MEASURING THE ECONOMIC VALUE OF WILDLIFE: A CAUTION[1]

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Wildlife values appear to be very sensitive to whether species are evaluated separately or together, and value estimates often seem inconsistent with neoclassical economic theory. Wildlife value estimates must therefore be used with caution. Additional research about the nature of individual value structures for wildlife is needed.

Introduction

Attempts to derive economic values for wildlife are undertaken for a variety of reasons. The earliest studies focused on the value of wildlife to "users," such as hunters. Shortly thereafter the ecological sciences brought attention to the importance of species that have no traditional "use" value. Economists responded with the suggestion that wildlife might produce several types of "nonuse" or existence values. Krutilla (1967), for example, argued that people often value natural resources that they have no desire to ever actually use or see.

Empirical evidence has tended to confirm Krutilla's hypothesis (see Boyle and Bishop, 1987); in fact, nonuse values may often be the most important component of total economic value. Information about nonuse value is becoming increasingly important because litigation for environmental damages frequently requires it, and because the opportunity costs of wildlife preservation continue to grow. But as the scope of valuation expands, new problems emerge, and wildlife value estimates continue to be viewed with skepticism (see Sagoff, 1988).

This paper examines the validity and meaning of wildlife value estimates derived from the contingent valuation method (CV). [2] CV is the only method which can estimate both "use" and "nonuse" values. However, CV results often appear to be very sensitive to whether a natural resource is valued on its own or as part of a more inclusive category. Another concern is that since decisions about wildlife often involve ethical or moral considerations, many people may be unwilling or unable to assign meaningful economic values to wildlife.

These problems suggest that wildlife value estimates must be used with caution. We conclude that better information is required about the nature of individual value structures for wildlife and about "what goes on in peoples' minds" when they respond to CV questions.

Concepts of Economic Value

Some wildlife species have market value, and both implicit and explicit economic values are derived from the recreational opportunities associated with wildlife. However, these measures do not necessarily capture all aspects of public preferences and valuation; a more complete valuation includes "nonuse" or existence values.

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 every actually use. Several motives for Krutilla's existence value have been suggested: some may value the knowledge that the resource is available for the enjoyment of others, some may wish to leave an endowment or bequest to future generations, and some believe that natural resources have intrinsic value independent of any benefit or harm to humans.

There is, however, substantial debate about the structure of individual preferences which give rise to these values. Loomis (1988) suggests a general form of an interdependent utility function:

$$U_a = F_a(f_{1a}(X_a, R_a) + f_{2a}(Q_a, (R_a, Q_b)))$$

Where U_a is a weakly separable function relating the utility of individual a to a's own consumption 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.[3]

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 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 these values.

Many important questions about the valuation of wildlife remain. Two problems are of primary concern here. First, strong embedding effects have frequently been observed in which the value of a natural resource is much larger when evaluated on its own than when valued as part of a more inclusive category (Kahneman and Knetsch, 1990). This result is inconsistent with neoclassical economic theory unless people are willing to pay a large portion of their income (or budget) or unless the natural resources contained in R_a, R_b are

1/ This research was sponsored, in part, by the Forest Service, U.S. Department of Agriculture.

2/ Contingent valuation uses survey questions to elicit the mazimum amount individuals would be both willing and able to pay for wildlife.

3/ The bundle of private goods, X_a, can include wildlife related commodities, such as books and televised nature programs. Each individual is assumed to have a unique set of tastes and preferences which change over time with experience, development of skills and learning. The current preference structure is therefore directly related to previous use and experience (Randall and Stoll, 1983).

close substitutes. Neither condition is likely and as pointed out by Kahneman and Knetsch, "...if the value (of a resource) is much larger when it is valued on its own than when it is evaluated as part of a more inclusive package of public goods, which measure is the correct one?"

Other problems arise from the public good nature of nonuse values associated with wildlife.[4] Economic theory often fails to explain individual behavior abut the provision of public goods. Examples abound: Why do we contribute to public broadcasting when we know that others will contribute, and if we do contribute, how do we decide on how much?

Several competing theories attempt to explain cooperative or "social" behavior related to the provision of public goods. Margolis (1982) purposes a dual utilities model to explain how individuals allocate resources (income, time, etc.) to satisfy preferences for both public and private goods. Preferences for public goods are assumed to be irreducibly distinct from those associated with private goods; there is no "grand maximand." Rather, Margolis suggests that individuals attempt to seek a balance or "fair share" allocation between private goods and social spending. CV results might therefore represent individual's judgements about paying their "fair share" as opposed to the economic value of the goods in question.

