A comparative analysis of use and non-use value estimation: A case study in Newfoundland

B.S. Condon and W.L. Adamowicz

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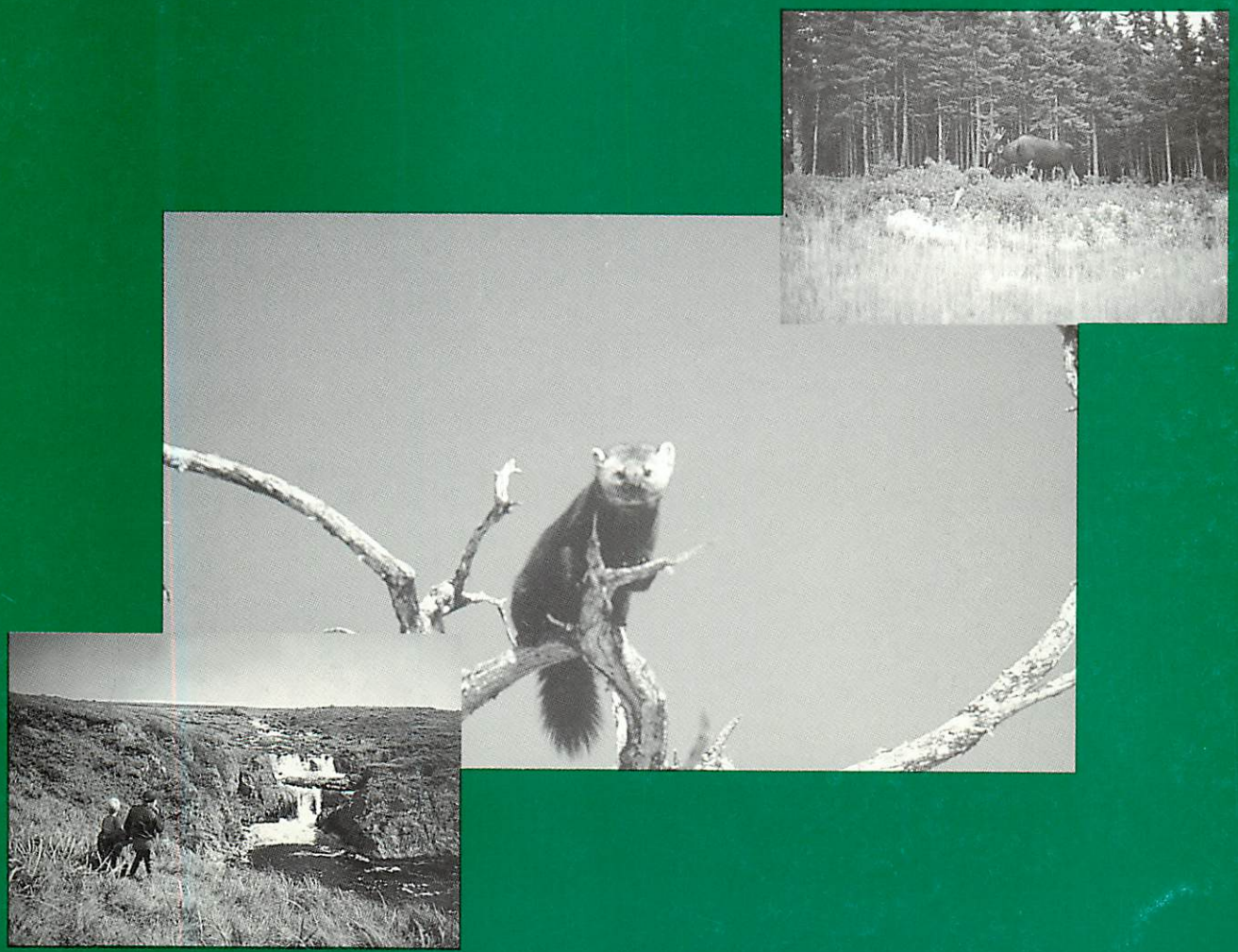

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A Comparative Analysis of Use and Non-use Value Estimation: A Case Study in Newfoundland

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ABSTRACT

The purpose of this study was to develop economic measures for two wildlife resources in Newfoundland. The contingent valuation method was used to value the existence of the Newfoundland pine marten, a threatened species, and moose hunting in Newfoundland. Estimating the value associated with moose hunting is less complex than estimating that associated with the existence of the pine marten as the demand for hunting is related to an activity within a region and is at least partially revealed through trip expenditures. However, the demand for the existence of a Newfoundland pine marten is not directly related to activity within a region; its net economic value must be inferred. Individuals value the pine marten for reasons ranging from altruism to feelings of environmental responsibility; however, these values are not completely revealed through an individual's actions. In examining these two wildlife resources the measurement of a use value (recreational activity and food value) can be compared to a non-use value (existence value). The latter at times is difficult to estimate and conducting these two studies together offers insights into benefit estimation and the differences in estimation between use and non-use values.

