

ANALYSIS

Environmental attitudes, motivations, and contingent valuation of nonuse values: a case study involving endangered species

Matthew J. Kotchen^{a,*}, Stephen D. Reiling^{b,c}

^a *Department of Economics and School of Natural Resources and Environment, Dana Building 430 E. University, University of Michigan, Ann Arbor, MI 48109, USA*

^b *Maine Agricultural and Forest Experiment Station, 101 Winslow Hall, University of Maine, Orono, ME 04469, USA*

^c *Department of Resource and Economics and Policy, 101 Winslow Hall, University of Maine, Orono, ME 04469, USA*

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Abstract

This paper explores relationships among environmental attitudes, nonuse values for endangered species, and underlying motivations for contingent valuation (CV) responses. The approach combines techniques from the attitude–behavior and economic valuation literature. Attitudes are measured with the New Ecological Paradigm (NEP) scale, and economic values are derived from a referendum, CV survey for peregrine falcons and shortnose sturgeons. Respondents with stronger pro-environmental attitudes are found more likely to provide legitimate yes/no responses, while those with weaker attitudes are more likely to protest hypothetical CV scenarios. Analysis reveals environmental attitudes as a significant explanatory variable of yes/no responses, whereby stronger pro-environmental attitudes result in higher probabilities of responding ‘yes’. Pro-environmental attitudes are also shown to result in higher estimates of mean willingness to pay (WTP). Significant relationships are found between environmental attitudes and nonuse motivations. Specifically, pro-environmental attitudes are associated with stronger reliance on ethical motives for species protection. These results are discussed as they relate to testing predictions in the literature about potential bias in CV studies and to supporting National Oceanic and Atmospheric Administration (NOAA) recommendations for improving CV reliability. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

Nonuse values are not revealed through observable economic transactions and are not measurable through market data. Consequently,

* Corresponding author. Fax: +1-734-936-2195.

E-mail address: mkotchen@umich.edu (M.J. Kotchen)

empirical estimation of nonuse values requires the use of hypothetical, or stated-preference, markets. A method known as contingent valuation (CV) involves directly questioning people through surveys about the economic value they place on a change in the quantity and/or quality of a specified resource (for further details see Mitchell and Carson, 1989). While nonuse value estimates derived in this way are widely used in benefit–cost analysis and natural resource damage assessments, the reliability of CV techniques for this purpose is continually debated.

In 1993, a panel of prominent economists assembled by the National Oceanic and Atmospheric Administration (NOAA) issued a report assessing the reliability of CV for estimating nonuse values (Arrow et al., 1993). They concluded that CV can provide useful information about nonuse values, but they went on to recommend several guidelines that CV studies should follow in order to produce reliable estimates. While these guidelines have set a standard for CV studies, research has been conducted to evaluate whether specific recommendations are actually improvements in CV techniques (e.g. Dubourg et al., 1995; Loomis et al., 1995; Carson et al., 1997; Kotchen and Reiling, 1999). One of the Panel's recommendations that has received less attention, however, is the use of respondent attitudes to help interpret survey responses. The Panel specifically recommended using 'attitudes toward the environment' to help interpret responses to valuation questions (Arrow et al., 1993, 4609). The rationale is that such respondent characteristics may provide an internal test of response plausibility, which is important since contingent values are entirely hypothetical and have been criticized for being irrational and upwardly biased (e.g. Hausman, 1993; Diamond and Hausman, 1994).

The importance of considering environmental attitudes in the context of CV studies is underscored by concern in the literature with motivations and belief systems that give rise to nonuse values. Economists have shown how obtaining unbiased and theoretically correct estimates of nonuse values depends on examining underlying motivations (McConnell, 1983, 1997; Bergstrom and Reiling, 1998; Johansson-Stenman, 1998).

Among the important motives are ethical beliefs, specifically those less amenable to making trade-offs. While questions have been raised as to whether ethical motivations give rise to legitimate economic values (Brookshire et al., 1986; Rosenthal and Nelson, 1992; More et al., 1996; Nelson, 1996), there is evidence that up to 25% of CV responses related to wildlife and ecosystems are motivated by ethical beliefs (Stevens et al., 1991; Spash and Hanley, 1995). The problem for empirical researchers is that measuring such motivations and analyzing their influence on economic values is vulnerable to the 'fallacy of motivational precision' (Mitchell and Carson, 1989). That is, respondents to CV surveys are unlikely to be aware of what motivates their value judgments to the degree desired by the researcher. Measuring attitudes, on the other hand, is a topic that has been advancing in the social-psychology literature for several decades, and a recent paper by Spash (1997) finds that environmental attitudes are correlated with ethical beliefs about the environment. Thus, as Spash explains, analyzing environmental attitudes in the context of CV studies of environmental resources may be useful for explaining valuation responses and underlying motivations.

This paper builds upon prior research by simultaneously exploring relationships among environmental attitudes, nonuse values, and underlying motivations. Using a case study involving endangered species, the goal is to further the understanding of how attitudinal considerations may contribute to CV methodologies. Two questions are of central concern. First, how do environmental attitudes influence CV responses and elicited values? Second, is there a relationship between environmental attitudes and motivations that give rise to nonuse economic values? The approach is unique in that techniques are combined from the attitude–behavior and economic valuation literature.

