Rethinking the Scope Test as a Criterion for Validity in Contingent Valuation

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We believe that the best way to establish the validity of values estimated through the contingent valuation (CV) method is to compare them with values estimated in what are now called simulated markets (Bishop and Heberlein 1979). Simulated markets involve laboratory or, better yet, field experiments where results from actual transactions can be compared with CV values. But such markets are often difficult to set up. In the struggle to assess the validity values estimated by CV economists have turned to the "scope test" a simple statistical test that could be more generally applied than simulated markets. A CV survey that offers a consumer/respondent more of an environmental good or a higher level of environmental services should elicit greater economic value (Mitchell and Carson 1989). Thus, observing whether CV respondents are (a) sensitive or (b) *in*sensitive to differences in the scope is appealing for its intuitive, commonsense logic and theoretical simplicity.

A recent review by Carson (1997), however, showed that out of 22 studies where scope sensitivity was investigated, four failed to show scope outright while two others showed mixed results (see Appendix A). Studies that failed to find scope have been widely discussed in the literature and have sometimes been used to discredit CV more generally as a valuation methodology (Diamond and Hausman 1994).

Even though most studies show scope, however, even a few exceptions are troubling in the face of questions about theoretical validity(Bishop, Champ, Brown, and McCollum 1997). What would the theory of gravity be if one out of five rocks when dropped landed on the ceiling rather than the floor? Perhaps those that go up are not really rocks, but helium balloons cleverly disguised as rocks. In order to better understand the utility of the scope test we need to better understand the *conditions* that produce non-scope. The object of this study is to examine such conditions—to search for the helium--for four environmental goods using both aggregate and individual data as well as retrospective interviews.

Previous Failures to Find Scope Sensitivity

The idea of scope *in*sensitivity actually first originated with Kahneman (1986). To support his hypothesis, Kahneman (1986) presented a graph (p. 191) showing three demand curves derived from a telephone survey of Ontario residents. Each curve was interpreted as representing respondent's demand for one of three *nested* goods: fishing in the lakes of (1) All of Ontario—the 'whole', (2) the Haliburton region in Ontario—a 'part' of the 'whole', and (3) the Muskoka region in Ontario-also a 'part' of the whole (Kahneman 1986).[1] All respondents were asked their willingness to pay (WTP) in the form of a tax to maintain the quality of fishing in these three geographically distinct regions. The resulting graph shows three demand functions that are very similar in shape and magnitude. In other words, "people seem to be willing to pay almost as much to clean up one region or any other, and almost as much for any one region as for all Ontario together" (Kahneman 1986, p. 191).

In addition to reiterating the original findings from the Ontario experiment, Kahneman and Knetsch (1992) provided new empirical data that has since been widely cited as further evidence of scope *in*sensitivity (Diamond and Hausman 1994) All respondents were given the same information describing an inclusive package of public

[1] The terms "part" and "whole" were first used in this context by Mitchell and Carson (1989, p. 237), who clearly anticipated scope issues when they spoke of the possibility of "part-whole bias."

services including education, health, police protection, roads, and environmental services. WTP questions were then administered to three sub-samples. Respondents in one sample received three WTP questions starting with the most inclusive good--environmental services, a subset of that inclusive good--improved disaster preparedness, and ending with the most specific good--improved rescue equipment and trained personnel. Respondents in a second sample were only asked two WTP questions: the first question asked about WTP for improved disaster preparedness and a subsequent question asked about WTP for improved rescue equipment and trained personnel. Finally, respondents in a third sample were asked about their WTP to improve the availability of equipment and trained personnel for rescue operations alone. Because Kahneman and Knetsch (1992) observed that no statistically significant difference between mean WTP for the public goods, the authors concluded that respondents were insensitive to the inclusiveness of the public good being valued and that the magnitude of the good had no discernible effect on WTP.

Three additional studies commonly cited as supporting the claim of scope insensitivity were carried out by Desvouges *et al.* (1993), Diamond *et al.* (1993), and Schkade and Payne (1993) (Hausman 1993). First to test whether the contingent valuation method was sensitive to scope variations, Diamond et al. (1993) elicited WTP estimates to avoid a 1% annual commercial timber harvest in several different wilderness areas throughout the Western United States. Diamond et al. (1993) tested the hypothesis that WTP would vary by the *size* of the wilderness area being protected. Using the same split-sample design, the three areas were the Selway Bitteroot wilderness (1.3 million acres), the Bob Marshall (1.0 million acres), and Washakie (0.7 million acres). No significant difference was found between WTP estimates for the three areas. Several other treatments involving wilderness areas also failed to find scope sensitivity. The authors concluded that in general, "whatever CV surveys may be measuring, they are not measuring consumers' economic preferences over environmental amenities" (Diamond, et al. 1993, p. 61).

Desvouges et al. (1993) investigated the sensitivity of WTP to prevent (a) 2000, (b) 20,000, or (c) 200,000 birds from being killed in oil holding ponds in the Central Flyway. The CV survey involved a self-administered questionnaire conducted with respondents in Atlanta shopping malls. Respondents in three different sub-samples were asked their WTP to prevent the deaths of either 2000, 20,000, or 200,000 birds. The resulting means for the three treatments were $80, $78, and $88, were not statistically different, leading the authors to conclude that, "WTP estimates of nonuse values do not satisfy simple validity and reliability requirements...current methods for estimating nonuse values are neither valid nor reliable for damage-assessment purposes" (Desvouges et al. 1993)p. 93). This study was replicated by by Schkade and Payne (1993).

Rethinking Scope Sensitivity Using Social Psychological Attitude-Behavior Theory

Differing conceptions of "value" have long been recognized and debated in both economics (Milgrom 1993; Aaron 1994)and social psychology (Heberlein, 1988; Peterson et al. 1988; Schwarz 1997). Traditionally, economic theory has defined 'value' in a rather strict and narrow behavioral sense(Freeman 1993; Milgrom 1993). In this sense, the economic value of a commodity is no more and no less, than the amount of money a person is willing to give up to get the commodity, or the amount the person

requires as compensation for loss of the commodity. On the other hand, in terms of attitude theory, willingness-to-pay as an elicited contingent value is best conceived as a behavioral intention—an expression of a *willingness* on the part of the survey respondent to engage in a behavior relevant to the commodity(Ajzen and Peterson 1988, Heberlein 1988). A CV value is *not* an observable behavior like buying or selling commodities in the marketplace; rather it is an expressed intention to make a purchase should the opportunity be available.

