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The Economic Valuation of Nontimber Resources in Newfoundland: A CVM Approach

by

Barbara Susan Condon

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE
IN
FOREST ECONOMICS

DEPARTMENT OF RURAL ECONOMY
EDMONTON, ALBERTA
FALL 1993

ISBN 0-315-88120-8

UNIVERSITY OF ALBERTA

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NAME OF AUTHOR Barbara Susan Condon

NAME OF THESIS The Economic Valuation of Nontimber Resources in Newfoundland: A CVM Approach

DEGREE FOR WHICH THESIS WAS PRESENTED Master of Science

YEAR THIS DEGREE WAS GRANTED Fall 1993

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DATED June 21, 93

UNIVERSITY OF ALBERTA

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ABSTRACT

A discrete choice contingent valuation model was developed to estimate the value of some of the nontimber resources in Newfoundland and to examine the value of changes in environmental quality that could result from management changes. Data were collected for this thesis through personal interviews, a household survey and a moose hunting survey. A logit model was used to determine the probability that an individual would answer yes to the discrete choice contingent valuation question given his/her socioeconomic characteristics, preferences, budget constraint, and the amount he/she was willing to pay. Three specifications were used to estimate welfare measures associated with the contingent valuation questions: two specifications were consistent with utility theory and one specification was not strictly compatible with utility theory. It has been argued that the model that is inconsistent with utility theory provides a superior statistical fit. The sensitivity of the welfare measures was investigated. The models were relatively robust across specifications and no specification was consistently statistically superior. Therefore, in this case, the advantages of adopting an explicit utility function to model responses and obtain theoretically correct measures of welfare appear to outweigh the advantage of improved statistical fit.

The results of the models show there is substantial value associated with the nontimber resources in Newfoundland. However, the results suggest caution should be used when applying the results of the discrete choice contingent valuation method. Welfare measures are sensitive to truncation, specification and the choice of statistical estimation. Although not explicitly investigated in this thesis, moral satisfaction and the embedding effect may also influence willingness to pay responses.

The discrete choice contingent valuation method appears to be one of the best available tools for valuing nontimber resources. Future research should focus on how to separate the signal from the noise in the contingent valuation responses and how to best model the signal within the responses.

ACKNOWLEDGEMENTS

There are many people during my graduate program that I would like to thank for their guidance, support and friendship. First, I would like to thank my supervisor, Dr. W. Adamowicz, for his helpful suggestions and encouragement. Although most of my research and analysis was done in Newfoundland, Vic was always available to offer invaluable advise.

Second, I would like to thank the staff at Forestry Canada in Newfoundland for providing such a positive working environment. I would like to thank Peter Trelawny for his administrative and technical assistance and moral support during my research in Newfoundland. The numerous informal discussions, encouragement and brutal squash games make the countless hours of envelope stuffing and data entry pass quickly. I would also like to thank Craig Collins for spending the countless hours of envelope stuffing with me and for all of his technical support. Next, I would like to thank Dave Higdon who provided indispensable computer support and who always made time in his hectic schedule to help me with my somewhat endless computer problems.

There are many other people whose assistance was greatly appreciated. I would like to thank Grant Milne and Bill Phillips for initiating this project; Judy Boucher, Rural Economy, for typing and editing my surveys; Rick Gulliver at the Wildlife Division, St. John's, for providing the information needed in the moose hunting survey; and Bonnie Hill at Provincial Parks, St. John's, for providing valuable feedback on questionnaire design.

Last, I would like to thank Mark Tanguay and my family for their endless support and encouragement during my graduate program.

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1.0 Introduction

Forests supply a diverse combination of market and nonmarket goods creating a complex management problem for the utilization of the forest resource. The values associated with conventional forest products, such as lumber and pulp and paper, pass directly through the market system. On the other hand, there are many benefits derived from timber resources that do not pass through the market system that are more difficult to measure, such as the value of a day spent hunting, fishing, or birdwatching. It is becoming increasingly important to identify these nonmarket benefits due to the increased pressures on our natural resources, the increased demand for nontimber resources, and society's strong desire to preserve our natural heritage for future generations.

Forest land managers on Crown lands are faced with managing forests not only for the timber and the wood products produced from it, but also for other uses such as wildlife and recreation. Managing the forest for multiple use is an enormous challenge and the key to success is the recognition of the interdependencies in production between uneven aged timber stands, wildlife habitat, watershed maintenance and forest recreation (Bowes and Krutilla,1989). The difficulty lies in the selection of the optimal management program so as to best provide the combined social net benefits from timber and other multiple use services where the optimal forest management program will depend on the relative values of wood production and nontimber resources.

A major constraint to integrated resource management in Newfoundland is inadequate information on forest land values apart from commercial timber. In Newfoundland, fish and wildlife living in forest habitats provide important social benefits and are strongly linked to rural life throughout the province. The objective of this thesis, using personal interviews, a mail-out household survey and a mail-out moose hunting survey, was to estimate some of the economic values associated with the nontimber resources in Newfoundland. A discrete choice contingen

valuation model was developed to examine the value of changes in environmental quality that could result from forest management changes.