The next section provides an overview of research that has investigated the relationship between attitudes and behavior, emphasizing the connection between environmental attitudes and environmentally related behaviors. There is also discussion of potential advantages to integrating environmental attitude–behavior research with

CV methods. Section 3 describes the data collection and analytical methods for a CV study designed to estimate nonuse values for protection of peregrine falcons (*Falco peregrinus*) and shortnose sturgeons (*Acipenser brevirostrum*). The inclusion of a general measure of environmental attitudes known as the New Ecological Paradigm (NEP) scale (Dunlap and Van Liere, 1978; Dunlap et al., 1992) is discussed. Results are presented in Section 4, followed by discussion and conclusions in Section 5.

2. Environmental attitudes, motivations, and contingent valuation

The relationship between attitudes and behavior has led to interest in environmental attitudes as predictors of environmentally based actions and participation decisions. Much of the research in this area is built on what Ajzen and Fishbein (1980) refer to as the ‘theory of reasoned action’. Central to this theory is the idea that individuals possess an array of personal values, and each of these values is held with differing ranks or weights. These preferences then serve as criteria for judging the suitability of particular behaviors. Cognitive processes precede behavioral decisions in which the most salient values are evaluated in terms of their relative importance. The result is that potential behaviors with more favorable outcomes to the individual are associated with stronger behavioral intentions, which subsequently increase the probability of these particular behaviors actually occurring.¹ For example, an individual who strongly agrees with the statement that ‘humans are severely abusing the environment’ is expected to be more likely to support conservation efforts than an individual who strongly disagrees with the statement, assuming other characteristics are identical. In this example, the statement represents a value or belief that humans are abusing the environment, and the degree of agreement or disagreement serves

as a weighting of attitude strength, which is hypothesized to explain behavior.

The social-psychology literature on behavioral research has established attitudes as important predictors of behavior, behavioral intentions, and explanatory factors of variants in individual behavior (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980; Ajzen, 1988). Many studies have specifically focused on the relationship between environmental attitudes and environmentally related behaviors. These studies include investigations of environmental attitudes and political participation (Mohai, 1985, 1990, 1992), choice of recreational activities (Jackson, 1987; Luzar et al., 1995), conservation behaviors (De Young, 1986; Lynne et al., 1988; Vining and Ebreo, 1992; Guagnano et al., 1995; Steel, 1996; Weaver, 1996), and willingness to modify behavior (Walsh and McGuire, 1992). Most of these studies, however, have been provided by social science disciplines other than economics. While they further the understanding of environmental attitude–behavior relationships, they provide less guidance for explaining, predicting, and testing hypotheses about environmentally related economic behavior.

A few studies in the social-psychology literature have investigated correlations between measures of environmental attitudes and general measures of environmentally related willingness to pay (WTP). Stern et al. (1993), for example, analyze the relationship between attitudes and responses to two WTP measures: “How many extra dollars per year in income tax would you be willing to pay if you knew the extra money would be spent to protect the environment?” and “How much increase in gasoline prices, in cents per gallon, would you be willing to pay if the money was spent to protect the environment?”. Considering a variety of environmental issues, Kahneman et al. (1993) compare WTP with other responses related to environmental concern. In another study, Stern et al. (1995) examine environmental attitudes and WTP extra income to preserve tropical forests and WTP extra gasoline tax to reduce the use of fossil fuels. More recently, Widegren (1998) investigates the relationship between environmental attitudes and WTP for environmentally friendly food items.

Inconsistencies among these studies, however, limit our ability to understand the relationship

¹ According to the theory of reasoned action, the likelihood of a behavior actually occurring is also influenced by subjective norms, which are beliefs about how other people, whose opinions are valued, would perceive one’s engagement in the particular behavior.

between environmental attitudes and environmentally related WTP responses. Both significant and insignificant correlations are found between environmental attitudes and WTP. This result may be due, in part, to the way attitudes are measured differently among studies. Moreover, the construction of WTP questions provide another potential limitation. The economics literature has shown that valid CV questions of WTP must include three components: (1) a detailed description of the resource to be valued, including the initial and alternative conditions of the hypothetical scenario; (2) the form and frequency of payment, which include options such as higher income taxes, increases in utility bills, and payment into dedicated trust funds; and (3) how respondents are asked their WTP (e.g. open-ended question, payments cards, or referendums at specified dollar amounts) (Mitchell and Carson, 1989). The CV questions used in each of the studies mentioned above do not fully consider all three components. Each is missing either a detailed description of the resource, the form and frequency of payment, or how respondents are asked their WTP. Therefore, elicited values are likely to measure general economic intentions rather than rigorous estimates of WTP.

While economists generally focus on measuring WTP, there has been recognition of potential advantages to CV methods of considering the social-psychology literature (Bishop and Heberlein, 1986; Peterson et al., 1988; Harris et al., 1989; Arrow et al., 1993). From an economic perspective, investigating attitudes and the 'theory of reasoned action' is similar to defining utility functions and explaining behavior based on utility maximization. Aside from discussion papers, however, progress has been modest. Attempts to consider environmental attitudes in CV studies have generally been limited to questions about membership to environmental organizations (e.g. Hanley and Graig, 1991; Brown et al., 1996). The problem with this approach is that such questions may be a poor reflection of environmental attitudes, which include differing levels of concern and a wide range of individual beliefs and circumstances. Moreover, no discussion has taken place as to what is expected from variables indicating membership to environmental organizations, and as Spash (1997)

points out, no hypotheses have been tested. Interpretation is also complicated by the way environmental participation decisions depend on degrees of personal efficacy and resource availability, in addition to environmental attitudes (Mohai, 1985).