RÉSUMÉ

L'étude avait pour objet de formuler des mesures économiques pour deux ressources fauniques de Terre-Neuve. La méthode des enchères a été utilisée pour estimer l'existence de la martre des pins de Terre-Neuve, une espèce menacée, et la chasse à l'orignal à Terre-Neuve. Il est moins complexe de déterminer la valeur de la chasse à l'orignal que celle de l'existence de la martre des pins, étant donné que la demande de chasse est associée à une activité au sein d'une région, en partie révélée par les dépenses associées aux excursions. En contrepartie, la demande pour l'existence de la martre des pins de Terre-Neuve n'est pas directement associée à une activité au sein d'une région; sa valeur économique nette doit être inférée. Les gens accordent de la valeur à la martre des pins pour toutes sortes de raisons, allant de l'altruisme à un sentiment de devoir envers l'environnement; or, ces valeurs ne sont pas complètement révélées par les activités des personnes. À l'examen de ces deux ressources fauniques, la mesure d'une valeur d'utilisation (activité récréative et valeur alimentaire) peut être comparée à une valeur de non-utilisation (valeur d'existence). Il arrive que cette dernière valeur soit difficile à estimer et al conduite de ces deux études en parallèle offre des perspectives sur l'estimation des avantages et sur les différences d'estimation entre valeurs d'utilisation et de non-utilisation.

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A COMPARATIVE ANALYSIS OF USE AND NON-USE VALUE ESTIMATION: A CASE STUDY IN NEWFOUNDLAND

by

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1.0 INTRODUCTION

Traditionally, the goal of forest management was to maximize wood production without impacting on the other values associated with the forest. More recently, as a result of increased public concern for forest resources, the pressure on forest managers has increased; they are not only faced with managing the forest for the timber and wood products produced from it, but for other uses such as wildlife. To effectively manage the forests for multiple uses, information must be available on the values of nontimber goods and services.

Nontimber goods include wildlife and their habitats, and wilderness and recreation areas and the services they provide include activities such as hunting, fishing, and berry picking. These forest benefits have value as a result of their use or potential use, yet markets, which determine the price of timber products, do not exist for most nontimber resources. However, the lack of prices associated with nontimber resources does not imply they do not have an economic value (economic value, in monetary terms, referes to the amount an individual is willing to exchange for a good from a set of resources or the minimum amount an individual would accept in exchange for the good {Adamowicz 1991}).

Individuals incur expenses in order to take part in wildlife-related activities. In 1991, Newfoundland residents spent an estimated $126.5 million on wildlife-related activities, $80 million of which was spent on hunting-related activities (Filion *et al.* 1993). These expenditures contributed to the provincial economy, supported jobs, and supplied tax revenue to local and provincial governments (Filion *et al.* 1990). However, although expenditures are important to identify the regional distribution and the economic impacts of wildlife-related recreation, they are not measures of value but a cost of participation. Gross expenditures underestimate the net economic value of wildlife-related activities and do not give an estimate of additional value created, for example, when hunting opportunities are improved. Land-use allocation decisions would benefit from information on the net value of nontimber goods and services.

The 1991 survey on the *Importance of Wildlife to Canadians* attempted to estimate the value of maintaining abundant wildlife. Specifically, Newfoundlanders were asked if they would be willing to pay one to five percent more in certain taxes or prices to ensure that abundant wildlife was maintained through the conservation of wetlands, forests, and other habitats. The results of the survey showed that 48.7% of Newfoundlanders were willing to help pay to maintain abundant wildlife through increases in one or more selected items.

While the national survey examined the value of a diverse set of habitats, this study, through personal interviews, a mail-out household survey, and a mail-out moose hunting survey, examines two specific cases of valuation. The first case attempts to estimate the value associated with moose hunting in Newfoundland; the second the value of the existence of the Newfoundland pine marten, a threatened species. These are among the most important nontimber issues in Newfoundland.

Moose hunting, as well as providing sport and recreational opportunities, is an important food source for many Newfoundlanders. In 1992, 28, 390 moose hunting permits were issued. However, hunting permits are not sold through competitive markets and as a result licence fees do not reflect the full economic value associated with moose hunting. In the moose hunting survey, we attempted to estimate a use value from participating in hunting (although not examined in this paper, the value of management changes were also estimated to determine if changes in management practices would increase hunter's benefits).

Historically, pine marten were found in most forested areas on the island of Newfoundland; however, by

1973 there was only a remnant population on the west coast of the island. Although a Pine Marten Study Area was established in 1973 to prevent trapping and snaring in the area, and timber harvesting is suspended, the area represents a source of relatively accessible timber. Although in the short term there may be a surplus of over-mature timber, timber supply analysis shows a deficit in the long term. The timber in the Study Area would make a significant contribution to the economic and social well-being of the province. Considering these conflicting demands on the forested areas where the pine marten is populated, it is important to attempt to evaluate this area to assist in land-use allocation decisions.

Evaluating the benefits of moose hunting and the preservation of the pine marten habitat also allows the estimates of a use value (recreational activity value) to be compared with a non-use value (existence value). Although the methods used to capture use and non-use values are similar, the latter is difficult to measure; conducting these two studies together may offer insights into estimation and the differences between use and non-use benefits.

The remainder of this report is organized as follows: Section 2 reviews some of the theoretical concepts important in economic valuation; Section 3 describes the survey design; Section 4 summarizes the results of the pine marten contingent valuation question and Section 5 the moose hunting contingent valuation question; and Section 6 consists of a discussion of the implications of the results (for the survey questionnaires, refer to Condon 1993. For results from the household and moose hunting surveys, that are not covered in this report refer to Condon and Adamowicz 1993).

