursue other species.

Recent demand studies have shown that consumers actively seek variety from their consumption expenditures. Theil and Finke (1983), Jackson (1984), and Shonkwiler, Lee, and Taylor (1987) found that the number of goods consumed in any broad consumption category tends to increase as expenditures on that category increase. These studies indicate that variety increases consumers' satisfaction and the pursuit of variety is an integral part of consumption decisions. Jackson (1984) attributes the demand for variety to insatiability and an innate need for diversity in the human experience.

Recreation choices such as the allocation of hunting expenditures can be viewed as consumption decisions, but the task of identifying hunters' demand for species variety is complicated by the lack of explicit markets for hunting activity. Variety is not purchased directly but is a product of the hunter's decisions to allocate trips to hunt different species given economic constraints and species availability. In addition, variation in economic constraints and tastes may lead to corner solutions in which some hunters may not hunt one or more species from the available array.

The relationship between hunting expenditures and the demand for species variety is important because preferences for species variety influence the level of effort for individual species and wildlife management policies can change economic constraints. The fact that real expenditures per hunter in the U.S. increased more than 60 percent during the period 1970–85 while participation increased only 14 percent (U.S. De-

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[1] Hay and McConnell (1979) used a supply index of wildlife species diversity in their analysis of nonconsumptive wildlife recreation and suggested that more experienced nonconsumptive users seek greater diversity. Their analysis, however, did not develop a behavioral framework to explain the demand for species diversity.