Beyond helping to explain CV responses, more fully considering attitudes will provide further insight into motivations giving rise to nonuse values. While the credibility of nonuse values depends largely on the plausibility of nonuse motives, these motivations are a source of continuing conflict within the economics literature. Initially, option and bequest motivations were thought to be the two sources of nonuse value (Weisbrod, 1964; Krutilla, 1967; Krutilla and Fisher, 1975). The former comes from the desire to preserve options for future use; the latter comes from the desire to bequeath natural resources to one's heirs or future generations. More recently, other motives have been suggested. While economists employ different nomenclature, these additional motivations may be separated into three categories: altruistic motives to others of the current generation (McConnell, 1983; Randall and Stoll, 1983); a recognition of the intrinsic value for non-human species and their environments (Randall and Stoll, 1983; Stoll and Johnson, 1984; Attfield, 1998); and an ethical belief or feeling of moral responsibility (Kopp, 1992; Spash and Hanley, 1995; Spash, 1997; Kotchen and Reiling, 1998).

The motivations of particular interest in this paper are those based on moral and ethical beliefs, which may be associated with individuals having different environmental attitudes. A recent paper by Spash (1997) finds correlation between environmental attitudes and ethical beliefs, and he uses this correlation to suggest that CV studies of environmental amenities are biased against individuals with strong pro-environmental orientations. Specifically, individuals with strong pro-environmental attitudes are found more likely to hold rights-based beliefs than utilitarian beliefs about the environment. The fundamental difference between the two decision-making approaches is their willingness to accept tradeoffs. A rights-based approach to endangered species protection, for example, is characterized by beliefs such as 'all species simply have a right to exist'. In this case,

ethical criteria are used in the decision process, and tradeoffs jeopardizing species survival are unlikely to occur. A utilitarian perspective, on the other hand, may acknowledge benefits and costs of protecting a particular species and be willing to accept tradeoffs in order to maximize personal or social utility. Given this distinction, Spash (1997) argues that valuation studies, which inherently force tradeoffs through WTP, or willingness to accept (WTA) measures, are biased in favor of utilitarian perspectives. Spash hypothesizes that individuals with rights-based beliefs will be more likely to refuse appropriate participation in CV studies, and analytical methods will erroneously regard these responses as indicating no value or irrationality. Assessing the validity of this hypothesis, however, requires a CV application that simultaneously considers environmental attitudes and nonuse motivations.

The following analysis provides such a research design by focusing on environmental attitudes, motivations, and nonuse economic values for two endangered species. The results seek to provide further insight as to (1) how environmental attitudes influence CV responses and elicited values and (2) whether there is a relationship between environmental attitudes and nonuse motivations for valuing environmental resources.

3. Data collection and analytical methods

Data were collected in the Spring of 1997 from the Maine Natural Resource and Endangered Species Survey (Kotchen, 1997). Questionnaires were mailed to a random sample of 1200 Maine residents over the age of 18. Mailing procedures were conducted in accordance with the Total Design Method (Dillman, 1978). A total of 194 surveys could not be delivered due to incorrect or incomplete addresses, and 635 were returned for a response rate of 63.1%.² The primary objectives of

²The sample was obtained from the Maine Bureau of Motor Vehicles in Augusta, Maine, and this rate of undeliverable surveys is to be expected when sampling from Maine State drivers' licenses and registration cards, which only require renewal every 7 years.

the survey were to measure environmental attitudes and estimate nonuse values for protection of peregrine falcons and shortnose sturgeons, both endangered species in Maine. Loomis and White (1996) provide a review of other studies valuing endangered species. Potential bias resulting from asking respondents to value more than one species was avoided by stratifying the sample such that one-half received questions about peregrines and the other half received questions about sturgeons.

The CV section was constructed according to guidelines established by the NOAA panel (Arrow et al., 1993). Background information and a proposed recovery plan was provided for either peregrines or sturgeons based on consultations with the Maine Department of Inland Fisheries and Wildlife and the Department of Marine Resources.³ A technical drawing of the species and map indicating its present range in Maine were also included. The question format was a voter referendum to approve establishment of a state-wide species protection fund. Respondents were asked to suppose the proposed fund was on the next state ballot, and implementation would cost them a specified dollar amount in a one-time payment through increased taxes. Specified dollar amounts were randomly assigned to respondents and correspondingly printed in survey booklets. These ranged from \$2 to \$50 for the peregrine, and \$1 to \$35 for the sturgeon.⁴ Given this information, respondents were asked whether they would vote 'yes' or 'no' to approve establishment of the fund.

Follow-up questions were asked to determine reasons for respondents' answers. Those answering 'no' were asked if they would be willing to pay some amount even though they were unwilling to pay the specified amount. This indicated whether they held any economic value for protection of

³Recovery for both species involved restoring a self-sustaining, breeding population. For the peregrine falcon, this involved increasing the state's current population of eight resident pairs to 15 resident pairs. For the shortnose sturgeon, this involved protecting a population at the mouth of the Kennebec river from future dredging and water pollution.