2.0 THEORETICAL BACKGROUND

2.1 Concept of Value

An important objective of integrated resource management is to measure the benefits associated with forest resources; this implicitly involves estimating demand. The demand for a good or service indicates the quantity of use that participants in a market would be willing and able to purchase at each price. In order to measure the benefits associated with resource outputs, they must be expressed in a common metric unit, in this case dollars, for comparison. Forest outputs, such as pulp and paper, and timber, move through markets; however, other outputs, such as recreation and wildlife, do not. As a consequence, resources such as wildlife are often undervalued in the decision making process. In the absence of markets it becomes necessary to use other methods to determine the value associated with these non-market outputs.

Consumer surplus, an economic measure that approximates net value, is the difference between the maximum amount an individual is willing to pay to obtain a good or service and the amount actually paid. The net economic value is derived by summing the consumer surplus for each individual and adding these values across individuals. The basic premise of economic value is that the value of a good is not intrinsic but depends on the preferences of individuals. Therefore, economic value is not constant and may change with time and vary across individuals.

2.2 Types of Values

The total value of the wildlife resource can be divided into a use and non-use component. Use values include consumptive uses such as hunting and trapping, and non-consumptive uses such as wildlife viewing. Non-use values represent values in which the individual does not consume or actively participate; they include option and existence values. Option value is the value individuals associate with changing levels of uncertainty of future demand and/or supply. Existence value is that placed on a natural resource amenity, even though individuals may never use or visit it; however, it is important for them to know that the amenity will continue to exist. Existence demand is altruistically motivated by one of three categories of altruism: interpersonal, intergenerational, and resource (Randall and Stoll 1983). Interpersonal altruism is the existence value derived from knowing that the natural amenity will be available for use by others; intergenerational altruism reflects the importance of passing on natural resources to future generations; and resource altruism is the enjoyment in knowing that the resource itself is benefitting from being undisturbed.

2.3 Theoretical Models

The objective of non-market benefit estimation is to determine the economic value, in monetary terms, of the impact of a change in the quality and quantity of a good or service that does not have a market price. A number of theoretical models have been developed to measure the economic values associated with wildlife and wildlife-related activities. Two commonly used approaches are the contingent valuation method (CVM) and the travel cost method (TCM). The CVM is based on constructing market scenarios to estimate the value of changes in environmental quality or quantity, while the TCM is based on observations of actual

behaviour.

The TCM uses travel cost as a proxy for price in order to estimate demand. An increase in the quality of a recreation area is reflected by an increase in the demand for the site. The number of trips is regressed on price and demographic variables revealing the demand function for trips to a site. The TCM has some inherent problems: first, it is difficult to estimate the utility or disutility of travel time (Cesario and Knetsch 1970; Wilman 1980; McConnell and Strand 1981; Smith and Desvousges 1986) second, it is restrictive in that it can only be used to estimate use values; and third, it is difficult to determine an appropriate functional form (Ziemer *et al.* 1980; Kling 1988; Adamowicz *et al.* 1989).

The CVM uses surveys to determine respondents' willingness to pay for a change in environmental quality or quantity. Willingness to pay (WTP) is defined as the amount an individual would pay over and above what they already pay to obtain the good or service. As no market system exists to capture the value of environmental amenities, the CVM relies on establishing a hypothetical market and asking individuals to reveal a dollar amount that they would be willing to pay if such a system did exist.

The CVM must establish baseline conditions with respect to the availability of a good or service, and explicitly describe the institutional and structural framework which regulates access and use (Randall 1987). It must thoroughly characterize the changes that will result from policy alterations, and through creating a hypothetical market, it must attempt to accurately capture the individual's WTP. In addition, it must outline the conditions for the provision of the environmental improvement as well as the method of payment. The quality of the estimates depends on the characteristics developed within the contingent market.

Although the CVM is a relatively flexible tool, it has a number of drawbacks. One of the most prominent problems is that it is based on a hypothetical market situation. If the respondent does not believe in the developed market situation, eliciting true WTP values for goods and services is difficult. Depending on their preferences for the outcome, respondents may also act strategically by overstating or understating their true WTP value.

These biases can be minimized by carefully structuring realistic market scenarios. Advances in question structuring that elicit yes/no responses to bid amounts have been effective in reducing strategic behaviour (for further details on biases in the CVM, refer to Cummings *et al.* 1986 and Mitchell and Carson 1989).

The CVM has been accepted by the United States Department of Interior (1986) for valuing non-market goods and has been recommended by the United States Water Resources Council (1979, 1983). Due to the restrictions inherent in the TCM, the CVM was chosen to estimate the net economic values associated with the two wildlife resources in Newfoundland because of its ability to estimate both use and non-use values, and its relative flexibility. Researchers using the CVM have raised a number of issues regarding the reliability of this method especially when measuring non-use values (Mitchell and Carson 1989). By comparing a use and a non-use value, this study is designed to yield further results on the issue of bias and survey design in the CVM.

Two common approaches to elicit WTP values are open-ended questioning and the dichotomous choice method. In open-ended questioning, the respondent is asked the maximum dollar amount he/she would be willing to pay for a change in environmental quality or quantity. In the dichotomous choice method, the respondent is asked if he/she would be willing to pay a specified dollar amount for a change in environmental quality or quantity. The offer amounts are varied across individuals and the respondent simply answers yes/no to the contingent valuation question. The advantage of the dichotomous choice method is that it mimics market behaviour, making the developed market more realistic for the respondent. Although less information is obtained about respondents' preferences than other methods such as open-ended questioning, this technique may be inherently more reliable as individuals only have to place bounds on their valuation. The advantages of presenting a realistic market situation may outweigh the cost of the loss of information. Loomis (1990) used a test-retest method to determine the reliability of dichotomous choice estimates on total WTP, and concluded that it reduced the burden on the respondent without a loss in reliability.