Attitude theory suggests this behavioral intention is influenced by affective and cognitive dimensions of a person's "attitude" towards a commodity (Zajonc et al. 1982; Zajonc 1980). On the one hand, 'cognitions' involve the thoughts and knowledge that people might have about an environmental commodity. For example, a survey respondent might say, "I know a lot about air quality" or "I think a lot about the air that I breathe". Cognitions are generally conceptualized as *information, knowledge or beliefs*, where beliefs are understood to be the associations or linkages that people establish between the attitude object and various objective attributes(Fishbein and Ajzen 1975). The affective dimension of attitudes deals with emotions. An example might be a statement such as, "I like the air quality in my neighborhood."

Scope tests have traditionally looked at scope in the behavioral intention domain of attitudes. But attitude theory would suggest that we might also want to look at 'affective scope' -- liking the whole more than the part—or 'cognitive scope'--knowing more and thinking more about the whole than the part. Under these conditions, we might reasonably anticipate that the respondent will exhibit all of the virtues of a rational consumer and express a higher WTP (behavioral intention) for more of the commodity than less. Conversely, a respondent may show something akin to 'reverse affective scope'—liking the part more than the whole—or 'reverse cognitive scope'—knowing more and thinking more about the part than the whole. In this case, attitude-behavior theory suggests that a higher WTP (behavioral intention) will be expressed for the part of the environmental good rather than the whole. In this manner, scope *in*sensitivity is placed in a richer theoretical context; one that appreciates both the attitudinal and situational characteristics that might reasonably lead the individual to show scope *in*sensitivity.

Our point is to move beyond merely accepting or rejecting the validity of estimates derived using the contingent valuation method, and instead describe the specific factors that affect scope judgments in a real world context.

Four Attitude Objects (Environmental Goods)

Based on 27 interviews with randomly selected property owners in Vilas and Oneida counties in Northern Wisconsin (the "Lakeland Area), we identified four environmental goods for study. **Water quality** in lakes was selected because it is a concrete and symbolic object of vital economic and social importance to residents of the Lakeland Area. The part was the well-known Minocqua chain of lakes in the center of the study area. The whole was all of the lakes in Vilas and Oneida County (over 2300 lakes in all) including the Minocqua chain.

The second object was wolves, or more precisely, **wolf populations** in Northern Wisconsin. The current population is about 200 wolves (Thiel 1993). At the time of our research, the Wisconsin Department of Natural Resources was developing a wolf

management plan and the question of wolf populations in northern Wisconsin was being publicly debated. Wolf populations were numerically nested: the whole was 800 wolves in Northern Wisconsin and the part was 300. Wolves are symbolic of wildness in nature, but unlike water quality in lakes, most people don't get to see wolves or otherwise interact with wolves.

Policy makers would sometimes like to have economic values for complex scientific concepts. Because we are skeptical of the adequacy of CV for valuing such domains, which do not have the concreteness of lakes or even wolves, we wanted to include such a good. In our developmental interviews we asked about **biodiversity** Most Lakeland property owners thought of biodiversity as a simple proxy for the concept of "nature". For example, while deer in northern Wisconsin are overabundant and biologists complain that their presence actually reduces the number and distribution of plant species, most residents we interviewed felt that deer *added* to biodiversity. Biodiversity is ambiguous and confusing but important. The whole was protection biodiversity in all of Northern Wisconsin, while the part was protecting biodiversity only in Vilas and Oneida counties.

In the 1980's local Indians had won state and federal court cases that reestablished their right to hunt, fish and gather off reservation. The Indians began to exercise their rights to harvest game fish with spears during the spawning season in April, before the regular sport fishing season opened. This created controversy and confrontations at boat landings that bordered on race riots. Although the research team went into the field thinking that the conflict was long over, the topic came up repeatedly in our developmental interviews with respondents expressing very strong feelings about the issue. In an effort to have one environmental object where perhaps rationality was overwhelmed by emotion, we selected **Chippewa Indian spear fishing** in the Minocqua Chain (part) and in all of the lakes in Vilas and Onieda county (whole).

Mail and Telephone Survey

Information about knowledge, interest, and satisfaction with the whole and the parts of the four attitude objects was obtained using a 19 page mailed questionnaire. The inside cover had a map of the two counties where respondents could circle the lakes they had experience with and a color map showing the state with northern Wisconsin and Vilas and Oneida Counties highlighted so people could see what we meant by the "whole and the part areas."

One week after we received the completed questionnaire, respondents were contacted by phone to measure their willingness to pay The first telephone interview asked respondents what they would be willing to pay for all four objects, two parts and two wholes. The question-order sequence of objects was randomly assigned. Furthermore, during the first telephone interviews (referred to below as the Time 1 interview), each respondent was randomly assigned either the part or the whole for each item. Two weeks after their first completed telephone interview, respondents were contacted for a second interview (the Time 2 interview), which obtained their willingness to pay for the remaining four part-whole complements.

Procedures and Response Rate

The final sample size for the mail questionnaire was 1,435 cases (an additional 65 questionnaires were undeliverable or the individual was deceased or no longer living at the specified address). One hundred and twenty four respondents either refused participation by returning their mail questionnaire with a note stating that they did not want to participate in the study or by telling the interviewer that they did not wish to continue with the study during the reminder telephone call conducted on November 6, 1998. By January 25, 1999 the final number of completed mail surveys was measured at n=876, with an overall mail response rate of 876/1,435 = 61%.

For the telephone interviews, response rates and sample dispositions were calculated both separately and cumulatively for Time 1 interviews and Time 2 interviews. As anticipated, attrition rates and observed non response errors were substantially higher for Time 1 telephone interviews than Time 2 interviews, with 70 cases refusing outright to participate in the first telephone interview and 120 determined to be "not available" by the UW survey center staff after repeated calls. The final within-mode response rate for telephone Time 1 was 686/876 = 78% with a cumulative response rate of 686/1,435 = 48%. In the case of Time 2 interviews, attrition rates and non-response declined to only n=29 refusals with only n=49 cases determined to be not available. The final within-wave response rate for Time 2 was therefore 617/676 = 90% with a cumulative response rate of 617/1,435 = 43%. Hereafter, the final sample of n=617 cases described above will serve as the primary data used in this study and will be referred to as the Lakeland survey sample.