In the absence of market prices, the contingent valuation method (CVM) provides a means of valuing nontimber goods and services to consumers. Although, there are a wide variety of approaches to elicit values in the CVM, close-ended questioning, or the dichotomous choice approach, has recently received relatively wide-spread attention as it provides an approach that mimics market behaviour. This approach involves asking individuals whether or not they would be willing to pay a specified amount of money for a change in environmental quality or quantity. The offer amounts are varied across individuals and the respondent simply answers yes or no to the contingent valuation question. The probability that an individual will respond "yes" to the willingness to pay (WTP) question depends on whether the utility gained from paying the amount and the loss of income is greater than the utility from having spent the income on other goods. Although an individual will always select an alternative that will maximize his/her utility, his/her choice contains some components which are unobservable to the researcher, and therefore, an individual's utility must be treated as a random variable. These unobservable components include variation in tastes among individuals in a population and other unobserved variables. Therefore, there are two components of utility that must be modelled; a deterministic component and a random component. The deterministic or non-random component reflects the observable component of an individual's utility and the random component reflects the unobservable component. The systematic portion of the response to the contingent valuation question can be retrieved by developing a formal model of individual behaviour to describe preferences where a specific estimating equation is derived from a utility function (Hanemann, 1985).

As utility is ordinal, the specification of the absolute levels of utility is irrelevant, only the difference between utility levels is important. Monotonic transformations will not change the

relative ranking of alternatives, and therefore, will not affect the probability that a choice will be made. This is the basis of the utility difference model developed by Hanemann (1984) which provides the theoretical foundation to derive the parameters necessary for estimating the expected value of WTP.

As the dichotomous choice contingent valuation questions involve yes/no responses, a qualitative choice model is used to analyze the responses. If the probability distribution of the error term is believed to have a Type I extreme value distribution, a logit model can be used in estimation. This non-linear model is consistent with the theory of consumer utility maximization.

Maximum likelihood estimation is used in statistical estimation to derive a logit curve which plots predicted probabilities from the logistic regression against WTP values. The area below the curve can be integrated to determine the expected value for WTP. Therefore, assuming utility maximization, a specific estimating question can be derived from a utility function and a budget constraint, and estimates of expected values can be obtained.

The valuation of nonmarket goods and services has increased over the past few decades as decision makers are increasingly faced with conflicts over resource use. One of the most important reasons for valuing nontimber goods and services is that so both priced and unpriced goods and services can be included in resource allocation decisions. Benefit-Cost Analysis (BCA) is a useful tool in accessing the economic feasibility of projects, ranking projects, and optimizing the scale of projects. It attempts to measure the welfare gains and losses to society by aggregating the monetary values of the benefits and costs involved. The basis for BCA is efficiency in resource use. Therefore, by quantifying the nontimber values, both the timber and nontimber goods and services of the forest can be evaluated on the common base of monetary units and the tradeoffs involved in integrated resource management can be examined. For example, the value of timber harvesting on an area of forested land can be compared with the benefits from

recreation on the same area of land to determine which land use yields the highest value.

Economic models have been developed which incorporate nontimber values into rotation decisions (Hartman,1976; Calish et al.,1978; Englin,1989). Generally, amenity values are represented by an amenity function which include a variety of activities. If the amenity function is increasing over time, the optimal timber rotation is lengthened, whereas if the amenity function is decreasing over time, the rotation period is shortened.

Nontimber values are important for identifying the regional distribution of these services and the regional economic impacts (Adamowicz,1992). Individuals incur costs while using nontimber resources and although this is different from measures of value, expenditures are important from a regional economic standpoint. Nontimber values can also be used in determining compensation in cases of loss or damage. Valuation techniques, such as the travel cost model and the contingent valuation model, have been used in court cases in Canada and the United States and have been accepted by the United States Resources Council as acceptable methods for valuing nontimber goods and services (Adamowicz,1992). Last, although timber values can be included in national income accounting, the services provided by nontimber resources are not included in national accounts. Although this may not be a concern in Newfoundland, it is a growing concern in many developing countries where growth may be illusionary if it is based on depleting the country's renewable natural resource base.

The remainder of this thesis is organized as follows: Chapter 2 reviews the theoretical basis of the contingent valuation method, particularly the discrete choice method. Chapter 3 describes the survey design. Chapter 4 summarizes the results of the contingent valuation questions in the household survey. Chapter 5 summarizes the results of the contingent valuation questions in the moose hunting survey. Chapter 6 consists of a discussion of the implications of the results and directions for future research. Appendix A provides the results of the contingent

valuation questions in the personal interview surveys that were used as a pretest to the household survey. Appendix B contains copies of the household, moose hunting and personal interview surveys.

For the results from the personal interview survey, the household survey and the moose hunting survey, that are not covered in this thesis, refer to Condon and Adamowicz (1993).

2.0 Theoretical Background

This chapter will define economic value, examine the different types of values, review 2 common theoretical models used in benefit estimation, specifically the contingent valuation method when dealing with discrete choices, and review theoretical models in which Hicksian equivalent surplus measures can be obtained.

2.1 Economic Value

The objective of benefit estimation is to determine the value, in monetary terms, of the impact of a change in quality and quantity of a good or service that does not have a market price. Economic value, in monetary terms, refers 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). Economic value is the combination of the ability to pay, the value assigned to the desired end, the perceived efficacy of the good as an instrument to that end, and the availability, perceived efficacy, and price of alternatives (Peterson et al.,1990). It not only depends on short run personal preferences but on the long run institutional context (Bromley,1982). The basic premise of economic value is that the value of a commodity is not intrinsic but depends on the preference systems held by individuals (Brown, 1984). Therefore, economic value is not constant, and may change over time and vary across individuals.