2.4 Model Development

In economic analysis, utility is an economic measure of satisfaction consumers derive from goods and services. Economic welfare is the sum of individual levels of utility and represents a measure of society's well-being. An individual's utility function can be expressed as $U = V(w,y;s)$ where w is some change in the wildlife resource, y is all other goods, represented by income, and s is a vector representing the individual's attributes. Although individuals "know" their utility function, it is not observable to the researcher. Therefore, to estimate an equation which predicts an individual's choice, utility is divided into a systematic or non-random component, $V(w,y;s)$, which reflects the observable

component, and a random component, ϵ, which reflects the unobservable component. This indirect utility function is represented by:

(2-1) $U = v(w,y;s) + \epsilon_w$

It is assumed that when an individual is faced with a feasible set of discrete alternatives that he/she will choose the one that will maximize his/her utility. For example, the probability that an individual will respond 'yes' to a dichotomous WTP question depends on whether the utility gained from answering 'yes' and the loss of income is greater than the utility from responding 'no' and having spent the income on other goods. To illustrate, take for example an individual who is faced with a decision as to whether he/she is willing to pay more to hunt moose. The respondent has two choices: either to pay the amount and continue to hunt, or not pay and stop hunting. An individual is willing to pay to continue hunting (w=1) if:

(2-2) $v(1,y - x;s) + \epsilon_1 \geq v(0,y;s) + \epsilon_0$

where x = the dollar amount to be paid, and
w = 0, 1 indicates the no hunt, hunt option.

He/she is willing to pay \$x (w=1; y - x) if the utility of hunting (w=1) and the loss of income (y - x) is at least as great as not paying \$x (w=0; y) and foregoing hunting (w=0).

Demand theory demonstrates that a higher percentage of individuals will be willing to pay lower bids. Interpreting these percentages as probabilities that hunters will be willing to pay, expected values can be calculated (Loomis 1988). The dependent variable, the discrete response, is regressed on the explanatory variables which include the bid amount and socioeconomic variables; it is interpreted as the probability that an individual will vote 'yes' given an individual's attributes and the bid amount the individual is asked to pay. This regression results in a logit curve and the area under the curve is the expected value for WTP.

Since the utility function is unobservable to the researcher, an individual's choice is expressed in a probabilistic framework. The probability that an individual will be willing to pay a specified amount is expressed as:

(2-3) $P_o = F\eta(dv)$

where $dv = v(1, y - x;s) - v(0, y;s)$
$F\eta$ = cumulative probability distribution function of η

$\eta = \epsilon_0 - \epsilon_1$.

The cumulative distribution function (cdf) is the cumulative probability that WTP takes on a value greater than zero. The probability function, $F\eta(dv)$, allows estimates of welfare measures to be derived. The discrete choice model is interpreted as the theoretically correct measure of the value of an environmental quality/quantity change to an individual given his/her income and attributes that may influence the WTP decision (Hanemann 1984).

Hanemann (1984) provides a linear specification of the non-random component of the indirect utility function (for details on the derivation of the mean and median welfare measures, see Hanemann 1984):

(2-4) $v(w, y;s) = \alpha_w + \beta y$,
$w = 0, 1$

where α and β are estimate parameters. This utility function results in a utility difference, dv, where:

(2-5) $dv = (\alpha_1 - \alpha_0) - \beta x$.

Alternatively, welfare can be measured as the quantity of money needed to make an individual indifferent between (i) paying the specified amount and having the higher level of environmental quality and (ii) not paying and remaining at the same level of environmental quality. This welfare measure, the median of the distribution, can be expressed as:

(2-6) Prob $v(1, y - E^*;s) \geq v(0, y;s) = 0.5$

where E^* is the median of the distribution and satisfies:
$dv(E^*) = 0$.

This can be interpreted as the dollar value where 50% of the respondents would vote 'yes' and 50% would vote 'no.'

The expected value or mean of WTP, E^+, for Hanemann's linear utility-theoretic model (2-5) can be expressed as:

$$(2\text{-}7) \quad E^+ = \frac{1}{-\beta} \ln(1 + e^{\alpha}),$$

and the median can be expressed as:

$$(2\text{-}8) \quad E^* = -\alpha/\beta.$$

In some cases the differences between the mean and median welfare values may be substantial. The mean is more sensitive to skewness or kurtosis, and therefore may be heavily influenced by the tails of the distribution. The median, on the other hand, is a relatively robust measure of central tendency and less sensitive to outliers; however, it cannot be aggregated across the population (Boyle and Bishop 1988). If there is a "fat tail" or a large area under the tails of a probability distribution the median value may reflect the value of the majority of the population. However, if the true distribution is skewed (it is not a consequence of estimation), the median will not reflect the interest of those individuals who place a high value on the good.

In summary, the mean is a theoretically correct measure of expected value but may be questionable on statistical grounds, while the median is statistically preferred but does not result in a Pareto-efficient outcome (Pareto efficiency involves the comparison of aggregate gains and losses summed over the population. In order to achieve this, the mean must be taken across strata. Use of the median value will not result in a Pareto effiecient outcome, as the median voter preferes more or less public expenditure than consistent with Pareto efficiency, Johansson *et al.* 1989). The choice between the mean and median welfare measure will likely depend on whether the objective of welfare evaluation is to measure the welfare gain or loss to each individual, or to aggregate the gains and losses over all members of the population.