Independent Variables: Affect, Cognition, Experience and Personal Characteristics

In the initial three pages of the mailed survey respondents were asked to report where they lived in the Lakeland Area, if it was a seasonal residence, and how much time they spent there. They were also asked to report their participation in outdoor sports and in local environmental activities. The questionnaire also included a 6-item modified New Environmental Paradigm (NEP) Scale (Dunlap and Van Lier 1984; Dunlap and Van Liere 1978). The next 14 pages measured attitudes toward the four objects (part and whole). The last 3 pages measured respondent's attitudes toward payment and standard social and economic variables.

Table 1: Independent Variables Used in Analysis

Variable	Example Description
NEP	Attitude scale representing ecocentric value-orientation
Importance	How important is the issue of lake water quality to you personally? 1 = Not at all important.....7 = Extremely Important
Feelings	How do you feel about the quality of water in Northern Wisconsin? 1 = Strongly Dislike.....5 = Strongly like
Think About	How often do you think about the quality of water in Minocqua Chain (All Lakes)? 1 = Never.....6 = Almost Every Day
Know About	How much would you say you know about the quality in Minocqua Chain (All Lakes)? 1 = Know Almost Nothing..... .5 = I'm An Expert
Satisfaction	How satisfied are you with the quality of water in Minocqua Chain (All Lakes)? 1 = Extremely Dissatisfied.....5 = Extremely Satisfied
Affect	How would you rate the quality of water in the Minocqua Chain (All Lakes)? 1 = Extremely Bad..... 7 = Extremely Good
Recreation Experience	Experiences associated with Minocqua Chain of lakes (All Lakes): 1= No experience.....5 = A great deal of experience
Affect Strength	Cumulative Affect (Satisfaction & Affect) towards Minocqua Chain and All Lakes 0 = No feelings.....24 = A lot of Feeling
Cognition Strength	Cumulative Cognitions (Think & Know) towards Minocqua Chain and All Lakes 0 = No Cognitions.....22 = A lot of Cognitions
Affect Scope	Affect (Satisfaction & Affect) Difference between Minocqua Chain and All Lakes -12..... 0= No Difference.....+12
Cognition Scope	Cognitive (Think & Know) Difference between Minocqua Chain and All Lakes -11..... 0= No Difference.....+11
WI Residence	"Did your household pay Wisconsin State Income Tax in 1997?"
Angler	"I spend time fishing on lakes in Vilas and Oneida counties and think of myself as a committed angler"
Age	"In what year were you born?"
Gender	"Are you?" 0 = Male 1 = Female
1997 Income	"What was the combined total 1997 annual income, before taxes of all members of your immediate family living in your household?"

For all environmental objects, the brief introduction was followed by two broad attitudinal questions—one question asked respondents how important water quality, wolves, spearing, and biodiversity was to them personally and a second asked how they

felt about the object (strongly dislike to strongly like). Following the two questions, the the differences between the environmental whole and the environmental part were described in a special box (e.g., "Vilas and Oneida counties includes only the area that lies within the two-county boundary" and "All of Northern Wisconsin includes all of the state of Wisconsin north of Highway 8).

Following the part-whole distinction, the questionnaire proceeded to measure four attitudinal variables for **both** the whole and the part. First, respondents were asked to rate each object on a modified Likert scale ranging from extremely bad to extremely good. Second, respondents were asked to report how much they knew about the environmental object on a five-point scale-- "I know almost nothing" to "I am an expert". Third, respondents were asked to rate their personal level of satisfaction with the current state of the environmental object on a five-point scale ranging from "extremely dissatisfied" to "extremely satisfied". Finally, respondents were asked to report how often they thought about the object in question on a six-point scale from "never" to "almost every day".

In the case of lakes, we were able to measure respondent's direct experience with lakes with a five-point scale of participation on both the Minocqua Chain and all lakes of Vilas and Oneida counties (i.e. whether the respondent had power boated or water skied, fished, canoed or sailed, swum, or participated in shore line activities).

Dependent Variables: Contingent Values and Scope

Although the senior members of our research team pioneered the dichotomous choice format for CV in the 1970's, we chose to use an open ended approach in the current study. One problem with dichotomous choice is loss of information. If a person will pay 50 dollars in a take it or leave it format, we have no idea if he or she would really pay $150. The open-ended format allowed us to gain a point estimate of WTP at the individual level. This, in turn, allowed us to conduct scope tests at the individual, as well as the aggregate, level.

Our developmental interviews showed that many respondents were averse to conventional CV payment vehicles like property taxes when it came to issues like reducing the amount of spear fishing in lakes, yet were amenable to the idea of using taxes to increase the number of wolves in the area. On the other hand, at various points in our developmental interviews, respondents spontaneously brought up the idea of voluntary contributions to protect and increase biodiversity or mentioned things like higher construction and building permit fees to protect water quality in the lakes. A one-time payment to an "environmental trust fund" was selected as the payment strategy (Stevens et al. 1991; Spash and Hanley 1995). We offered respondents a range of four payment alternatives that would be directed into the public trust fund: (1) a one-time voluntary donation; (2) a one-time levy on property taxes, (3) a one-time levy on state income taxes or (4) one-time charges or fees for things like new housing and construction permits.

Box 1: Sample Willingness to Pay Question

One way to raise money would be for people to pay into *a public trust fund* that would be set aside by the State of Wisconsin to increase the number of wolves from 200 to 800...

...At this time, we don't know how you might be asked to pay into the trust fund by the State of Wisconsin, but we do know that payments to the fund would take place on a one-time basis and money could be collected in one of the following four ways:

- You might pay directly to the trust fund through a one-time voluntary donation.
- Your property taxes might increase on a one-time basis, affecting you directly through your tax bill or indirectly through the rent on your residence.
- If you are a Wisconsin resident, your state income taxes might increase on a one-time basis
- Or, you may pay directly through one-time government charges and fees on things like new housing construction, well drilling, septic system, and other permits.

Now, suppose that the number of wolves in Wisconsin could be increased from 200 to 800 if enough money were raised by the Trust Fund.

If you were given the one-time opportunity to pay money to the Trust Fund, what is the most money you would be willing to pay to ensure that the number of wolves in Wisconsin is increased to 800?