⁴The ranges of specified dollar amounts were determined based on focus group results and a review of studies having valued similar species. Specific increments and the frequencies of each are available upon request from the authors.

Table 1
Mean percentage distributions and item–total correlations for New Ecological Paradigm (NEP) scale items^a

Statement	STA	SWA	U	SWD	STD	r_{i-t}
1. We are approaching the limit of the number of people the earth can support.	26.0	32.2	23.2	11.2	7.8	0.58
2. Humans have the right to modify the natural environment to suit their needs.	6.7	25.7	10.8	32.6	24.3	0.56
3. When humans interfere with nature it often produces disastrous consequences.	42.4	38.1	8.5	8.1	3.0	0.50
4. Human ingenuity will insure that we do not make the earth unlivable.	12.9	24.6	29.0	20.6	13.2	0.45
5. Humans are severely abusing the environment.	41.9	39.4	6.7	8.9	3.3	0.59
6. The earth has plenty of natural resources if we just learn how to develop them.	31.6	36.0	15.7	11.2	5.6	0.40
7. Plants and animals have as much right as humans to exist.	55.3	28.7	4.3	6.5	5.4	0.47
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	2.1	10.3	20.9	32.6	34.2	0.67
9. Despite our special abilities, humans are still subject to the laws of nature.	49.8	41.3	6.3	1.9	0.9	0.38
10. The so-called ‘ecological crisis’ facing human kind has been greatly exaggerated.	7.3	18.1	25.7	25.5	23.5	0.71
11. The earth is like a spaceship with very limited room and resources.	25.5	32.0	16.6	18.4	7.6	0.56
12. Humans were meant to rule over the rest of nature.	9.6	16.0	12.8	27.3	34.4	0.59
13. The balance of nature is very delicate and easily upset.	38.7	38.5	9.9	10.5	2.5	0.59
14. Humans will eventually learn enough about how nature works to be able to control it.	6.2	18.9	27.5	26.6	19.9	0.41
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	23.3	30.1	27.0	13.4	6.3	0.67

^a STA, strongly agree; SWA, somewhat agree; U, ensure; SWD, somewhat disagree; STD, strongly disagree; r_{i-t} , item–total correlation. Percentages and correlations are mean results from peregrine and sturgeon survey versions. Percentages may not sum to 100 due to rounding.

the species. Those indicating ‘no’ again were assumed to hold no value and were asked to indicate their reason why, and this question was used to identify valid ‘no’ responses and protest ‘no’ responses.⁵ Those indicating some value, by answering ‘yes’ to either the referendum question or the follow-up value question, were asked to rate the importance of several possible reasons, including option, bequest, altruistic, existence, and ethical motivations (see Table 4).

Questions about environmental attitudes comprised a set of 15 Lickert scale items known as the

New Ecological Paradigm (NEP) scale (Dunlap et al., 1992). The NEP scale is based on the concept that multi-item indices yield more reliable attitudinal measures than single-item questions (Mueller, 1986). The NEP is an expanded and updated version of its predecessor, which has been used by social scientists for over two decades (Dunlap and Van Liere, 1978). While several of the items remain, the new NEP differs in the way items are selected to elicit five facets of environmental attitudes: reality of limits to growth; anti-anthropocentrism; the fragility of nature’s balance; rejection of the idea that humans are exempt from the constraints of nature; and the possibility of an eco-crisis or ecological catastrophe (see Table 1). Analysis of new NEP results have revealed predictive and construct validity in addition to a marginal increase in internal consistency from the original scale (Dunlap et al., 1992). Thus, prior

⁵ Protest ‘no’ responses are those thought to arise from rejection of some feature of the hypothetical referendum, rather than from the absence of value. Responses considered protests in this analysis include: “I don’t think the recovery efforts would work”; “I should not have to pay for [species name] recovery”; “I am opposed to establishment of the proposed fund”; and “I am opposed to any new taxes”.

research involving the NEP scale, along with its recent modifications, provide a basis for hypothesis testing and a framework for interpretation. In the context of interpreting nonuse CV responses, the NEP scale provides a reliable way to assess environmental attitudes.

These data for the peregrine falcon and shortnose sturgeon enable analysis of the way environmental attitudes influence CV responses, elicited values, and nonuse motivations. Initially, respondents are categorized as having strong, moderate, or weak pro-environmental attitudes, and potential differences in response behavior are investigated between groups. These differences include proportions of responses that are missing, protests, or legitimately ‘yes’ or ‘no’. Models are then estimated to help explain observed yes/no responses. For both the peregrine falcon and shortnose sturgeon, the model specification is:

Yes/No

$$= f(\text{BID}, \text{NEP}, \text{KNOWLEDGE}, \text{INCOME})$$

where Yes/No is the dichotomous-choice response to the WTP question, BID is the specified dollar amount respondents are asked to pay, NEP is the result from the NEP scale, KNOWLEDGE is prior knowledge of the particular species in Maine, and INCOME is respondent annual household income.⁶ Estimation of this multivariate model enables empirical tests of hypotheses based on economic and attitude–behavior theory. Each variable is evaluated for its partial effect while controlling for all others. Thus, higher prices, or BIDs, are expected to result in lower probabilities of responding ‘yes’. Respondents with stronger pro-environmental attitudes are expected to have higher probabilities of responding ‘yes’. Those with higher incomes and prior knowledge of the particular species are also expected to have higher probabilities of responding ‘yes’. An

additional analysis based on estimation of these models is the calculation of marginal effects of environmental attitudes on WTP. Finally, all responses indicating some value are analyzed with respect to their underlying motivations and corresponding environmental attitudes.