In many cases the value of nontimber resources cannot be captured through its market price, either because there is no market price associated with the resource, as in the case of viewing wildlife, or the price does not reflect its economic value. Licence fees for hunters do not cover the benefits received, rather they are used to regulate the wildlife taken. In the same respect, the nominal entrance fees charged in forest recreation areas do not account for all the benefits received, but are kept at low levels to ensure that no one is excluded due to income constraints. Since these fees fail to reflect the true value of nontimber resources to society, it is

important to use alternative methods to estimate their values. Consumer surplus is a useful measure to determine the maximum amount of money an individual would pay above what he/she has already paid to receive the benefits from the good in question. There are four measures of consumer surplus: compensating variation (CV), compensating surplus (CS), equivalent variation (EV), and equivalent surplus (ES). The surplus measures are welfare measures where the consumer is constrained to buy only fixed quantities whereas the variation measures allow the consumer to vary the quantities purchased. The compensating measures are defined as the amount of compensation, paid or received, which would make an individual as well off as before a change (Boadway and Bruce,1984). The equivalent measures are defined as the amount of compensation, paid or received, which would make an individual as well off as they would be after the change. A compensating measure would be the amount of money an individual would accept in compensation for a decline in an environmental service whereas an equivalent measure refers to the amount of money an individual would pay to avoid the decline in environmental quality.

2.2 Types of Values

The benefits that accrue from nontimber resources are diverse and can be divided into use values and non-use values. Among the use values of nontimber resources are those in which users receive benefits directly or indirectly. Some users value nontimber resources directly though consumptive uses such as hunting or fishing, while others benefit indirectly through non-consumptive uses such as wildlife photography or birdwatching.

It was recognized by Wantrup (1952) that a significant proportion of the value of a resource was being ignored when only use values were being considered. The non-use values became known as preservation values which were divided into existence, bequest and option values. Existence values are the values placed on nontimber resources, such as wildlife, by people

who find it important knowing that there is wildlife within the forests, even though they may never see them. For example, many people value the Newfoundland Pine Marten, yet few people will ever see one. Preserving nontimber resources for future generations is known as bequest values. It reflects the importance that we place on passing on a diverse and relatively unspoiled natural environment. Last, option values are the values an individual places on preserving an area, although that individual may never use the area, but is willing to pay to perpetuate the availability of nontimber resources (Nautiyal,1988). Option values arise from a combination of the individual's uncertainty about his/her future demand for the site and uncertainty about it's future availability (Cicchetti and Freeman,1971).

2.3 Theoretical Models

Two commonly used approaches to measure nonmarket values are the contingent valuation method (CVM) and the travel cost method (TCM). The CVM involves the use of surveys to determine consumer's willingness to pay (WTP) for a nonmarket good. This method of benefit estimation has been accepted by the United States Department of Interior (1986) for valuing nonmarket goods and has been recommended by the United States Resources Council (1979,1983). The travel cost method (TCM) uses travel cost as a proxy for price to estimate demand. It relies on observations of actual behaviour to determine a value for the environmental amenity. Individuals from different origins face varying travel costs and therefore will visit a site at different rates. 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 (Wilman,1980; Smith and Desvousges,1986; Cesario and Knetsch,1970; McConnell and Strand,1981), second, it is restrictive in that it can only be used to value use values, and third, it is difficult to determine an appropriate functional form (Ziemer et al.,1980; Kling,1988; Adamowicz et al.,1989). Due to these restrictions, and

the more robust nature of the CVM in that it is able to value both use and non-use values associated with an environmental quality change, the CVM was chosen in this thesis as the method for benefit estimation. Further, as one of the objectives of this thesis was to quantify the value of changes in environmental quality that could result from changes in forest management, the CVM provided the necessary flexibility.

2.4 The Contingent Valuation Method

The contingent valuation method (CVM) elicits responses from participants concerning the price they would be willing to pay in order to obtain or maintain an environmental improvement. Willingness to pay (WTP) is defined as the amount of money an individual would pay to obtain the change and still be as well off as before the change. The CVM is based on establishing a hypothetical market and asking individuals to reveal extra market values contingent upon the existence of this market. The WTP method provides a means of discovering a price that the individual would pay if a market system did exist, or in other words, it provides a means of capturing the consumer surplus. Two assumptions are implicit in this model; consumers have the ability to assign accurate values to nontimber resources and the values can be captured in the hypothetical markets developed.

The CVM must establish baseline conditions with respect to the availability of nontimber values, 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 participants' WTP. As well, it must outline the conditions for provision of the environmental improvement and the method of payment. The quality of the results depends on the characteristics developed within the contingent market.

There are various techniques involved in administering the contingent valuation survey and

some controversy as to which technique is the most appropriate. The most common techniques are iterative bidding, open-ended questioning, and dichotomous choice. The iterative bidding technique begins with an interviewer developing the market conditions under which the item is to be valued. The interviewer then asks whether the interviewee will accept an initial bid, and then depending on the response from the interviewee, the interviewer increases or decreases the bid until an acceptable value is found (Boyle and Bishop,1988). This results in a final bid which can be used as a measure of Hicksian compensating or equivalent surplus for the item being valued. There are two drawbacks associated with the iterative bidding technique. First, individuals may be bid up beyond their true WTP in order to satisfy the interviewer and appear generous towards the cause, and second, this technique may involve a starting point bias where discrepancies arise in the reported value of an item depending on the initial bid value (Samples,1985; Boyle et al.,1985).

In open-ended questioning the respondent is asked the maximum he/she is willing to pay for a change in environmental quality. Although this method eliminates a starting point bias, some studies indicate that individuals may have difficulty in revealing an accurate valuation for nonmarket resources (Seller et al.,1985).