Findings

Attitudes Toward the Objects

The data revealed four environmental goods that were viewed quite differently by respondents. Water quality, spear fishing and biodiversity were all important but our respondents strongly disliked spearfishing while having positive feelings toward water quality and biodiversity. Wolves were seen as not important or unimportant by almost a majority of the respondents and nearly a majority were either neutral or disliked wolves. (Table 2)

Table 2: Percent Rating Importance and Feelings Toward Four Environmental Goods

Variable		Water Quality	Wolves	Spearfishing	Biodiversity
Importance					
	Not Important	0.3	11.2	2.5	1.2
	Very Unimportant	2.3	4.9	1.6	2.8
	Somewhat Unimportant	0.2	5.6	2.3	3.6
	Neither	0.2	26.1	7.7	7.2
	Somewhat Important	9.0	31.9	24.3	27.2
	Very Important	47.5	14.1	28.4	41.5
	Extremely Important	40.5	6.2	33.2	16.5
		100	100	100	100
	Mean	6.2	4.3	5.7	5.5
	S.D.	.96	1.6	1.4	1.2
Feelings					
	Strongly dislike	0.7	4.7	49.9	0.2
	Dislike	8.9	6.5	32.8	4.8
	Neutral	14.3	33.9	14.1	25.2
	Like	60.5	41.7	2.1	60.6
	Strongly like	15.7	13.1	1.0	9.2
		100	100	100	100
	Mean	3.82	3.52	1.7	3.7
	S.D.	.83	.96	.86	.69

Aggregate Scope

Using only Time 1 interviews, we were able to test for scope in mean values in a the split sample design. WTP to maintain water quality and prevent spear fishing showed aggregate scope. (Table 3). These same goods also showed cognitive, affective and direct experience scope. Respondents tended to say that they knew more about and thought more about water quality and spear fishing in all lakes than in the chain, and that they liked the water quality and disliked spearing more in all the lakes than in the chain. They also recreated more in all the lakes than the chain, our measure of direct experience scope.

Wolves failed to show aggregate scope. People on average were no more willing to pay for 800 than they were for 300. They failed to show cognitive or affective scope as well. Actually they showed reverse scope in their attitudes. Our respondents knew more and thought more about 300 wolves than 800 and they were much more satisfied with 300 wolves than 800.

In the aggregate respondents were significantly more likely to pay to maintain biodiversity in their local area than they were in the whole North (i.e., reverse aggregate scope for WTP). They also showed reverse cognitive and affective scope.

Table 3: WTP and Attitude Scope for Four Environmental Goods

	Part	Whole		
Water Quality	Minocqua Chain	All Lakes	**Difference**	**Scope**
Willingness to Pay	$107	$260	**+$153**	Yes
Know about	2.23	2.59	**+ 0.36**	Yes
Think about	2.82	3.44	**+1.62**	Yes
Satisfaction	3.42	3.73	**+0.31**	Yes
Affect	4.97	5.50	**+0.33**	Yes
Recreation Experience	2.50	4.23	**+1.73**	Yes
Spear fishing	Minocqua Chain	All Lakes		
Willingness to Pay	$47	$102	**+$55**	Yes
Know about	3.23	3.47	**+0.24**	Yes
Think about	2.84	2.95	**+0.11**	Yes
Satisfaction	2.25	2.13	**-0.12**	Yes*
Affect	2.26	2.13	**-0.13**	Yes*
Recreation Experience	2.50	4.23	**+1.73**	Yes
Wolves	300 Wolves	800 Wolves		
Willingness to Pay	$42	$40	-$2 ns	No
Know about	1.97	1.71	**-0.26**	No
Think about	2.34	1.94	**-0.40**	No
Satisfaction	4.44	3.48	**-0.96**	No
Affect	4.49	3.46	**-1.03**	No
Biodiversity	2 Counties	N. Wisconsin		
Willingness to Pay	$173	$125	**-$48**	No
Know about	2.42	2.29	**-0.13**	No
Think about	2.96	2.79	**-0.17**	No
Satisfaction	5.09	5.03	**-0.06**	No
Affect	5.11	5.04	**-0.07**	No

Values in bold represent $p > .05$

*The affect and satisfaction questions measure how satisfied the respondent is with the "current level" of off reservation spearfishing by Chippewa. The CV question asks the respondent how much money he or she would be willing to give to halt the current level of off reservation spearfishing. Affective scope implies that the respondent is willing to pay more to reduce spearfishing where they are more dissatisfied with the current level. Thus, the *negative* difference score respresents positive affective scope.

Individual Scope

Studies cited previously that failed to show scope were based on split sample designs. That is, people got to express a WTP for only a whole or a part but not both.

Thus the only analysis that could be done was to look at averages as we did in the last section. But human behavior is complex and much is hidden behind averages. By asking people for their WTP for both the whole and the part in two telephone interviews separated by a week allows us to explore scope at the individual level. This allows us to reconceptualize non scope: 1) a person's WTP can be zero for the whole and zero for the part, we call this "zero no scope," 2) a person's WTP can be positive but the same amount for both the whole and the part, 3) a person's WTP can be less for the whole than the part, something we might call "reverse scope." (Table 4)

Table 4: Scope and No Scope for Aggregate and Individual Data

AGGREGATE SCOPE	NO SCOPE $WTP_P \geq WTP_W$			SCOPE $WTP_P < WTP_W$
INDIVIDUAL SCOPE	REVERSE SCOPE $WTP_P > WTP_W$	ZERO NO SCOPE $WTP_{P=0} = WTP_{W=0}$	POSITIVE NO SCOPE $WTP_{P>0} = WTP_{W>0}$	POSITIVE SCOPE $WTP_P < WTP_W$

The results of the individual analysis are presented below in Figure 3. As the data show, *a majority of respondents failed to show scope for each of the four environmental objects*. For **water quality**, which showed scope in the aggregate, only 41% of respondents showed scope sensitivity—that is, only 2 out of 5 respondents were willing to pay more to clean up all of the lakes than the four lakes in the Minocqua chain. For Indian spear fishing which also slowed aggregate scope only 1 in 5 showed scope.