2.5 Discrete Choice Estimation

A discrete or qualitative choice model is used to analyse the yes/no responses to determine the probability that an individual with a set of attributes will make a given choice, and to estimate maximum WTP, a necessary condition to make a correct evaluation of economic efficiency (Loomis 1988).

A number of qualitative models are frequently used to analyse a discrete dependent variable: the linear probability, the probit, and the logit models. The linear probability model may result in estimated values falling outside the 0-1 interval, outcomes may be predicted with certainty, and estimates may be inefficient. The logit and probit models are effective in constraining the estimated probabilities into the 0-1 interval without creating probabilities equal to zero or one. However, the probit model which must be expressed as an integral, may create added computational costs, and involves nonlinear estimation. Therefore, the logit model is often used as it is more convenient analytically.

Maximum likelihood statistical estimation is used as a result of its large sampling properties that allow hypothesis testing of linear restrictions by asymptotic t-values and the likelihood ratio test (Amemiya 1981).

3.0 SURVEY DESIGN

Data were collected for this study through personal interviews, a mail-out household survey, and a mail-out moose hunting survey. In total, 232 personal interviews were conducted across the island of Newfoundland in gravel pit camping areas, and private, provincial, and national parks. The personal interviews served as a pretest to the household survey and were useful in reducing sample bias; the response rate was 100%. By asking individuals open-ended questions on their maximum WTP to preserve pine marten habitat, the pretest was also used to determine a range of values for the pine marten dichotomous contingent valuation question. Based on these open-ended valuation questions, uniformly distributed random dollar amounts between 1 and 100 were chosen in the dichotomous choice survey questions.

The household survey containing the pine marten valuation question was mailed to 2, 859 randomly selected households on the island of Newfoundland (Appendix A). A second questionnaire was sent out to non-respondents three weeks after the first mailing. The overall response rate was 51.48%.

The moose hunting survey containing the hunting valuation question was mailed to 1, 506 randomly selected moose hunters on the island of Newfoundland who were selected from the population of individuals who obtained licences for the 1992 season (Table 3-2). Again, a second questionnaire was sent out to non-respondents three weeks later. The overall response rate was 83.95%. Uniformly distributed random dollar amounts ranging between 1 and 100 were provided to respondents as a result of a pretest which asked hunters open-ended contingent valuation questions.

4.0 CONTINGENT VALUATION RESULTS FOR THE NEWFOUNDLAND PINE MARTEN

The Newfoundland pine marten requires large areas of over-mature forest and as a result, a conflict between traditional timber and marten management has been identified. Non-use values likely dominate the total value of the pine marten as there is virtually no consumptive use (trapping and snaring is prohibited in Newfoundland) and little non-consumptive use. The contingent valuation

question attempted to determine the existence value associated with the pine marten. Specifically, the question asked if an individual would be willing to pay an annual fee into a public trust fund that would set aside large areas of undisturbed mature forest (Appendix A).

4.1 Pine Marten Contingent Valuation Model

The variables expected to influence WTP are bid amount, household income, the number of children under the age of 16 living in a household, and education. The number of children under the age of 16 may act as a proxy for disposable income where the more children in this age bracket the household is supporting, the less income there is available for other uses. The probability that the respondent would be WTP was expected to be inversely related to the bid amount and the number of children under 16, and positively related to education (measured in years completed) and annual household income.

4.2 Empirical Results

Criteria used to evaluate the statistical model include: parameter values, signs, asymptotic test statistics, the likelihood ratio test, and summary statistics including the McFadden r-square, the percentage correct predictions, and the Hensher-Johnson (H-J) prediction success index. The McFadden r-square measures goodness of fit. The percentage correct predictions compares the calculated probabilities with the actual choice. The H-J prediction success index is the proportion of individuals expected to choose an alternative who actually choose that alternative minus the proportion which would be successfully predicted if the choice probabilities for each sampled individual were assumed to equal the predicted aggregate share (Hensher and Johnson 1981). This index takes into account that the proportion successfully predicted for an alternative will vary with the aggregate share of that alternative. The overall prediction success index can be determined by aggregating the indices over the alternatives, weighting, and normalizing. The highest obtainable value is one, and the greater the value the greater the predictive capability of the model.

There were a total of 554 useable pine marten contingent valuation responses. The coefficients in the model all had their expected signs and all were significant except household income (Table 4-1). As collinearity between variables can often be a factor attributing to insignificant variables, it was tested to see if it was a contributing factor. Pairwise correlation analysis showed no significant correlation between any of the independent variables. The insignificance of income may be a result of the lack of variation in income or it may simply not be a significant factor.

The summary statistics of the pine marten question show that the estimated model approximates the observed data quite well. The chi-square statistic resulting from the likelihood ratio test of the null hypothesis that all non-intercept parameters are zero shows that the model is significant.

Table 4-1 Pine marten dichotomous choice contingent valuation model

Variable	Coefficient
Intercept	-2.3630*[b]
	(-3.7833)[a]
Bid amount	-0.026348*
	(-6.8432)
Number of children	-0.22348**
	(-2.1188)
Education	0.17653*
	(3.6679)
Income	0.019013
	(.59522)
Sum[c]	0.106618
McFadden r-square	0.11574
Correct predictions (%)	75.1
H-J normalized success index	0.136
Chi-square (df)	74.66(4)
n	554

[a] Asymptotic t-values in parenthesis.
[b] Single asterisk indicates significance at the 1% level, double asterisk indicates significance at the 5% level, triple asterisk indicates significance at the 10% level, and no asterisk indicates the variable is not significant at the 10% level.
[c] Sum is the grand constant which is the sum of the explanatory variables (except the bid variable) multiplied by their means. Sum was calculated using the mean values of number of children (0.79422), education (14.148), and income (7.8664).