The dichotomous technique or close-ended questioning involves asking respondents whether they are willing to accept or reject a value. The values are varied across respondents and only a yes or no response is required. The advantage of this method is that the respondent is not faced with the complexities of the iterative bidding technique, and therefore, it is relatively simple for the respondent as he/she does not have to come up with exact values. Although less information is obtained about respondents' preferences, this technique may be inherently more reliable as individuals only have to place bounds on their valuation. As well, dichotomous contingent valuation questions resemble a more familiar market setting. 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 loss in reliability of the estimated WTP. The dichotomous technique is simple to administer as no interviewer is required and the interviewer and starting biases are eliminated. As a result of these advantages, the contingent valuation questions in this thesis were constructed to obtain yes or no responses. These dichotomous choices make it necessary to analyze the responses in a discrete choice framework.

2.5 Discrete Choice Theory

Discrete choice theory parallels consumer theory in that an individual is assumed to have consistent and transitive preferences over a range of alternatives that determine a preference ordering. However, instead of deriving demand functions, discrete choice analysis operates directly from utility functions (Ben-Akiva and Lerman,1987). This divergence between discrete choice theory and consumer theory is a result of the presence of corner solutions in discrete choice where the dependent variable is a dichotomous choice.

The purposes of discrete choice analysis are to determine the probability that an individual with a set of attributes will make a given choice, and to infer maximum WTP, a necessary condition to make a correct evaluation of economic efficiency (Loomis, 1988). The dependent variable, the discrete response, is regressed on the explanatory variables and the predicted values fall between 0 and 1. The dependent variable is interpreted as the probability that an individual will vote yes given an individual's attributes and the amount of the offer which the individual must pay. Discrete choice analysis also allows predictions to be made with respect to individuals not in the original sample.

There are a few models that are frequently used to analyze a discrete dependent variable: the linear probability model (LPM), the probit model and the logit model (Amemiya,1985).

Linear Probability Model $$F(x)=x \qquad (2-1)$$

Probit Model $$F(x)=\phi(x)=\int_{x}^{-\infty}\frac{1}{\sqrt{2\Pi}}\exp[-(t^2/2)]dt \qquad (2-2)$$

Logit Model $$F(x)=\Lambda(x)=\frac{e^x}{1+e^x} \qquad (2-3)$$

There are a few drawbacks in using the LPM when the dependent variable is qualitative. First, the mathematical expectation of a qualitative variable is a nonlinear function of its independent variables and therefore the LPM is incorrectly specified (Aldrich and Nelson,1984). Second, the LPM results in predicted values falling outside the 0-1 interval or outcomes predicted with certainty which is not consistent with expectations. Third, although the coefficients may be unbiased, the estimates are not efficient and the error term is heteroscedastic (Pindyck and Rubinfeld,1981). Although heteroscedasticity can be corrected for using weighted least squares, observations may still lie outside the range of 0 and 1. If the linear model is used when the true relationship between the independent and dependent variable is nonlinear, the distribution properties will not hold, the estimates will be biased and the variance will not be correctly estimated (Aldrich and Nelson,1984).

Both the logit and the probit models are effective in constraining the estimated probabilities into the 0-1 interval without creating probabilities equal to zero or one. The probit model is based on the cumulative normal function and the logit model is based on the logistic function. Although the logistic and normal cumulative distributions are very similar and yield similar predicted probabilities, the probit model must be expressed as an integral, it may create added computational costs and involve nonlinear estimation. Therefore, the logit model is often used as it is more convenient analytically.

The logistic distribution is a smooth S shaped curve. The distribution is the greatest when $P = 1/2$ implying that the changes in the independent variables will have their greatest impact on the probability of choosing a given option at the midpoint of the distribution. The relatively low slopes near the end points of the distribution imply that large changes in the explanatory variables are necessary to bring about a small change in probabilities.

In order to calculate an individual's WTP for an environmental quality change, the logit model is estimated using a maximum likelihood method approach. The maximum likelihood estimates are unbiased, efficient, and normality holds asymptotically. A likelihood function is constructed which gives the probability of the observed data as a function of the unknown parameters (Hosmer and Lemeshow,1989). The objective of maximum likelihood estimation is to find the parameters which maximize the logit likelihood $L(Y/X,\beta)$. The likelihood function is the product of those who voted yes and those who voted no and is represented by

$$L(Y|X_i\beta)=\Pi_i\frac{e^{X_i\beta}}{1+e^{X_i\beta}}\Pi_j\frac{1}{1+e^{X_j\beta}} \tag{2-4}$$

where i = 1, yes response

j = 0, no response

XB = linear function of the attributes of the individual

2.6 Welfare Measures

It is assumed that when an individual is faced with a feasible set of discrete alternatives that he/she will choose the alternative that will maximize his/her utility. An individual's utility function can be expressed as a function of an environmental amenity, i, and all other goods, y, represented by income. The utility function is given by U = v(i,y;s) where s is the vector of attributes of the individual that may influence the WTP decision. Although the individual knows his/her utility function, it is not observable to the researcher and therefore in order to estimate an equation to predict individual's choices, utility must be divided into a systematic or non-random component, v(i,y;s), which reflects the observable component, and a random component,

ϵ, which reflects the unobservable component of an individual's utility. The utility function is given by

(2-5) $\quad u = v(i,y;s) + \epsilon_i,\ i=0,1$

where ϵ_0 and ϵ_1 are assumed to be independently and identically distributed random variables with zero mean.