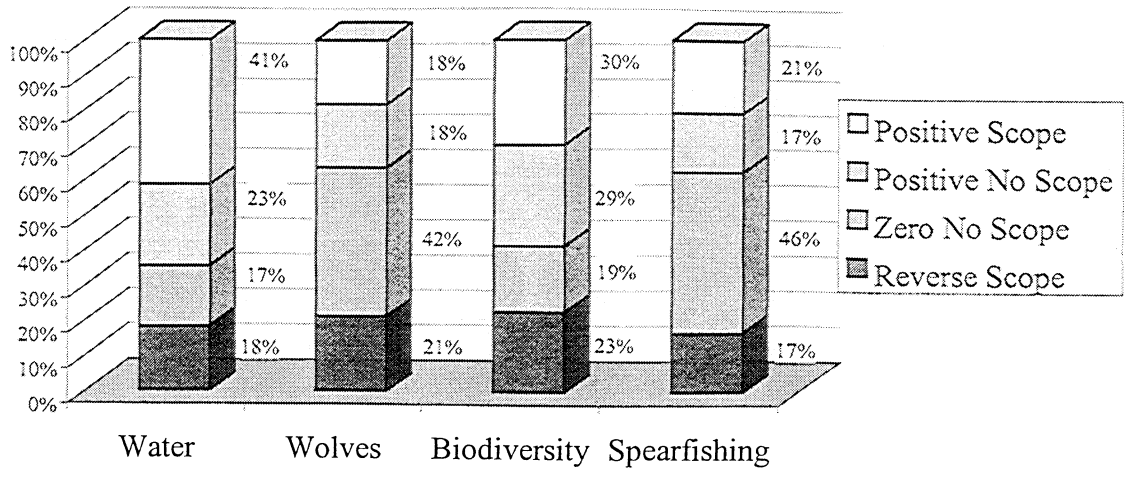

Figure 3: Four Types of Scope Sensitivity

For wolves, about which most people had little interest and no strong feelings, 42% said they would pay nothing for 300 or 800 wolves. The public thought spear fishing was important and had strong feelings about it but 46 percent said they would pay

nothing to stop spear fishing on either the chain or all of the lakes. Biodiversity, which showed reverse scope in the aggregate, only had 23 percent of the people showing reverse scope when we consider the individual data.

Predicting Individual Scope Types

Because we have WTP for the whole and the part for each individual we can explore what attitudinal and personal characteristics explain which type of scope a person showed. There are four dichotomous dependent variables in this analysis: 1) positive scope compared to the other three groups, 2) positive no scope compared to the other three groups, 3) zero scope compared to the other three groups and 4) reverse scope. The independent variables include a general measure of environmentalism, belief that water quality is important to the respondent, general liking water quality in the north, affective scope(liking the whole more than the part), cognitive scope (knowing and thinking more about the whole than the part), cognitive strength(knowing and thinking about the good), affective strength (liking the good), recreation scope(using the whole more than the part (lakes only)) and five personal characteristics, age, gender, income, residence, and angling behavior.

If we can explain some of the variance in the scope types from these variables using logistic regression we have a better understanding of why people are expressing what seem to be inconsistent economic preferences. If such predictions prove impossible, then we might conclude that either random error or other unmeasured variables determined relative WTP.

Water Quality

The independent variables significantly predicted each of the four scope types (Table 5) for water quality.

Table 5: Logistic Regression Estimates for Water Quality Scope Sensitivity

Independent Variables	Positive Scope	No Scope Positive	No Scope Zero	Reverse Scope
Environmentalism	1.07	**1.14***	**0.82**	0.90
Water Quality Important to Respondent	0.96	1.05	1.23	0.89
Like Water Quality in Northern Wisconsin	1.37	.81	.61	1.10
Affective Scope	1.09	.94	.89	.97
Cognitive Scope	**1.14**	1.01	.96	**.81**
Cognitive Strength	1.03	1.00	.95	.96
Affective Strength	**.89**	1.05	1.11	1.07
Recreation Scope	**2.31**	**.37**	1.56	.71
Angler	1.14	.76	1.29	.94
Wisconsin Resident	1.30	**.50**	1.53	1.15
Age	1.00	.85	**1.38**	.90
Female	.85	.94	.51	**2.09**
Income	**1.13**	.96	**.91**	.94
Cox and Snell R Square	**0.13**	**0.08**	**0.11**	**0.07**
Model X^2 p value	p<.000	p<.011	p<.002	p<.000

*Values in bold represent Wald Statistic with p <.05. Coefficients over one increased odds of being in the category compared to all other categories and those below 1.0 decrease the odds. A coefficient of two means that a unit increase in the independent variable doubles the odds while a coefficient of .50 means that the person is half as likely to be in the category.

People who show cognitive scope are more likely to be in the positive scope category. Respondents who show recreation scope are more likely to show positive scope. If you feel the water quality is better in both the whole and the part (affective strength) then you also are willing to pay less to maintain quality. Those with higher incomes show positive scope.

Respondents who are willing to pay some positive amount but the same for the whole and the part **(positive no scope)** are less likely to be Wisconsin residents, much less likely to have recreational experience on the area lakes and more likely to hold pro environmental attitudes.

Those who are willing to pay zero for both the part and the whole **(zero no scope)** are older, have lower incomes, and are less likely to hold pro environmental values. They give lower ratings to the quality of the water in lakes all over the north.

Those who show **reverse scope**—who are willing to pay more to maintain water quality on the chain and are less likely to show cognitive scope--say they know and think more about water quality on the Minocqua chain than the rest of the lakes. They are also more likely to be female.

A number of variables had nothing to do with any of the water quality scope types. Anglers were no more or less likely to fall into any of the categories. Neither those showing affective scope (liking the whole more than the part didn't have any effect) nor those who thought water quality was important show any differences. Cognitive strength (thinking a lot and knowing a lot about water quality) didn't help explain scope. Those

who liked the water quality in the north or for whom water quality was important were also no more likely be in one of the scope categories. Environmental attitudes did differentiate the types but in different directions. Respondents who showed positive no scope held pro environmental attitudes, while those who showed zero no scope were less likely to do so.