4.3 Welfare Measures

The mean welfare value was calculated by integrating the area under the estimated WTP function from zero to infinity. Equation 2-7 was used to determine the mean WTP value, and equation 2-8 to calculate the median value. The

parameters α and β represent the sum variable (the sum variable was calculated using (i) only significant variables and (ii) both significant and insignigicant variables. There was little difference between the calculated measures, and the results appear to be relatively robust. Therefore, insignificant variables were included in the sum variable to avoid specification bias.) and the bid coefficient, respectively. The sum variable acts as a socioeconomic shift factor by approximating the value to the "average" person by translating all of the shift variables into the intercept term (Cooper and Loomis 1992).

The estimated mean WTP value for the pine marten was $28.38, and the estimated median value $4.05. The mean value was higher than the median value indicating that the distribution is skewed to the right, and that average WTP may be influenced by the willingness of a small part of the population to pay relatively high amounts. The aggregate welfare measure for the pine marten, based on the 1991 Newfoundland population census of 367, 539 individuals over 20 years of age is $10, 430, 757 annually (The present value for the preservation of the pine marten, in perpetuity, at an interest rate of 5%, is $208,620,000. At an interest rate of 10%, the present value of the preservation of the pine marten isn $104,310,000.). The estimated mean WTP value for the Newfoundland pine marten compares favourably to other contingent valuation studies on threatened and endangered species. For example, Bowker and Stoll (1988) estimated the value of the whooping crane, an endangered species, at $21 - $149 U.S. annually (the range of values depends on the level of truncation, specification, and various other factors); Boyle and Bishop (1987) estimated the value of the bald eagle, a prominent endangered species, at $11 - $75 U.S. annually, and the striped shiner, a relatively obscure endangered species, at $4 - $6 U.S. annually; and Rubin et al. (1991) valued the northern spotted owl, a threatened species, at $50 U.S. annually.

As a result of the Newfoundland pine marten's requirement for large areas of undisturbed mature forest, more could be understood about the conflict between forest management and marten management through a benefit-cost analysis that examines the benefits of preserving the pine marten and the economic costs (lost jobs and timber revenues). The estimated WTP value for the pine marten can be incorporated into a benefit-cost analysis to determine if the benefits outweigh the costs of habitat preservation. Decision makers could assess the magnitude of the costs and benefits, as well as the distribution.

4.4 Other Results

One of the shortcomings associated with the discrete choice contingent valuation is that it is difficult to identify the reason that individuals respond 'no.' Some individuals may answer 'no' because they are protesting the question format, others because the presented bid is too high. For this reason, respondents were asked why they answered 'no' to determine whether the negative response was due to a rejection of the developed hypothetical market. Protest responses do not indicate the received benefits, rather they are protests against a part of the simulated market developed in the contingent valuation question. Respondents were given a choice of options if they answered 'no' (Appendix A). As well as these choices, the respondent could choose an 'other' category where he/she could express other reasons for answering 'no.'

In the pine marten contingent valuation question, 'no' responses were not deleted from the analysis. Almost a quarter (22.66%) of those who answered 'no' to the pine marten contingent valuation question would pay something other than the value stated (Table 4-2). The 'other' category was chosen 15.25% of the time, with reasons ranging from individuals believing that it was a government responsibility to protect and preserve threatened species, to not knowing enough about the pine marten, to higher priorities for spending disposable income.

5.0 CONTINGENT VALUATION RESULTS FOR THE MOOSE HUNTING SURVEY

Moose hunting in Newfoundland is an integral part of many Newfoundlanders' way of life. In 1992, 28, 390 moose hunting permits were issued. However, hunting permits in Newfoundland are not sold through competitive markets and licence fees do not reflect the full economic value associated with moose hunting. One of the objectives of the moose hunting survey was to estimate the net economic value of moose hunting under current conditions. Respondents were asked if benefits received during the season were worth the money spent on moose hunting. If they answered 'yes' they were asked if out-of-pocket costs increased during the season would they continue to hunt moose (Appendix A). Randomly selected bid amounts between 1 and 100 were written on the questionnaires. The contingent valuation question followed a section where the respondents were asked to fill out their expenses during the season so that the respondent had a good idea of how much he/she had spent.

Economic theory suggests that individual preferences

Table 4-2 Reasons respondents answered 'no' to the pine marten willingness to pay question.

Justification	Frequency	Percent
1) I do not receive any benefits from the pine marten	69	15.03
2) I am not interested in donating any money towards the preservation of the pine marten	86	18.74
3) I do not think the pine marten should get in the way of the forest industry	55	11.98
4) I would pay something other than the value stated above*	104	22.66
5) I cannot afford it	38	8.28
6) Other	70	15.25
7) 1 & 2	15	3.27
8) 1, 2 & 3	9	1.96
9) Missing values	13	2.83
Total	459	100.00

*The mean amount given by respondents was $16.41.

are important in explaining demand choice. Questions in the survey were designed to measure individual preferences for various quality components of a moose hunting trip. The variables used in the moose hunting regression equations include ordinal variables which indicate the enjoyment of travelling time to the hunting site, and the importance of moose hunting compared to other recreational activities.