Another perspective is presented by Holl nder (1990) who argues that individuals gain social approval by contributing toward the provision of public goods. As a result, willingness to pay represents the combined value of "social approval" and of the good itself. Frank (1987), Sen (1979), Elster (1989) and Edwards (1986) suggest that individuals attempt to maximize programs. Each individual is assumed to have a unique set of personal satisfaction subject to constraints imposed by social norms and commitment to moral duty. Edwards (1986), for example, argues the need to identify CV respondents with ethical preference structures. According to Edwards, ethicists may be motivated by 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, p. 147). Some CV respondents might therefore refuse to make tradeoffs between money and wildlife. A more important concern, however, is that some ethicists might be willing to pay, but the amount might not represent economic value in the usual sense. Kahneman and Knetsch, for example, argue that CV responses "...reflect the willingness to pay for the moral satisfaction of contributing to public goods, not the economic value of these goods." Opaluch and Segerson (1989) and Harper (1989) take a slightly different view and argue that choices involving moral principles produce conflict and ambivalence which results in avoidance (nonresponse to CV questions), and use of simple lexicographic decision rules about monetary commitment.

A fundamental concern about wildlife valuation which emerges from this brief review is that economic values derived from CV may not be comparable (if significant nonuse values are involved) with those associated with other goods and services. CV respondents may be "paying" for social approval, for moral satisfaction, or their "fair share." Therefore, CV results may frequently be misinterpreted. Yet there is little empirical evidence about whether or not CV respondents assign meaningful economic values to wildlife. This issues is examined below.

Empirical Evidence

A CV survey about the value of bald eagles and wild turkeys in New England was mailed to 1,500 randomly selected households in the spring of 1989.[5] The survey included introductory information, general questions about outdoor activities and the importance of wildlife, valuation questions, and several follow-up questions to examine individual decision making processes and the consistency of results obtained from the valuation question. The total design method suggested by Dillman (1978) was followed throughout.

Most respondents reported very limited contact with bald eagles and wild turkeys. Only 25 percent had ever seen these animals in New England, yet 53% of respondents considered the existence of bald eagles in New England to be very important. Existence was somewhat important to 36%, and not important to only 11%. Wild turkeys were considered very important by 41% and somewhat important by 40%.

When asked why bald eagles are important, only 12% of the respondents indicated a personal use value, while 80 percent indicated some type of nonuse or existence value; either giving others a chance to view eagles (16%), to insure that eagles are available for future generations (23%), or an intrinsic value, "because eagles have a right to exist" (41%).[6] Consequently, nonuse or existence values are likely to be very important components of the total economic value of these species.

For economic valuation, the sample was partitioned into three groups, each of which received an identical questionnaire except for the valuation question. The first group received a valuation question about bald eagles. The second group was asked about bald eagles and wild turkeys combined, and the third group was asked about wild turkeys. The economic valuation question confronted each individual with a specified amount of money, N (randomly selected within fixed intervals over a range of $5 to $150), which she/he could contribute to ensure wildlife existence. Respondents were then given an opportunity to bid an amount less (or greater) than the stated value, N. 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?

4/ Existence is a pure public gook; one individual's enjoyment of existence does not reduce that of another. Consequently, $Q_a = Q_b$.

5/ Preliminary results from this data were discussed at the 1990 NERR meeting (see More, Glass and Stevens, 1990.) 41% and somewhat important by 40%.

6/ A comparable question was not asked about wild turkeys.

This formulation may create incentives for "free riding." An individual could, for example, refuse to pay, hoping that 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. Moreover, little evidence of free riding behavior has been found in previous studies, and a donation vehicle is quite realistic in light of recent budgetary problems facing many New England communities.

Results obtained from the donation vehicle must, however, be carefully interpreted. 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. Respondents were therefore asked a series of follow-up questions about why they were or were not willing to contribute.

The survey response rate was 37 percent which is slightly below average for academic surveys of the general population (Loomis, 1987). Average bids, maximum bids and standard deviations for each species are reported in Table 1. The average respondent was willing to pay $21.25 annually for bald eagles,

Table 1. Statistics for Amount Bid

Species	Mean Amount Bid ($) Per Year	Standard Deviation	Maximum ($)
Bald Eagles	$21.25	38.36	200
Wild Turkeys	$11.67	27.34	150
Bald Eagles & Wild Turkeys Combined	$9.00	16.23	75

$11.67 for wild turkeys, and $9.00 for bald eagles and wild turkeys combined. However, since many respondents refused to place a dollar value on wildlife, these values must be adusted. Over 80 percent of survey respondents said that bald eagles and wild turkeys are either very or somewhat important to them, but a majority of respondents, 62 percent, would not pay any money for restoration. When asked why, 40 percent of those refusing to pay protested the method of payment used in this CV; they stated that these species should be preserved but that the money should come from taxes or license fees. Twenty five percent protested for ethical reasons; they said that wildlife values should not be measured in dollar terms. Only 6 percent of those not willing to pay said that these species were worth nothing to them. [7] This implies that the average values in Table 1 are underestimated and when protest responses were removed from the data set the average respondent was willing to pay about $31 per year for bald eagles, $18.85 for wild turkeys and $13.12 for bald eagles and wild turkeys combined (see Table 2).