Spear Fishing

When we turn to spear fishing scope, the most notable thing is that the same independent variables that helped explain water quality scope in the same set of lakes were not able to explain the scope types for spear fishing. Only one of the four logistic regression models was significantly different from zero. (Table 6)

Table 6: Logistic Regression Estimates for Spear Fishing Scope Sensitivity

Independent Variables	Positive Scope	No Scope		Reverse Scope
		Positive	Zero	
Environmentalism	1.02	0.96	1.00	.99
Spear Fishing Important to Respondent	1.06	.97	.98	.94
Like Spear fishing in Northern Wisconsin	.84	**.43***	**1.88**	.90
Affective Scope	.92	1.34	1.08	.82
Cognitive Scope	1.06	1.09	.93	.95
Cognitive Strength	1.06	1.00	.95	.98
Affective Strength	1.06	1.11	**.88**	1.02
Recreation Scope Lakes	1.18	1.09	1.08	.67
Angler	1.34	1.06	**.65**	1.27
Wisconsin Resident	.72	.69	**2.16**	.73
Age	.95	.90	1.02	1.13
Female	**1.99**	.75	**.57**	1.15
Income	1.01	.95	1.00	1.04
Cox and Snell R Square	0.04	0.04	**0.07**	0.02
Model X^2 p value	NS	NS	p<.007	NS

*Values in bold represent Wald Statistic with p <.05. Coefficients over one increased odds of being in the category compared to all other categories and those below 1.0 decrease the odds. A coefficient of two means that a unit increase in the independent variable doubles the odds while a coefficient of .50 means that the person is half as likely to be in the category.

The only scope type that was significantly predictable was **zero no scope**—willing to pay nothing to prevent Indians from spear fishing on either the chain or all of the lakes. Anglers who are competing with Indians for fish were less likely to pay zero, but anglers were no more likely to show positive scope or reverse scope. Out-of-state residents were more likely to pay something to stop spear fishing, but this variable explained none of the other scope types. Men showed a greater likelihood of zero scope than women. Those people who liked spear fishing more (or who disliked it less) were much less willing to pay anything to stop it.

Wolves

Although wolves did not show aggregate scope, it turns out using individual data we can predict who will pay nothing for 300 OR 800 wolves. The R square predicting the **zero no scope** category was .38 (Table 7). The next highest R square in the other 15 regression models was .13. Wisconsin men with less positive environmental attitudes, who think wolves are unimportant and are less satisfied with wolves are the most likely to say they would pay zero dollars to preserve either 300 or 800 wolves. Or conversely out of state pro-environmental females who think wolves are important and feel positively about wolves are the least likely to be in the zero no scope category.

Table 7: Logistic Regression Estimates for Wolves Scope Sensitivity

Independent Variables	Positive Scope	No Scope Positive	No Scope Zero	Reverse Scope
Environmentalism	1.07	1.10	**.83***	1.04
Wolves Important to Respondent	1.02	**1.34**	**.67**	1.26
Like Wolves in Northern Wisconsin	.98	1.09	.66	1.36
Affect Scope	1.02	1.10	.92	.94
Cognitive Scope	1.23	1.02	.93	.88
Cognitive Strength	.97	.96	1.06	**.92**
Affective Strength	**1.21**	1.06	**.83**	.98
Wisconsin Resident	**.55**	.77	**3.19**	.86
Age	1.12	**.80**	1.17	.94
Female	1.68	**1.70**	**.39**	.92
Income	**1.07**	.96	1.04	.95
Cox and Snell R Square	**0.11**	**0.12**	**0.38**	**0.07**
Model X^2 p value	P<.000	P<.000	P<.000	P<001

*Values in bold represent Wald Statistic with p <.05. Coefficients over one increased odds of being in the category compared to all other categories and those below 1.0 decrease the odds. A coefficient of two means that a unit increase in the independent variable doubles the odds while a coefficient of .50 means that the person is half as likely to be in the category.

Those who show positive scope, who are willing to pay more for 800 than 300, like 800 more, are generally more satisfied with wolves and are more likely to be older females who live outside of Wisconsin. They also are likely to have higher incomes.

Respondents who give a positive value but don't differentiate between the whole and the part **(positive no scope)** are older people, females, and people who say wolves are important to them. **Reverse scope** for wolves is the least well explained by the independent variables. Those who say they have greater knowledge and think more about wolves are less likely to show reverse scope.

Biodiversity

The biodiversity story is much simpler to tell (Table 8). As these results show, none of our explanatory variables predicts **positive scope** or **reverse scope**. The logistic regression can explain who will pay nothing **(zero no scope)** for biodiversity in either the

Lakeland Area or all of northern Wisconsin and who will pay the same amount for each. It is your environmental attitudes. Going up one unit on the attitude scale increases the likelihood that you will be in the **positive no scope** and going up one unit decreases the likely hood you will pay nothing for biodiversity anywhere.

Table 8: Logistic Regression Estimates for Biodiversity Scope Sensitivity

Independent Variables	Positive Scope	No Scope Positive	No Scope Zero	Reverse Scope
Environmentalism	1.00	**1.11***	**.79**	1.07
Biodiversity Important to Respondent	.93	.97	.94	1.21
Like Biodiversity in Northern Wisconsin	.95	1.25	1.05	.79
Affective Scope	.94	.99	1.08	1.01
Cognitive Scope	.78	1.07	1.24	1.08
Cognitive Strength	1.02	1.02	.99	.95
Affect Strength	.95	1.05	1.02	1.00
Wisconsin Resident	.90	.89	1.60	.94
Age	.99	.88	1.22	.99
Female	1.34	1.23	.54	.78
Income	1.03	1.00	.93	1.01
Cox and Snell R Square	0.02	**0.05**	**0.11**	0.03
Model X^2 p value	NS	P<02	P<000	NS

*Values in bold represent Wald Statistic with p <.05. Coefficients over one increased odds of being in the category compared to all other categories and those below 1.0 decrease the odds. A coefficient of two means that a unit increase in the independent variable doubles the odds while a coefficient of .50 means that the person is half as likely to be in the category.

Post Survey Interviews

The research team conducted 30 retrospective interviews with respondents who had completed all three waves of the survey. Respondents were purposively sampled in order to ensure representation from all of the scope conditions (reverse scope, positive scope, zero no scope and positive no scope) across the 4 attitude objects. Respondent debriefing framed the purpose of the question-answer process about the survey, to gain a better understanding of how individual respondents interpreted the questions that we asked them (DeMaio and Rothgeb 1996; Willis et al. 1999). Retrospective think-aloud protocols were then used so that each respondent would "think aloud" as they read through their answers to the survey questionnaire, thus verbalizing the contents of their personal memories about why they answered each question in the manner that they did (Sudman et al. 1996).