5.1 Moose Hunting Contingent Valuation Model

The variables expected to influence whether the individual would answer 'yes' to the bid amount include the bid amount, annual household income, travel time, and the importance of moose hunting as a recreational activity compared to other recreational activities. The probability that the hunter is willing to pay the bid amount is expected to be inversely related to the bid amount and positively related to household income, the importance of moose hunting as a recreational activity, and how enjoyable the time is spent travelling.

5.2 Empirical Results

There were a total of 1, 053 useable contingent valuation responses in the moose hunting survey. The same criteria used to evaluate the pine marten model was used to evaluate the moose hunting model. All coefficients had their expected signs and were significant (Table 5-1). The summary statistics indicate the estimated model approximates the observed data well and the likelihood ratio test shows that the model is significant.

5.3 Welfare Measures

The mean WTP for moose hunting under current conditions was $131.01 per hunting season, and the median value was $122.54. Again, the mean value was higher than the median value but the difference was not substantial and the estimated values appear to be relatively robust. The aggregate value of moose hunting, based on the 28, 390 moose hunting licences issued in 1992, was $3, 719,

374/season. These moose hunting values are similar to estimates obtained in other hunting studies (Asafu-Adjaye 1989; Loomis *et al.* 1989; Walsh *et al.* 1989; Filion *et al.* 1990).

Table 5-1 Moose hunting dichotomous choice contingent valuation model: increased out-of-pocket expences.

Variable	Coefficient
Intercept	-1.0609*[b]
	(-3.1054)[a]
Bid amount	-0.01536*
	(-5.9696)
Importance of hunting	-0.20405*
	(3.7951)
Travel time	0.36710*
	(5.5180)
Income	0.13521*
	(5.4039)
Sum[c]	1.9168765
McFadden r-square	0.10424
Correct predictions (%)	74.4
H-J normalized success index	0.121
Chi-square (df)	127.14(4)
n	1053

[a] Asymptotic t-values in parenthesis.
[b] Single asterisk indicates significance at the 1% level, double asterisk indicates significance at the 5% level, triple asterisk indicates significance at the 10% level, and no asterisk indicates the variable is not significant at the 10% level.
[c] Sum was calculated using the mean values importance of hunting (3.7066), travel time (3.4710), and income (7.0057).

5.4 Other Results

A moose hunter's average expenditure was $185/trip and the average hunter took five trips in the hunting season. Therefore, the estimated utility-theoretic welfare measure for the net economic value of moose hunting ($131.01/season) may appear somewhat low compared to expenditures. It is possible that moose hunters spend a large portion of their total WTP in travelling to the site and on various other expenses. This is reinforced when examining the reasons respondents answered 'no' (Table 5-2). For example, 50.97% indicated that they either could not afford, or would not pay any more than they already pay to go moose hunting. Further, when hunters were asked to rank their reasons for moose hunting (sport, food, recreation, or other) in order of importance, food ranked first 66.7% of the time (Condon 1993). From this it is likely that moose hunters would not be willing to pay much more for moose hunting than for the equivalent amount of meat that could be purchased from the market.

Table 5-2 Reasons respondents answered 'no' to the contingent valuation question on increased out-of-pocket expenses

Reason	Frequency	Percent
1) The benefits I receive from moosehunting would not be worth the extra money	78	30.35
2) I cannot afford or would not pay any more than I already pay	131	50.97
3) Other	48	18.68
Total	257	100.00

6.0 DISCUSSION

Although it is recognized that individuals have value for environmental goods and services in which they may not participate or consume, estimating non-use values generally presents more difficulty than use values. Non-use values, unlike use values, are not revealed by an individual's actions; however, they may be partially revealed though voluntary contributions or political processes. Individuals have non-use values for reasons ranging from altruism to feelings of environmental responsibility (Randall and Stoll 1983). In this report, we estimated a use value (moose hunting) and a non-use value (existence of pine marten). In a comparison of the results of these analyses, one might expect non-use value results to be characterized by poor statistical fit and more diffuse responses to the contingent valuation questions. However, in comparing the moose hunting to the pine marten results we notice that:

(a) the statistical fit (measured by McFadden r-square, percent correct predictions and H-J success index) is at least as good in the models measuring non-use values, and that both models predict responses quite well;
(b) the parameter estimate on the proposed payment is strongly significant in both models;
(c) the analysis of answers to the question "why did you not accept the dollar amount?" reveals that in both cases respondents appear to have understood the questions and provided appropriate responses.

These results suggest that, in this study, the non-use value measurements are as "accurate" as the use value responses.

However, measurement of non-use values still raises some unique issues. First, how does the level of awareness or knowledge affect the magnitude of non-use values? In the pine marten contingent valuation question, many respondents in the personal interview survey and the household survey indicated that they did not have any previous knowledge of the Newfoundland pine marten. Is it possible to form accurate valuations for a species in which the respondent has had no previous experience or knowledge of its existence? Bishop and Welsh (1992) argue that it is theoretically possible that existence values "exist" for even obscure or previously unknown species or resources, even though respondents may not have full information. Incomplete information may reflect that, previously, the individual had never been faced with that choice situation. Further, incomplete information is not unique to non-market goods. Individuals are faced with incomplete information when purchasing market goods; for example, the choice of a house buyer may change significantly if he/she knew of a proposed freeway system in close proximity.