Table 2. Adjusted Statistics for Amount Bid

Species	Protest (%)	Mean Amount Bid ($ Per Year) (without protest)	Standard Deviation	t*	t**
Bald Eagles	31	$30.81	42.99	2.56	1.36
Wild Turkeys	38	$18.85	35.55	1.01	
Bald Eagles & Wild Turkeys Combined	31	$13.12	18.21		

* Compared to Bald Eagles & Wild Turkeys combined.
** Compared to Wild Turkeys.

The value estimates for bald eagles and wild turkeys seem "reasonable" when compared to previous research findings (for example, see Boyle and Bishop, 1987). The adjusted willingness-to-pay results also appear "reasonable" when compared to actual donations made by respondents during the previous year. Evidence obtained from follow-up questions showed that 32% of the respondents had actually made donations for wildlife preservation during the previous year; the average being approximately 70 dollars. However, the average value for bald eagles and wild turkeys combined was much less than when each was valued separately and added together. Moreover, the value of the "t" statistic in Table 2 suggests that this difference is statistically significant, which casts doubt on the validity and meaning of these value estimates.[8]

Further analysis revealed other potential problems with these value estimates. Many of those who were willing to pay expressed attitudes about wildlife which, when viewed from the perspective of neoclassical economic theory, appear "irrational." For example, forty-four 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% of all respondents agreed with the statement that, "As much wildlife as possible should be preserved no matter what the cost." These respondents may have failed to give meaningful responses to the willingness-to-pay question, and when the bids by respondents who strongly agreed with these statements were also removed from the data, the average respondent would pay $25.35 for bald eagles, $18.90 for wild turkeys, and $10.66 for bald eagles and wild turkeys combined.

Regression analysis was used to obtain additional evidence about the decision-making behavior of survey respondents. The dependent variable was the actual dollar amount respondents would pay. Independent variables included dummy variables for region of residence (S), membership in environmental organizations (ORG), type of residential neighborhood (U), and whether or not the respondent hunts or has hunted (H).

7/ Protest bids are quite common in contingent valuation. For example, Desvousges, Smith and McGivney (1983) identified nearly half of the zero bids in their study of water quality as protest bids.

8/ No significant differences were found in the distribution of the initial bid "N," or of the socio-economic or demographic characteristics of respondents between groups which might explain this result.

Variables for amount of money actually donated for wildlife preservation during the previous year, the initial amount asked for, N, and for the respondent's age, education and income were also included. The data from the three subsamples were pooled and dummy variables were used to represent survey type (D1=1 if bald eagle, D3=1 if bald eagles and wild turkeys combined). [9] The results presented in Table 3 show a statistically significant relationship between payment and the variables representing hunting, education, previous donation amount, and the initial bid, N. Hunters and respondents with more education were willing to pay a greater amount and payment increased with the amount actually donated. [10] However, this model does not adequately describe how individuals responded to the CV question because it explained very little of the variation in willingness-to-pay (R^2 = .15 to .17).

Table 3. Regression Model Results

Variable	All Data		Data with Protest Deleted	
Constant	-1.03	(.11)	-1.48	(.11)
D1	9.28	(1.89)*	12.26	(1.75)*
D3	-.72	(.15)	-2.48	(.37)
S	6.80	(1.47)	9.40	(1.42)
U	2.87	(.61)	1.40	(.22)
H	11.50	(2.56)**	16.61	(2.60)**
ORG	-2.05	(.41)	-1.80	(.26)
Age	-.09	(.75)	-.21	(1.21)
Education	11.64	(2.58)**	16.00	(2.37)**
Income	-2.41	(1.42)	-1.59	(.66)
Donation ($)	.08	(3.72)**	.07	(2.79)**
N ($)	.08	(1.84)*	.11	(1.89)*
R^2	.15		.17	
N	191.00		127.00	

"t" statistic in parenthesis (absolute value)
* significant at .05 level (2 tail)
** significant at .10 level (2 tail)

Summary and Conclusions

The results suggest a substantial economic benefit associated with bald eagles and wild turkeys in New England, most of which is attributed to some form of nonuse value. Consequently, nonuse or existence values cannot be ignored in economic analysis. Yet, evidence from the follow-up questions raises several concerns about the meaning and validity of CV value estimates.