The individual is faced with the decision as to whether he/she is willing to pay \$X for an increase in the quality of an environmental amenity. The respondent only needs to know which situation is preferred without actually assigning a value to the choice. An individual is WTP if

(2-6) $\quad v(1,y - \$x;s) + \epsilon_1 \geq v(0,y;s) + \epsilon_0$

where \$x = the bid amount

$i = 1$ indicates the presence of the quality increase

He/she is willing to pay \$x($i=1$; y - \$x) if the utility of the increase in environmental quality and the loss of income is at least as great as not paying \$x, and foregoing the increased environmental quality. As the utility function is unobservable to the researcher, individual's choices must be expressed in a probabilistic framework. The probability that an individual will be WTP a specified amount is expressed as

(2-7) $\quad P_o = F\eta(dv)$

where $dv = v(1,y - \$x;s) - v(0,y;s)$

$F\eta$ = cumulative probability distribution function (c.d.f.) of η

$\eta = \epsilon_0 - \epsilon_1$

The cumulative distribution function is the cumulative probability that willingness to pay will take on a value greater than zero. The c.d.f. in the probit model is the standard normal c.d.f., and in the logit model it is the logistic c.d.f. Estimating the probability function $F\eta(dv)$ allows estimates of welfare measures to be derived. If dv is considered the utility difference, then the

discrete choice model is interpreted as the theoretically correct measure of the value of an environmental quality change to an individual given his/her income and socioeconomic factors (Hanemann,1984).

Interpreting individual's choices in a probabilistic choice framework in discrete choice analysis is necessary for a few other reasons. First, individuals in choice situations may not always select the same alternative in repeat trials, and second, this probabilistic framework can capture the difference in choices between individuals who have identical choice sets, attributes, and socioeconomic characteristics (Ben-Akiva and Lerman,1987).

In order to retrieve the systematic portion of the response to the contingent valuation question, Hanemann (1985) suggests developing a formal model of individual behaviour to describe preferences where a specific estimating equation is derived from a utility function. He believes individuals may not know how they would respond to a new or previously unexposed good or service but once the choice is made, preferences are generally stable. Together with the maintained hypothesis of utility maximization, the specification of a utility function and a budget constraint, estimates of an individual's WTP can be recovered. This model provides the criteria for determining whether a given statistical model is compatible with utility maximization. Cameron (1987) has also developed a utility-theoretic interpretation that has been argued to be the dual to Hanemann's model (McConnell,1990).

Smith (1985) suggests that Hanemann may be "pushing the theory" as he assumes that individuals discover their preferences when they make a choice, but economists, in order to recover estimates of an individual's WTP, are assumed to know the nature of each individual's utility function up to a monotonic transformation. This raises some important issues in modelling individual's preferences. Although imposing a specific utility function provides consistency and allows extrapolation, the model imposed becomes a maintained hypothesis and may not be the

correct structure for modelling preferences. It may be argued that without knowledge of the form of the utility function, fewer restrictions should be imposed. However, there is no simple solution to this problem as a model that imposes fewer restrictions does not specify a utility function and does not produce theoretically correct measures of welfare. For example, the logarithmic model of discrete choice (applied by Bishop and Heberlein,1979,1980; Boyle and Bishop 1984; Sellar, Chavas and Stoll,1986; Loehman and De,1982) is not consistent with utility theory but it often produces superior statistical results. It is still somewhat unclear which method will provide the highest quality of information. As a result, three specifications of the contingent valuation models were estimated; two utility-theoretic models suggested by Hanemann (1984) and an ad hoc logarithmic model.

Hanemann (1984) provides two specifications of the non-random component of the indirect utility functions:

(2-8a) $v(i,y;s) = \alpha_i + \beta y, \quad i = 0,1$

(2-8b) $v(i,y;s) = \alpha_i + \beta \ln y, \quad i = 0,1$

These utility functions result in utility differences

(2-9a) $dv = (\alpha_1 - \alpha_0) - \beta x$

(2-9b) $dv = (\alpha_1 - \alpha_0) + \beta \ln(1 - x/y) \approx (\alpha_1 - \alpha_0) - \beta x/y$

In 2-8a and 2-9a, the discrete choice probabilities are independent of income, and therefore no income effects occur.

Following Hanemann (1984), the binary response probabilities can be expressed as

(2-10) $P_i = Pr(E > x) = 1 - G_E(x) = F\eta[dv(x)]$

where E - equivalent surplus and satisfies $v(0,y;s) = v(1,y - E;s)$

G_E - c.d.f. of an individual's true equivalent surplus

Considering these forms for dv, the expected value of WTP can be expressed as

(2-11) $$E^+ = \int_0^\infty [\,1 - G_E(x)]\,dx - \int_{-\infty}^0 G_E(x)dx$$

where $G_E(x)$ is the probability that an individual will pay the bid amount or the probability that the respondents true equivalent surplus is greater than the bid amount, Prob ($x \leq E$). The parameters α and β in the logit equation will identify $G_E(x)$ where the mean of $G_E(x)$ is the samples expected value of WTP. If we assume WTP is a non-negative random variable, the second expression in (2-11) becomes zero and simplifies to

(2-12) $$E^+ = \int_0^\infty [\,1 - G_E(x)\,]\,dx$$

where $$\lim_{x \to 0} G_E(x) = 0$$

$$\lim_{x \to \infty} G_E(x) = 1$$

These 2 conditions ensure that the area below the probability distribution function is equal to 1 (Boyle et al.,1988).

Some studies have used the truncated mean to uncover welfare estimates where all values above T are assigned a value of T (Bishop and Heberlein,1979; Sellar et al.,1985). The justification of truncating the data is that the maximum amount an individual is WTP is not infinity but some amount less than income. Generally, T is set at the maximum bid amount in the survey.