4. Results

Mean percentage distributions for NEP responses in the peregrine falcon and shortnose sturgeon survey versions are shown in Table 1. Response categories are given a numerical code between 1 and 5, such that higher values correspond to stronger pro-environmental attitudes. Thus, even numbered items are coded as: ‘strongly agree’ = 1; ‘somewhat agree’ = 2; ‘unsure’ = 3; ‘somewhat disagree’ = 4; and ‘strongly disagree’ = 5. The order is reversed for odd-numbered items. With a possible minimum score of 15 and maximum of 75, mean scores for the peregrine and sturgeon are 54.8 and 54.1, respectively.

The overall grouping of responses demonstrates a range of environmental attitudes. Significant majorities express the view that humans are having disruptive effects on nature’s balance. Strong environmental attitudes are revealed in relation to anti-anthropocentrism and, to a lesser degree, the idea that humans are subject to natural constraints. While respondents generally agree with statements about limits to growth, they show optimism about human ingenuity. Many respondents foresee the possibility of an eco-crisis or ecological catastrophe, but these attitudes are associated with a high level of uncertainty. When combined into a single scale, all 15 items demonstrate a relatively high degree of internal consistency. The last column of Table 1 shows item–total correlations for each item, and all correlations are reasonably strong, ranging from a high of 0.71 to a low of 0.38. Cronbach’s coefficient α , which is the mean of all split-half correlations, for both the peregrine and sturgeon versions, is 0.826 and 0.829. Thus, these results support findings of previous studies suggesting the NEP scale forms an internally consistent measuring instrument of environmental attitudes.

⁶ Hanemann (1984) has shown how a theoretically correct specification would not include income as an independent variable. Additional concern with theoretical considerations in the attitude–behavior literature, however, justify the inclusion of income in this analysis. External conditions such as personal income have been hypothesized as determinants of environmentally related behaviors (Mohai, 1985; Guagnano et al., 1995).

Table 2

Environmental attitudes and legitimate, protest, and missing contingent valuation responses for the peregrine falcon and shortnose sturgeon^a

	Pro-environmental attitudes			Total
	Weaker	Moderate	Stronger	
<i>Peregrine falcon:</i>				
Legitimate yes/no	64	80	89	233
Protest	28	18	9	55
Missing	1	1	2	4
Total	93	99	100	292
<i>Shortnose sturgeon:</i>				
Legitimate yes/no	87	88	95	270
Protest	29	14	10	53
Missing	1	0	2	3
Total	117	102	107	326

^a Weaker NEP ≤ 50 ; $51 \leq$ Moderate NEP ≤ 58 ; $59 \leq$ Stronger NEP.

All respondents are categorized as having weaker, moderate, or stronger pro-environmental attitudes according to NEP results. Weaker attitudes are those with NEP scores of 50 or below, moderate are those greater than 50 and less than 59, and stronger are those 59 or greater. Boundaries are determined such that approximately one-third of all respondents are included in each category.⁷

Comparisons among groups with respect to the frequency of legitimate yes/no, protest, and missing responses to the CV question are shown in Table 2 for both the peregrine and sturgeon. Differences between groups are significant (peregrine, $\chi^2 = 14.35$, $P < 0.01$; sturgeon, $\chi^2 = 12.39$, $P < 0.025$), indicating that environmental attitudes are related to the way respondents participate in the CV scenario. While there are only a few missing responses across all groups, notable differences are found between the proportion of protest responses. The strength of pro-environmental attitudes is inversely related to the proportion of protests, and the majority of these responses (over 80%) arise from opposition to new taxes. Thus, contrary to predictions in the literature, respondents with

stronger pro-environmental attitudes are more likely to provide legitimate yes/no answers in the specific context of this study.

Table 3

Logit equations for dichotomous-choice responses, mean WTP, and confidence intervals for peregrine falcons and shortnose sturgeons^a

	Peregrine falcon	Shortnose sturgeon
Constant	-3.2906** (1.0627)	-4.7345** (1.1894)
BID	-0.0472** (0.0139)	-0.0525* (0.0212)
NEP	0.0579** (0.0187)	0.0907** (0.0201)
KNOWLEDGE (1 = yes, 0 = no)	0.4606 (0.3105)	0.7519 (0.3954)
INCOME	0.1803E-4** (0.6424E-5)	0.1667E-4** (0.7162E-5)
Pseudo R^2	0.21	0.26
Percent correct predictions	67.5	70.5
Number of observations	206	200
Mean WTP (\$)	25.79	26.63
90% WTP confidence interval (\$)	21.83–36.06	19.13–57.81

^a Standard errors in parenthesis.

** Significant at $P < 0.01$.

* Significant at $P < 0.05$.