The value estimates were very sensitive to whether or not species were evaluated separately or together; the value of bald eagles and wild turkeys combined seems logically inconsistent with the results for bald eagles alone. The survey response rate was relatively low (37%) and many respondents protested the CV. They believed that wildlife should not be valued in dollar terms or that the money should come from somewhere else (taxes and license fees). Furthermore, a majority of those who would pay exhibited behavior which appears inconsistent with the neoclassical economic theory of tradeoffs between money and wildlife.

My principle concern is that we know very little about how people interpret CV questions and even less is known about their decision making strategy in CV. Consequently, we cannot be very certain about the meaning of the CV results. One explanation for the results reported here is that questions about wildlife existence created ambivalence among respondents resulting in nonresponse, protest, and lexicographic behavior. This implies that wildlife values were underestimated.

Another possibility is that individual decisions about monetary commitment might be based primarily on social, cultural, or moral (as opposed to economic) considerations. According to Sagoff (1988), many people believe that natural resources should be managed on the basis of normative, political, and cultural grounds, rather than from an economic efficiency perspective. Moreover, proponents of environmental ethics argue that wildlife have a right to exist independent of human attitudes toward their existence. Consequently, we might expect that CV respondents would often fail to make meaningful tradeoffs between money and wildlife.

Questions about the extent to which these results measure the economic value of wildlife remain unanswered. The monetary values reported here might measure the value of wildlife, they might reflect the amount of money which could be raised through private donations, or they might simply indicate the value of contributing to a "good cause."

These difficulties raise several obvious concerns about the meaning and validity of wildlife value estimates. Because very little is known about the process used by individuals in making choices about public goods involving altruism, ethical commitments, moral considerations, and ambivalence, we must investigate how individuals interpret CV questions. Wildlife 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 should be used in conjunction with economic valuation questions. As suggested by Smith (1985), "we must learn to communicate with the individuals we wish to interview. This will often mean asking them what they think we are asking for!"

9/ The model was estimated with two sets of data (protest responses included and excluded). The results remained relatively stable when protest responses were omitted (see Table 3).

10/ Since payment increased with N, some starting point bias may have occurred.

Literature Cited

Boyle, Kevin J.; Richard C. Bishop. 1987. Valuing wildlife in benefit-cost analysis: A case study involving endangered species. Water Resources Research. 23(5): 943-950.

Desvousges, W.H.; V.K. Smith; M. McGivney. 1983. A comparison of alternative approaches for estimating recreation and related benefits of water quality improvement. EPA-230-05-83-001, Washington, D.C.

Dillman, Donald E. 1978. Mail and telephone survey: The total design method. New York: John Wiley and Sons.

Edwards, Steven F. 1986. Ethical preferences and the assessment of existence values: Does the neoclassical model fit?. Northeastern Journal of Agricultural and Resource Economics. 15(2): 145-150.

Elster, Jon. 1989. Social norms and economic theory. Journal of Economic Perspectives. (4): 99-117.

Frank, R.H. 1987. If homo economicus could choose his own utility function, would he want one with a conscience?. American Economic Review. 77(4): 593-604.

Holl nder, H. 1990. A social exchange theory of voluntary cooperation. American Economic Review. 80(5): 1156-1167.

Kahneman, D.; J. Knetsch. 1990. Valuing public goods: The purchase of moral satisfaction. Berkeley, CA: 25 p.

Krutilla, J.V. 1967. Conservation reconsidered. American Economic Review. 57: 777-86.

Loomis, John B. 1988. Broadening the concept and measurement of existence values. Northeast Journal of Agricultural and Resource Economics. 17(1): 23-29.

Loomis, John B. 1987. Contingent values and aggregate benefits. Land Economics. 63: 396-402.

Margolis, H. 1982. Selfishness, altruism, and rationality. Cambridge: Cambridge University Press.

More, T.A.; R.J. Glass; T.H. Stevens. 1990. The economics of wildlife reintroduction. In: Proceedings, 1990 NERR conference, 1990, April 4-8; Saratoga Springs, N.Y. Northeast Forest Experiment Station.

Opaluch, J.J.; K. Segerson. 1989. Rational roots of irrational behavior: New theories of economic decision-making. Northeastern Journal of Agricultural and Resource Economics. 18(2): 81-95.

Randall, A.; J.R. Stoll. 1983. Existence value in a total value framework. In: Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. R.R. Rowe and L.G. Chestnut, eds., Westview Press: Boulder, Colorado.

Sagoff, Mark. 1988. Some problems with environmental economics. Environmental Ethics. 10: 54-74.

Sen, A. 1979. Personal utilities and public judgements: Or what's wrong with welfare economics?. The Economic Journal. 89: 537-558.

Smith, V.K. 1985. Some issues in discrete response contingent valuation studies. Northeastern Journal of Agricultural and Resource Economics. April: 1-4.

Weisbrod, B. 1964. Collective-consumption services of individual-consumption goods. Quarterly Journal of Economics. 78: 471-77.