Reverse Scope Is Not Irrational

The logistic regression analysis showed that at least some of the variance in this scope type can be explained by our independent variables. And our interviews showed why. After conducting several interviews the economist on our team observed, "These people aren't showing scope, but they aren't stupid." He was right. A respondent who

was willing to pay $500 dollars for 300 wolves and $100 for 800 wolves observed: "I rated 300 wolves as very good and 800 wolves as good. And the difference is because of the potential for the very kind of public dissatisfaction that we're seeing right now...Oh yeah, it [800 wolves] would be a problem for the wolves and it would be a problem for the wolf advocates and so on...So therefore, I would um, I would be concerned about whether 800 wolves would cause problems"

This person was not the only one concerned about this. Another respondent who said they would pay $200 for 300 wolves and $100 for 800 wolves held the same beliefs. "I think 800 is a too many where it could become a problem for them and possibly a people problem with, or problems with us.... Thinking that 300 is probably closer to the reasonable number than 800, I would be more willing to support the 300."

People showed reverse scope on water quality for different reasons than they did for wolves. As a respondent who was willing to pay $500 to maintain water quality on the chain and $100 for all the lakes explained "I'm familiar with Lake Minocqua and to some extent Tomahawk Lake [lakes of the Minoqua Chain]...And, and I'm less familiar with other lakes in Vilas and Oneida county although I'm familiar with the large flowages, Rainbow Flowage." "I had a larger stake in the Minocqua chain and...so I figured I was more responsible as a, as a property owner for the Minocqua Chain of Lakes than for, um, Vilas County." The chain had a special meaning for the respondent and was not seen as a part of a larger whole. "The chain is where my house is." Another female claimed.

Zero Means Zero

Our regression analysis showed however that zero no scope was the most predictable. Indeed it was the only kind of scope that we could significantly predict across all four goods. In the case of wolves 11 variables explained almost 40 percent of the variance in the zero-zero dependent variable.

In the words of one respondent "I think we could get along without them [wolves] very well, which we have...I don't think they're very important, I don't think they're very unimportant. Nature kind of takes care of itself." Another told us, "I would rather see them do other things with tax money than increase the wolf population. 800 no, no, I don't think we should have 800 wolves anyway and I wouldn't pay penny one to get 800 wolves."

Even though people liked "biodiversity," 19 percent held views like this person: "I myself don't feel that I should pay to uh keep plants and animals you know...It's the people that are developing the property and ruining that is the ones that should pay for it. So if the developer wants to take out 40 acres and put a subdivision in, then there should be a tax or whatever you want to call it on his property and not the person that just is trying to eke out a living in his space, and that's basically my feelings"

When it comes to spear fishing, 46 percent of the respondents were willing to pay nothing to stop spear fishing even though they had strong negative feelings about it. Some don't think it will be effective or appropriate: "No, you won't buy those people off. (pause) You know this isn't the first thing on the spearing and fishing --probably say maybe 30 years ago they did come up with a reservation fishing license, and they have one now but it didn't go over at all... You're not going to change anything until you change people." Another gives us insight that the whole and the part are the same and he

won't pay to stop spear fishing in either location "I didn't answer differently at all because there's no difference to me in where the spear fishing occurs. I didn't differentiate between the Minocqua chain and all the lakes in Vilas and Oneida county for any of the spear fishing questions. Because...the issue to me is identical regardless of where it happens. And then because I don't have, I don't feel a personal stake in any of these lakes...you know I haven't adopted any walleyes in any particular lakes or done any of the kind of wacky things that some fishermen might do. "

Positive Scope Isn't Always Well Informed

When one thinks about the no scope types we often reasons that there is just some kind of error. If only people were told that 800 wolves won't do any more damage or be any greater risk than 300 they might change their values. But in the case of wolves and biodiversity where people often had little information and very weak attitudes we got the sense the positive scope category was not without its own instability. This person based a response of $30 for 300 wolves and $75 for 800 on the following reasoning "I know very little. 800 wolves living in northern Wisconsin? Almost none. Hardly any information. The only information I have on the subject is what I've heard on the news. There's one group I believe up in the national forest over by (pause) I forget the name of the town, but there is one...Pack that they have, over the last 5 years I believe. I don't know if it's the Nicolet National Forest now, or if it's the other one... I believe it's Chequamegon....How satisfied are you or would you be with 300 wolves living in northern Wisconsin? Extremely satisfied. 800 wolves living in northern Wisconsin, here again extremely satisfied, and I would probably prefer the larger number of wolves...you'd have a better chance of seeing them, hearing them, observing them. That would be my, knowing that they are here." Notice that this positive scope was not based on a lot of information. If we had given him more information on the survey he might have ended up as a non scope type.

Positive No Scope Ignores Differences Between Wholes and Parts

Environmentalism often seem to motivate those who gave positive but equal values for water quality and biodiversity. But in many cases the respondent just did not differentiate between the whole and the part—this was about money to do good. This respondent was willing to pay $100 dollars for the chain and $100 for all lakes. "I believe in that. I could give $100 toward it...yes I felt good about that program and this was above and beyond my taxes. $100 is just sort of in my head as that would be, it, in other words the $100 had nothing to do with how much it would pay toward cleaning up a lake. It simply would be our family's maximum amount that we would ever put into a program outside of environmental things we're already involved in"

A person who was willing to pay $500 to protect biodiversity in Vilas and Onieda Counties and in all of Northern Wisconsin was not thinking about wholes and parts. "Well, I suppose I would associate it [biodiversity] with...just looking out in the backyard, you know, looking at the bird feeders and the deer feeders and ferns and the elms and the oaks making a place interesting, making it um I don't know, ecologically uh balanced is what I think about...In fact, this morning I saw a mother [deer] and two fawns out here...it was wonderful, and the hummingbirds were flying at the feeder at the

same time, so here I'm looking at all these beautiful, wonderful things that make me feel just great, it's a spiritual connection to me."

Discussion

This paper began with the observation that the scope test is very appealing for its intuitive, common sense logic and theoretical simplicity. Our working conclusion after looking at aggregate and individual data across these four objects is that the scope test is neither a necessary nor sufficient criterion for judging the validity of values estimated using CV. Two of the objects showed scope, and two didn't. Those that showed scope, also showed cognitive and affective scope. But when you know more about the part, and like the part more you pay more for the part than the whole. Does this make the values invalid?