⁷ While selection of these boundaries between strength of pro-environmental attitudes is somewhat arbitrary, any other boundaries would also be arbitrary. This method is justified on the basis that each group is equally represented and having three groups enables comparisons where all respondents are not clustered around the mean.

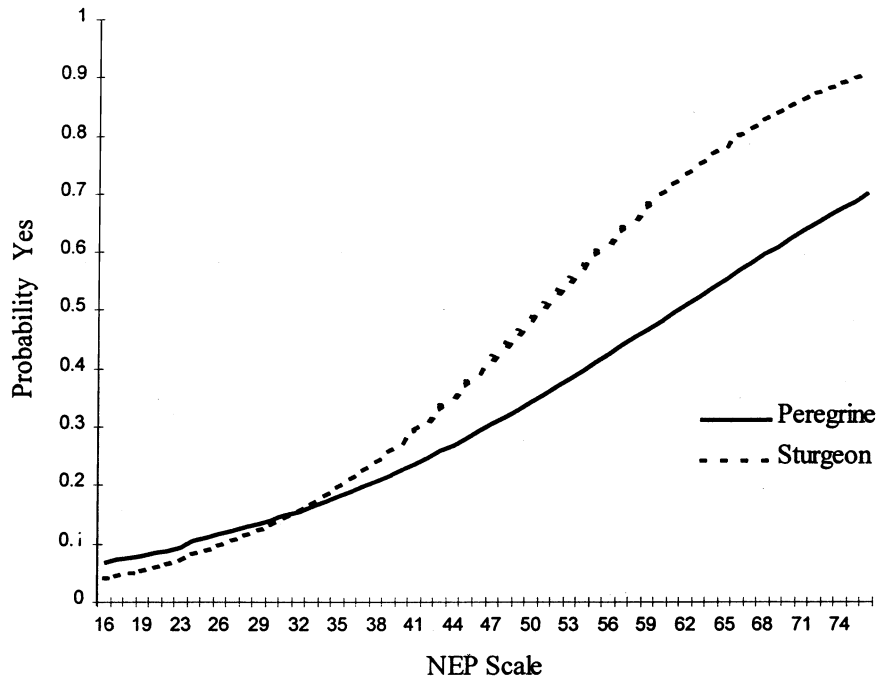


Fig. 1. Inverse cumulative distribution functions for environmental attitudes and the probability of responding yes.

Before estimating binary-choice models of yes/no responses, certain respondents are excluded from the analysis. As is customary in most CV studies, all protest responses and observations with missing data are not included (Mitchell and Carson, 1989). Furthermore, respondents designated as resource users are not included due to the objective of measuring only nonuse values (Mitchell and Carson, 1989; Silberman et al., 1992). For the peregrine falcon, users are identified as those having made a special trip to view the species, and ten users were identified. For the shortnose sturgeon, all respondents are assumed to be nonusers since the species' endangered status prohibits consumptive uses and opportunities to view the species are limited by its habitat.

The estimated logit models for the peregrine falcon and shortnose sturgeon are reported in Table 3. 'Yes' responses are coded as 1, and 'no' responses are coded as 0. All coefficients have signs in the expected direction. The NEP scale of environmental attitudes (NEP) is positive and significant for the peregrine and sturgeon, indicating that higher NEP scores result in higher probabili-

ties of answering 'yes'. Bid amount (BID) is negative and significant, showing that respondents are sensitive to the price they are asked to pay. Higher annual household income encourages support of the CV scenario, as INCOME is positive and significant. Prior knowledge of the species in Maine (KNOWLEDGE), however, has no significant effect on the probability of respondents answering 'yes' or 'no' to the valuation question. The percentage of right predictions for the peregrine and sturgeon is 67.7 and 70.5, and pseudo R^2 values are 0.21 and 0.26, respectively.

The marginal relationships between environmental attitudes and CV responses are summarized in Fig. 1. Using results from the logit equations in Table 3 and evaluating BID, KNOWLEDGE, and INCOME at their mean values, inverse cumulative distribution functions (c.d.f.s) of responding 'yes' are plotted against the range of NEP scores.⁸ As indicated by the coeffi-

⁸ Variable means for the peregrine are BID = 24.38, NEP = 55.3, KNOWLEDGE = 0.46, and INCOME = 41 323. Variable means for the sturgeon are BID = 11.78, NEP = 55.2, KNOWLEDGE = 0.27, and INCOME = 38 625.