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

(2-13) Prob $v(1,y - E^*;s) \geq v(0,y;s) = .5$

where $dv(E^*) = 0$

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

If the c.d.f. in (2-12) is logistic and WTP is assumed to be a non-negative random variable, the expected value of the Hicksian equivalent surplus, E^+, for Hanemann's linear utility-theoretic model (2-9a) can be expressed as

$$(2-14) \qquad E^+ = \frac{1}{-\beta} \ln(1 + e^{\alpha})$$

and the median can be expressed as

$$(2-15) \qquad \alpha + \beta E^* = 0, \quad E^* = -\alpha/\beta$$

The expected value for Hanemann's log model in (2-9b) can be expressed as

$$E^* = \frac{1}{-\beta/y} \ln(1 + e^{\alpha}) \tag{2-16}$$

where y is the mean of household income.

The median of Hanemann's log specification is expressed as

$$\alpha + \frac{\beta}{y} E^* = 0, \quad E^* = \frac{-\alpha}{\beta/y} \tag{2-17}$$

As well as the two specifications suggested by Hanemann (1984), a logarithmic form was used as a first order approximation for dv,

$$dv = (\alpha_1 - \alpha_0) - \beta_1 \ln x \tag{2-18}$$

If dv is treated as an approximation to a utility difference, then the mean of this distribution can be expressed as

$$E^* = \int_0^{\infty} [1 - (1 + e^{-\alpha - \beta \ln x})^{-1}] \, dx \tag{2-19}$$

$$E^* = -e^{-\alpha/\beta} \frac{\pi/\beta}{\sin(-\pi/\beta)} \tag{2-20}$$

The median of the logarithmic model is

$$\alpha + \beta \ln E^* = 0, \quad E^* = e^{-\alpha/\beta} \tag{2-21}$$

There is some debate as to whether the mean, truncated mean, or the median should be used when calculating welfare measures. Hanemann (1989) points out that there are two distinct components of welfare evaluation. First, the welfare gain or loss to each individual or group of individuals within the population must be determined, and second, the gains and losses must be aggregated over all the members of the population. These two objectives of welfare evaluation bring up different issues with respect to means and medians. The mean minimizes the sum of the squares of the deviations around a point and the median minimizes the sum of the absolute-errors loss function. As a result, the mean is more sensitive to skewness or kurtosis, whereas the median is a relatively robust measure of central tendency and less sensitive to outliers (Boyle et al.,1988). It has been argued that when there is a large area under the tails of the probability distribution, a "fat tail", the median may be superior to the mean. However, if the distribution is skewed in reality, the median will not reflect the interest of those individuals who truly place a high value on the good. As well, the logistic model allows for the possibility that an estimated distribution may be skewed toward higher values (Maddala,1983). The mean is a theoretically correct measure of expected value but may be questionable on statistical grounds, while the median is statistically preferred but no theoretical justification exists for its use. Johansson et al. (1989) argue that the mean is the better measure to use when calculating welfare measures as the goal is to compare project's aggregate benefits and costs (Mäler,1985). Further, their view is that using the median does not produce a Pareto-efficient outcome. Hanemann (1989) argues that the Kaldor-Hicks potential compensation criterion can be sacrificed and advocates " a social choice rule corresponding to (super-)majority voting", but Hanemann (1984) also states that the choice between the median and the mean "entails a value judgement as to the appropriate method of conducting welfare evaluations".

Duffield and Patterson (1991) argue the merits of the truncated mean as it reduces the

influence of the upper end of the distribution, it can be aggregated and it does not extrapolate beyond the data set. However, Cooper (1993) and Bishop et al.(1988) show that when the range of integration is truncated at a point less than infinity, the properties of the c.d.f. are violated, and therefore, the truncated mean is not a correct measure of expected WTP. Bishop et al. (1988) point out that if the truncated random variable is normalized, the properties of the c.d.f. are not violated. However, there is still the difficulty associated with determining a truncation point as any truncation point may be viewed as somewhat arbitrary. Bishop et al. (1988) feel that fat tails arise out of the selection of a range and distribution of dollars amounts and the "tails of the estimated distribution are artifacts of the range of dollar values for which observations exist". As a result of the problems associated with truncation, the mean or median may provide superior estimates of welfare.

Bishop and Heberlein (1979), in a well known study of goose hunting, were the first to ask contingent valuation questions with yes or no responses. Since their study, a number of other studies have used close-ended questioning to obtain welfare measures (Carson et al.,1990; Loehman and De,1982; Bowker and Stoll,1988; Sellar et al.,1986). Bishop and Heberlein (1979) analyzed their responses using a logit model and derived an estimate of the value of a permit to the average hunter. They used a statistical model that was not strictly compatible with utility maximization and truncated the bid at the highest value. Hanemann (1984) pointed out the substantial differences in welfare measures in the Bishop and Heberlein contingent valuation study depending on whether the Hicksian compensating welfare measure was truncated at the highest bid. In one experiment, the truncated welfare measure was five times smaller than the untrucated welfare measure indicating that the truncated version was a poor approximation to the untrucated version.

Bowker and Stoll (1988) used logit and probit analysis to quantify individuals' economic

surplus associated with the preservation of the whooping crane. The authors used the 3 specifications discussed earlier (Hanemann's utility-theoretic specifications and a general log model). Their results indicated little difference existed between the logit and probit models; however, considerable differences existed between the 3 specifications where the specifications suggested by Hanemann were statistically inferior to the general log model. In most cases, the estimated mean equivalent surplus measures were substantially larger than the medians despite truncation and the estimated mean values were sensitive to truncation.