Are the WTP estimates for wolves invalid because people say they would pay no more for 800 than 300? If there were a simulated market for wolves, we are quite confident that those people who said they would pay zero, will actually pay zero. Moreover, we are certain that many people who said they would pay more for 300 wolves than 800 would actually do so with real money.

When we looked at the individual data we found the majority of the respondents failed to show scope for any of the four goods. This surely does not inspire confidence about the scope test as a validity criterion. Some people showed reverse scope for very good and well thought out reasons. So it is possible that some of the reverse scope judgments are validly representing what people would really be willing to pay if a market were available. So we believe that evidence of reverse scope is not sufficient to call the values in a single study invalid or the method in general flawed.

It does seem to us that very often the whole-part distinction is more in the mind of the analyst than in the mind of the respondent. For many of our respondents wolves went from an environmental good at 300 to an environmental bad at 800, and the Minocqua chain is a different attitude object than all of the lakes. While the chain is physically a subset of all the lakes, peoples ways of thinking about them may not be that simple. We think this might explain the some of the studies cited at the beginning of this paper failed to find scope. Environmental goods often have many attributes. Scope tests simply assume that one attribute (e. g. number of wolves, acres of wilderness etc.) defines the good, holding all other attributes constant. Respondents are smarter than that.

About biodiversity the public didn't have a clue. But they were willing to give very high values for what they thought biodiversity was. We fully expect that our respondents would have paid at least $173 dollars, on average, to keep the trees and plants and animals in their county. They wouldn't pay more for the whole north because the whole north is somewhere else. People will pay more for the part than the whole simply because they live in Vilas and Oneida counties or on the Minocqua Chain. Parts and wholes are two different things. More important what they said they were paying for was nature rather than what "biodiversity." The CV measure here even if it were validated by a simulated market, would be a most invalid indicator of the value of biodiversity as defined by the scientific community. Just because CV is sometimes badly applied, however, does not mean that the method itself is fundamentally flawed—just that it is difficult to use. The warning, "Don't try this at home," applies.

Even though spear fishing showed aggregate scope we were not able to predict the various scope types. Were other variables working or was there simply a lot of error variance here? Our guess is attitudes toward Indians and the impact of spearing on both the fish and the community would have explained these scope conditions but they were not asked on the surveys. Wolves did not show scope, but individual scope was quite predictable. We think the reason that we often got the same values for the whole and the part was that for most people 300 and 800 were really not very different. And those who did make the distinction between 300 and 800 felt that 800 was less desirable than 300. They didn't show scope but for good reason. We expect that the lack of distinction in numerical sense is why Desvouges et. al.(1993) did not find scope when respondents were presented with 2000, 20,000 and 200,000 birds. In each case the respondents were informed that the number presented was a relatively small proportion of birds.

There was certainly evidence in our data that the goods were loaded with ideological value as Kahnman observed in 1986. Willing to pay nothing for biodiversity or the same positive value for the whole and the part was tied to only one variable—environmentalism. When asked to give money for biodiversity the broad environmental value was the only predictor. But the fact that the values from the CV application are tied to this broad disposition doesn't mean that our respondents are unwilling to pay if we threatened to bulldoze forest and kill all the wild animals in Vilas and Onieda counties

So what to do? Based on these data we think that it is expensive and generally useless to have large split sample designs where half the people express a value for a part and half for a whole in an effort to show that a particular CV application is valid. Sometimes you will get scope, when people know and like the whole more than the part, but other times you won't, as when the whole and the part are really different goods, or people like the part more than the whole. The failure to find scope simply tells you something about the good, rather than the validity of the estimates, and the utility of the method. It would be nice if there were some easy statistical test like the scope test to compare groups to say conclusively if the CV application in any study was valid or not. Unfortunately, on the basis of our data, we don't believe the scope test *per se* is either necessary or sufficient to accomplish this task.

It would be better to focus the time and energy on trying to figure out a simulated market, even in a lab or an artificial setting for water quality, wolves, Indian spear fishing or biodiversity than to keep searching for evidence of validity or invalidity in scope tests.

Generally we think it is better to use CV on objects that individuals know a lot about, have strong feelings about, and lots of direct experience with. In these cases, whether one gets scope or not, the questions will make sense to the respondent and his or her answers will make sense. It is likely then that they will actually pay what they say they will pay. We think the values expressed about water quality and spear fishing have stronger cognitive and affective grounding, and in that sense would be more stable over time. The values for wolves although predictable and valid at the time we gathered our data could change if there were a key event associated with wolves. Our experience with biodiversity suggests that it is dangerous to think that elicited contingent values accurately represent people's values for abstract scientific constructs.

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Appendix A

Environmental CV Studies That Have Tested Scope Sensitivity*

Author(s)	Environmental Good(s) Studied	Scope Sensitivity?
Bowker & Didychuk (1994)	Agricultural Land in Canada	Yes
Boyle, Welsh and Bishop (1993)	Different CFS Water Flowages in the Grand Canyon	Yes
Carson, Mitchell & Ruud (1989)	Air Pollution—Visibility and Health Effects	Yes
Carson and Mitchell (1993)	National and Regional Freshwater Quality	Yes
Desvouges et. Al. (1992)	Waterfowl Deaths in Central Mississippi Flyway	No
Diamond et al. (1993)	Wilderness areas in four Rocky Mountain states	No
Duffield and Neher (1991)	Montana Waterfowl	Yes
Hoevenagel (1994)	Six environmental programs	Yes
Jakus (1992)	Gypsy Moth Control	Yes
Kahneman (1986)	Fish in Ontario Lakes	No
Kahneman and Knetsch (1992)	Environmental Services	Mixed
Krieger (1994)	Sport Fishing	Yes
Loomis et. Al. (1993)	Forests in Southeastern Australia	Mixed
Magnussen (1992)	North Sea Water Pollution Prevention	Yes
Mitchell and Carson (1986)	Drinking Water in the United States	Yes
Mitchell and Carson (1995)	The Kakadu Conservation Zone Australia	Yes
Mullarkey (1997)	Highway Expansion and Wetland Protection	Yes
Rowe et Al. (1991)	Northwest Oil Spills	Yes
Schkade and Payne (1994)	Waterfowl Deaths in Central Mississippi Flyway	No
Whitehead (1992)	North Carolina Sea Turtle Extinction	Yes
Whitehead & Blomquist (1991)	Kentucky Wetlands	Yes
Wu (1991)	Ohio Freshwater Streams	Yes

*Adapted from Carson(1997).