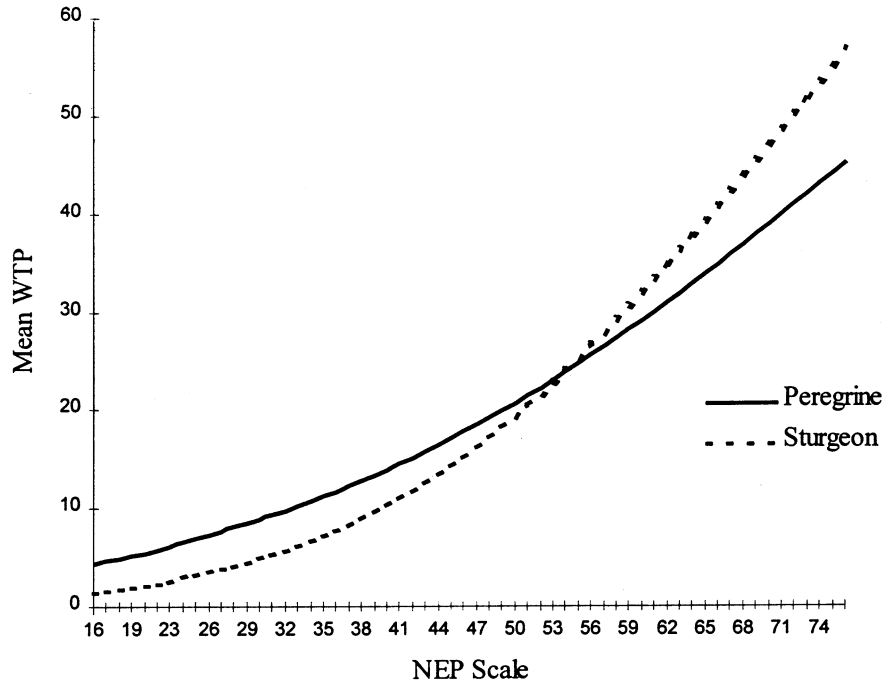


Fig. 2. Environmental attitudes and predicted mean WTP.

cient on NEP, the probability of responding 'yes' is an increasing function of NEP score. The c.d.f.s for both species are relatively similar, although the sturgeon begins slightly lower and ends higher. Respondents with the weakest environmental attitudes have less than a 10% chance of approving the hypothetical species protection programs. Respondents with the strongest environmental attitudes have approximately 60% and 90% chances of approval for the peregrine and sturgeon.

Results from the logit equations in Table 3 are also used to demonstrate the relationship between environmental attitudes and mean WTP. Mean WTP is calculated by assuming no negative values for species protection and using the formula suggested by Hanemann (1989):

$$E(\text{WTP}) = \left(\frac{1}{\beta_1} \right)^* \ln(1 + \exp^{\beta_0})$$

The results are shown in Table 3, along with simulated confidence intervals (Park et al., 1991). Mean WTP is approximately \$26 for the pere-

grine and \$27 for the sturgeon. The sensitivity of mean WTP to different levels of environmental attitudes is summarized in Fig. 2. Expected values of WTP are calculated at each NEP score increment. As expected, mean WTP increases with increases in pro-environmental attitudes. The weakest attitudes yield an estimate of below \$5 for both species. Moderate attitudes, like those of the overall sample mean, yield similar estimates of approximately \$25, and strong attitudes result in estimates for mean WTP of over \$40 and \$50 for the peregrine and sturgeon, respectively.

Means and percentages of responses to nonuse, motivational questions are reported in Table 4. Respondents were asked to indicate the importance of different reasons for holding economic values for species protection. Specific motivations include (1) option, (2) altruistic, (3) bequest, (4) existence, and (5) rights-based values. Responses are coded as 'very important' = 1, 'important' = 2, 'slightly important' = 3, and 'not important' = 4. Therefore, lower values indicate more importance,

Table 4
Means and percentages of the importance for different motivations for protecting peregrine falcons and shortnose sturgeons^a

Motivating reason	Mean	Attitude strength	Very important	Important	Slightly important	Not important
1. I may want to see a Maine (species name) in the future	2.38	Weak Moderate Strong	16.7 7.9 27.0	34.7 40.7 37.2	36.1 45.1 23.6	12.5 6.2 12.2
2. I enjoy knowing other people are able to enjoy (species name) in Maine	2.18	Weak Moderate Strong	19.2 14.7 32.2	43.8 46.6 42.1	30.1 32.8 19.1	6.8 6.0 6.6
3. I enjoy knowing future generations will be able to enjoy (species name) in Maine	1.85	Weak Moderate Strong	24.7 26.5 65.6	49.3 51.3 20.5	20.5 20.5 12.3	2.7 1.7 1.6
4. I enjoy knowing (species name) exist in Maine even if no one ever sees one	2.0	Weak Moderate Strong	16.2 23.3 49.7	50.0 50.9 34.6	23.0 24.1 13.7	9.5 1.7 1.6
5. All endangered species in Maine have a right to exist	1.46	Weak Moderate Strong	43.2 59.8 84.3	40.5 35.9 14.4	13.5 3.4 1.0	2.7 1.0 1.0

^a Means are calculated from coding where 'very important' = 1, 'important' = 2, 'slightly important' = 3, 'not important' = 4, 'Weak = NEP ≤ 50; Moderate = 51 ≤ NEP ≤ 58; Strong = 59 ≤ NEP.

and mean ratings are reported in column 2.⁹ Among the five motivations considered, maintaining the option to view the species in the future appears to be least important. The relative importance of motivations associated with altruistic, bequest, and existence values appear fairly similar. The most important motivation corresponds to the statement that “All endangered species in Maine have a right to exist”, which indicates a rights-based or ethical belief.