The objective of benefit evaluation is to obtain preferences from individuals that represent the population as a whole once they are presented with a set of available information about the issue. However, although it is theoretically possible to have existence values for goods and services that were previously unknown to the respondent, increments in information may result in large shifts in existence values. For example, if new information rendered a species, previously thought to have a healthy and viable population, endangered, there may be a large shift in its existence value. Although, as Randall and Stoll (1983) point out, it is not the estimates of existence values that are volatile; rather it is the perceived reality of the existence value when information is introduced.

The second issue involves the determination of who is benefitting from preserving a threatened or endangered species or wilderness area. For example, who benefits from the knowledge that there are polar bears in the arctic? Demand for these services is often not related to economic activity within the region. Many value the northern spotted owl, a threatened species in the Pacific Northwest, and these individuals live across the United States, and perhaps around the world. A benefit-cost analysis on the preservation of the northern spotted owl showed that the net benefits were negative in Washington and Oregon, but positive in all other areas across the United States (Rubin *et al.*, 1991). This resulted in the benefits outweighing the costs on a national basis. The relevant population base can determine whether the benefits outweigh the costs.

A third issue involves the question, if individuals value the Newfoundland pine marten merely for its existence, do they value the whooping crane, the bald eagle, the striped shiner and all other endangered species, and if so, are they willing to pay to ensure the survival of all threatened species? This sum of money could become exponentially large if these values were simply added together. McConnell (1983) suggests that individuals have a two-stage contingent market process: in the first stage, a budget to be spent on existence goods is determined, and in the second, the consumer chooses among various types of existence goods. Further, Bishop and Welsh (1992) state that this "adding-up" issue really is a non-issue as values cannot be added to one another without careful consideration of the relationships between them.

Emerging from the "adding-up" issue is the relative importance of uniqueness, scarcity, and substitution possibilities in existence values. All of these factors may affect the resulting magnitude of the existence value.

One of the most challenging issues in the measurement of non-use values is the embedding phenomenon. Embedding exists when the value of a good changes depending on the ordering of goods presented to the respondent. In particular, relative to being valued independently, the value of the good appears to decrease when its value is elicited after a more encompassing good is valued. Empirical evidence suggests that embedding occurs quite frequently in the measurement of non-use value (Kahneman and Knetsch 1992). While the analysis presented in this report did not examine the research on the embedding effect, this is an area that requires further research (for recent research on embedding effects in nontimber valuation, see Loomis *et al.* 1993 or Tanguay 1993).

Capturing non-use values may provide a new set of

problems and challenges, but as Bishop and Welsh (1992) state, "to ignore existence values would be to court the equally damning criticism of having made a thinly masked value judgement in favour of use values as the only true economic values. Having come this far in the valuation of natural resources, do we dare turn away from this new challenge?"

The CVM has the potential to be a useful tool in measuring the values associated with nontimber resources. Although estimating non-use values may present more challenges, the results of this study seem to demonstrate that the following guidelines may help reduce the volatility of the estimates:

(a) careful pretesting of the survey question;

(b) the use of the dichotomous choice format which puts fewer "mental" demands on the respondent and resembles a real market situation;

(c) having a check in place to ensure that the respondent understands the market developed, such as a follow-up question to determine the reasons behind responses. These guidelines have also been suggested by the NOAA panel on contingent valuation (Arrow *et al.* 1993).

This paper has examined the valuation of nontimber resources in Newfoundland. Specifically, it addressed a use value, moose hunting, and a non-use value, the existence of the Newfoundland pine marten. Both wildlife resources are of considerable importance in Newfoundland. Although one might expect non-use estimates to be more volatile, this study demonstrates that the non-use value responses appear as reliable as the use value responses. The next logical question is: are both sets of results "reliable" in some sense? This, however, is a topic for further research.

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APPENDIX A

Household survey contingent valuation question

The Newfoundland pine marten is a small mammal that is a member of the weasel family. It is about twice as large as a squirrel and its colour varies from dark brown or near black to pale buff with irregular markings on the throat and/or underside. The pine marten is found on the west coast of Newfoundland with the greatest concentrations between Grand Lake and Corner Brook. It spends most of its time in tree tops and prefers large tracts of undisturbed mature forest. The pine marten is considered a threatened species due to logging, snaring and disease. Research has shown that clearcutting of forests reduces the population of pine martens in the affected areas by 60%.

Would you be willing to pay $ _____ per year into a public trust fund that would set aside large areas of undisturbed mature forest for the pine marten to ensure the species does not suffer further losses in population?

_____ Yes
_____ No

If your answer in the previous question was no, please tell us why.

_____ I do not receive any benefits from the pine marten.
_____ I am not interested in donating any money towards the preservation of the pine marten.
_____ I do not think the pine marten should get in the way of the forest industry.
_____ I would pay something other than the value stated above.
Please indicate the value $_____.
_____ Other (please specify).

Moose hunting survey contingent valuation question

Were the benefits received during the season worth the money you spent moose hunting?

_____ Yes
_____ No

If the out-of-pocket costs incurred during the season were to increase by $_____ would you still continue to hunt moose?

_____ Yes
_____ No

If your answer to the previous question was no, please tell us why.

_____ The benefits I receive from moose hunting would not be worth the extra money.
_____ I cannot afford or would not pay any more than I already pay.
_____ Other (please specify).