The sensitivity of the welfare measures to truncation, specification and the choice of statistical estimator, suggests caution should be used when applying the results of dichotomous choice studies and results should be reported in a way that makes others aware of the variability among the welfare estimates.

3.0 Personal Interview, Household and Hunter 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 during July and August in gravel pit camping areas, private parks, national parks and preselected provincial parks. The personal interviews served as a useful pretest to the household survey and were useful in reducing sample bias. The response rate of the personal interviews was 100%. The pretest was also used to determine a range of values for the dichotomous contingent valuation questions by asking individuals open-ended questions on their maximum WTP for an environmental quality change. Both nonresidents and residents were interviewed; however, only 18% of those surveyed were nonresidents.

The household survey was mailed to 2,859 randomly selected households on the island of Newfoundland during the first week of September following the end of the summer recreation season. The survey package included a questionnaire, a postage paid return envelope, a cover letter explaining the importance of the survey, and an entry form for a prize draw. A second mailing was done 3 weeks later. 149 questionnaires were undeliverable, reducing the sample size to 2,710 households. Of these, 1,395 households responded giving an overall response rate of 51.48%.

The moose hunting survey was sent out to 1,506 randomly selected moose hunters on the island of Newfoundland. The 1,506 moose hunters were randomly selected from the population of individuals who obtained licences for the 1992 season. The survey was sent out the first week in January, with a second mailing during the third week of January. The survey package for the moose hunting survey included a questionnaire, a postage paid return envelope, a cover letter explaining the importance of the survey, and an entry form for a prize draw. 11 questionnaires were undeliverable reducing the sample size to 1495. Of these, 1255 moose hunters responded,

giving an overall response rate of 83.95%.

4.0 Contingent Valuation Results For the Household Survey

There were 2 discrete choice contingent valuation questions in the household survey, one dealing with clearcutting of forests and other with the Newfoundland Pine Marten, a threatened species. The questions were divided among the sample population so that each household only received one contingent valuation question. From the results of the personal interview survey that asked respondents open-ended contingent valuation questions, random uniform dollar amounts between 1 and 100 were assigned to the dichotomous choice questions in the household survey.

In 1989, a Forestry Canada National Survey of Canadian Public Opinion on Forestry Issues showed that clearcutting was a major public concern. The contingent valuation question in the household survey asked if an individual would be willing to pay an annual fee for a permit to enter an area where an alternative method of harvesting was used. The question stated that clearcutting was an environmentally sound method of harvesting and attempted to capture the value of visiting another area solely on the basis of aesthetics. This question was used to determine if there was any economic surplus associated with visiting an area where an alternative method of harvesting was used. The second part of the question asked whether the individual would still be willing to pay the specified amount if clearcutting was incorporated into the landscape such that the visual impact of clearcuts were reduced. This part of the question attempted to determine how strong the individual views were against clearcutting. For the exact wording of the contingent valuation questions, refer to Appendix B.

The Newfoundland Pine Marten requires large areas of over-mature forest and as a result of this requirement, a conflict has been identified between traditional timber management and marten management. The contingent valuation question dealing with the Newfoundland Pine Marten was used to quantify individuals' economic surplus associated with the species. Existence values likely dominate the total value as there is virtually no consumptive use (trapping and

snaring is prohibited) and little non-consumptive use associated with the Newfoundland Pine Marten. Therefore, individual responses were likely motivated through concern for the existence of the Newfoundland Pine Marten rather than any direct benefit associated with the threatened species. The contingent valuation 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.

4.1 Clearcutting Contingent Valuation Model

There were a total of 711 useable responses from the clearcutting contingent valuation question. The final model that was used to determine the probability of answering yes to the clearcutting dichotomous contingent valuation question is given by:

$$(4\text{-}1) \qquad CLWTP = \beta_0 - \beta_1(BID) + \beta_2(DONATIONS) - \beta_3(POP) + \beta_4(INC)$$

where CLWTP = 1 if the respondent answered "yes", zero otherwise

BID = the dollar amount the individual is asked to pay, a random number between 1 and 100

DONATIONS = a dummy variable that indicates whether the respondent donated to an environmental or wildlife organization

POP = a variable indicating the population of the area in which the respondent lives

INC = a variable indicating the annual household income before taxes

Equation (4-1) states that the probability of saying yes he/she is willing to pay $X is inversely related to the bid amount and the population of the area where the respondent lives and positively related to donations and household income. BID, DONATIONS, POP, and INC are variables that are believed to influence his/her response. The higher the bid amount and the larger the population of the area where the respondent lives, the more likely he/she will answer "no" to the contingent valuation question. Individuals from smaller centres may have closer ties to the forest and be more familiar with clearcutting, and therefore, may be more likely to respond in favour

of paying the bid amount if he/she feels there is a negative aesthetic value associated with clearcuts. The respondent is more likely to pay the bid amount, if he/she donated either time or money to an environmental or wildlife organization. The higher the household income, the more likely he/she will be willing to pay the bid amount.

4.2 Pine Marten Contingent Valuation Model

There was a total of 635 useable Pine Marten contingent valuation responses. The logistic regression for the Newfoundland Pine Marten is given by:

(4-2) $PMWTP = B_0 - B_1 (BID) - B_2 (CHILD) + B_3 (EDUC) + B_4 (INC)$

where PMWTP = 1 if the respondent answered "yes", zero otherwise

CHILD = the number of children under the age of 16 living in the household

EDUC = the number of years of education completed

The variables BID and INC are the same as defined above. The probability that the respondent is willing to pay $X is inversely related to the bid amount and the number of children under 16 in the household and positively related to education and household income.