The remaining columns of Table 4 show response percentages according to strength of pro-environmental attitudes. For example, 16.7% of respondents with weaker environmental attitudes, who also reported some economic value for species protection, rated reason 1 very important. Based on this stratification, environmental attitudes are found to be significantly related to the way respondents rate the importance of nonuse motivations. Significance tests for each motivating reason resulted in χ^2 statistics greater than 12.59, which is the 95% critical value for 6 degrees of freedom. The most noteworthy differences are in the way attitudes influence ratings of ‘very important’. Stronger pro-environmental attitudes result in higher percentage ratings of ‘very important’ for every motivating reason. Specifically, 84% rated the rights-based, ethical motivation as ‘very important’ compared to 60% and 43% for moderate and weaker environmental attitudes. Other substantial differences are related to bequest and existence motivations, for which the percentage of stronger pro-environmental attitudes result in over twice the percentage of ‘very important’ responses. While differences are also observed for option and altruistic motivations, the pattern is not consistent. Respondents with weaker attitudes rated these motivations ‘very important’ more

frequently than respondents with moderate attitudes, although the difference is marginal for altruism.

5. Discussion and conclusions

This study investigates relationships among environmental attitudes, nonuse CV responses, and underlying motivations. Environmental attitudes are measured with the NEP scale as modified by Dunlap et al. (1992). The replication of their analysis supports the conclusion that the NEP scale constitutes an internally consistent measuring instrument. Respondents classified as having weaker, moderate, or stronger pro-environmental attitudes reveal significantly different ways of participating in referenda, CV scenarios involving protection of peregrine falcons and shortnose sturgeons. Those with stronger pro-environmental attitudes are more likely to provide legitimate yes/no responses, while those with weaker attitudes are more likely to provide protest responses. Dichotomous-choice models of CV responses also show how environmental attitudes are a significant determinant of yes/no responses. Stronger pro-environmental attitudes result in significantly higher probabilities of responding ‘yes’, while controlling for price, income, and prior knowledge of the species. Correspondingly, derived measures of mean WTP are sensitive to changes in environmental attitudes, as stronger pro-environmental attitudes yield higher estimates of mean WTP.

Together, these results show that analyzing environmental attitudes in the context of CV studies is useful for explaining nonuse valuation responses. Since responses are entirely hypothetical and are frequently criticized for being irrational and upwardly biased, comparing them to indices of environmental attitudes provides one test of internal validity. Thus, support is found for the NOAA Panel recommendation for using ‘attitudes toward the environment’ to help interpret responses to valuation questions (Arrow et al., 1993, 4609). Additional support is found for Spash’s empirical finding of correlation between environmental attitudes and rights-based beliefs

⁹ Tests for significant differences among mean values are not conducted. This is due to the fact that responses provide information about importance, but differences between response categories remain unknown. For example, the difference between ‘important’ and ‘slightly important’ may be greater than, less than, or equal to the difference between ‘slightly important’ and ‘not important’. A statistical comparison of mean values would unrealistically assume consistent differences between response categories. Therefore, comparisons of mean values are based on qualitative observation.

about the environment (Spash, 1997), but not for predictions about protest responses. Results for the peregrine falcon and shortnose sturgeon show how environmental attitudes are significantly related to the importance placed on different underlying motivations for nonuse value. Specifically, those with stronger pro-environmental attitudes place more weight on the importance of rights-based, or ethical, reasons for species protection.

Predictions based on this finding of association between attitudes and motivations, however, are brought into question. Are CV studies of environmental resources biased *against* individuals with strong pro-environmental attitudes? Due to the incompatibility of rights-based beliefs and ascribing economic value, there is the possibility that individuals with strong pro-environmental attitudes will be more likely to refuse participation in WTP or WTA procedures. As suggested by Spash (1997), bias then results as these responses are erroneously treated as acts of irrationality or as representing no value. Nevertheless, the empirical results presented here for WTP suggest an opposite effect: respondents with stronger pro-environmental attitudes are more likely to participate in the valuation procedure, despite the importance of rights-based motivations.

Therefore, are CV studies of environmental resources biased *in favor* of individuals with strong pro-environmental attitudes? While this paper does not intend to answer this question, attention is given to the importance of considering both attitude–behavior and economic theory in any answer. As demonstrated by the ‘theory of reasoned action’, one would expect individuals with stronger pro-environmental attitudes to place greater value on environmental resources and to behave according to these values. Such behaviors would certainly include participating in an environmentally related survey and, perhaps, demonstrating a higher WTP. The results of this application to the protection of two endangered species provide evidence to this effect. The economic question, however, relates to whether all hypothetical responses represent legitimate economic values. Johansson-Stenman (1998) explains how resolving this question necessitates consideration to a larger degree than is conventionally

done in CV studies of motives and fundamental values underlying WTP. Toward this goal, this paper provides further empirical evidence of the relative importance of different motivations for nonuse values, in addition to their relationship to environmental attitudes.

Further research integrating techniques from the attitude–behavior and economic valuation literature would be helpful to understand how psychological considerations may improve valuation methodologies. Specifically, studies integrating attitudinal measures and CV methods are recommended to gain a better understanding of the influence of environmental attitudes. Studies should be conducted to observe whether the attitudinal and motivational results presented here for WTP are similar in applications measuring WTA. Finally, experiments should be conducted with modified versions of the NEP scale and/or other scales with fewer items. More opportunities would arise to include condensed scales that are shown to successfully measure attitudes and predict behavior, since CV surveys require careful design, often involving tradeoffs between design features.

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