CHILD, EDUC and INC are all characteristics of the respondent that are believed to influence his/her response. The more children under the age of 16 in a household, the less likely the individual is willing to pay the bid amount. This variable may act as a proxy for disposable income where the more children under the age of 16 the household is supporting, the less income available for other uses. The higher the level of education and the higher the income, the more likely an individual will pay the bid amount.

4.3 Contingent Valuation Results

Table 4-1a and 4-1b present the coefficients on the logit equations and the t-statistics of the two welfare models suggested by Hanemann (1984) and a logarithmic model. The column SUM is the grand constant which is the sum of the explanatory variables (except the bid variable)

multiplied by their means. The importance of this variable will become evident in the calculation of the welfare measures. The coefficients all had their expected signs. For example, the sign on income was always positive and the sign on the bid amount was always negative. However, income was not significant in Hanemann's linear specification or the ad hoc logarithmic specification.

There is little difference between the specifications in both the clearcutting and the Pine Marten models. All the variables have the same significance levels, except population in the clearcutting model. Two goodness-of-fit measures were used to indicate the accuracy in which the models approximated the observed data; the % correct predictions and the Hensher-Johnson (H-J) prediction success index. The % correct predictions compares the calculated probabilities with the actual choice. The H-J 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). It 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.

In the clearcutting model, the % correct predictions, 69.62%, is slightly higher in the ad hoc log model but the H-J Normalized Success Index is higher in Hanemann's linear model (0.09). Therefore, no model conclusively seems to outperform another on statistical grounds. In the Pine Marten model, the % correct predictions, 76.5%, in the log model is slightly higher than Hanemann's specifications and the H-J Normalized success index is higher (0.166). Therefore, the log model may have a slightly better statistical fit. Hanemann's log specification generally seems to perform the poorest.

Table 4-1a Clearcutting Dichotomous Choice Contingent Valuation Models

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	2.4674[*b] (4.2920)[a]	1.5691[*] (5.0253)	1.3386[*] (5.6135)
Bid Amount		-0.018403[*] (-5.2167)	
Bid/Income			-0.046934[*] (-3.4582)
Log Bid	-0.57160[*] (-4.6584)		
Donation	1.3005[**] (3.0479)	1.3696[*] (3.1854)	1.2377[*] (2.9278)
Population	-0.089707[***] (-1.7444)	-0.082548 (1.5610)	-0.096470[***] (-2.0092)
Income		0.030305 (0.98198)	
Log Income	0.26922 (1.3798)		
Sum[c]	2.8347432	1.685142	1.1440528
Correct Prediction (%)	69.62	67.93	68.57
H-J Normalized Success Index	0.085	0.09	0.06
N	474	474	474

[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 of Donation (0.1097), Population (3.4241), Log Income (1.9755) and Income (8.1983).

Table 4-1b Pine Marten Dichotomous Choice Contingent Valuation Models

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	-0.86076	-2.3630[b]	-1.9865[b]
	(-1.2590)[a]	(-3.7833)	(-3.1392)
Bid Amount		-0.026348[b]	
		(-6.8432)	
Bid/Income			-.080280[b]
			(-4.1487)
Log Bid	-0.85556[b]		
	(-7.7320)		
No. of Children	-0.23311[c]	-0.22348[c]	-0.22553[c]
	(-2.1491)	(-2.1188)	(-2.21193)
Education	0.19055[b]	0.17653[b]	0.12006[b]
	(3.9517)	(3.6679)	(2.9552)
Income		0.019013	
		(.59522)	
Log/Income	0.12750		
	(.59898)		
Sum[c]	1.895298	0.106618	-0.4670116
Correct Predictions (%)	76.5	75.1	73.5
H-J Normalized Success Index	0.166	0.136	0.084
N	554	554	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 was calculated using the mean values of No. of Children (0.79422), Education (14.148), Log Income (1.9239) and Income (7.8664).

4.3 Welfare Measures

Calculating the net willingness to pay involves estimating the area under the logit curve. In order to do this, all the coefficients other than the bid amount were multiplied by their mean value and summed and the logistic equation was used to calculate the net willingness to pay. Figure 4-1a and 4-1b are the logit curves for Hanemann's utility-theoretic models. The vertical axis is the WTP per trip and the horizontal axis is the probability the respondent will answer yes to the WTP question. The area under the curve gives the average consumer surplus, or the amount of money the respondent would pay, above what he/she has already paid for the environmental quality change.

Equivalent surplus measures were calculated based on the models presented in Tables 4-1a and 4-1b. The mean values were calculated by integrating the area under each estimated WTP function from zero to infinity. The welfare measures are summarized in Table 4-2. Mean and median values were calculated for all the models except the expected value for the logarithmic model could not be obtained as the model did not converge when integrated. Equations (2-14) and (2-16) were used to determine the expected values of maximum WTP for Hanemann's specifications. The median values were calculated using equations (2-15), (2-17), and (2-21). The mean equivalent surplus measures are higher than the median values in all cases. This is typical of the dichotomous choice method in that the distribution is skewed to the right indicating that average WTP may be heavily influenced by the willingness of a small part of the population to pay relatively high amounts.

Estimated mean WTP values for the Pine Marten ranged from $28.38 to $47.68, depending on the specification. This compares to estimated mean WTP values for the whooping crane, a prominent endangered species, that ranged from $21 to $149 annually, depending upon the level of truncation and specification (Bowker and Stoll,1988). Boyle and Bishop (1987)

estimated mean WTP values for the bald eagle and the striped shiner, both endangered species. The estimated expected value for the bald eagle ranged from $10.62 to $75.31 annually, depending on a number of various factors, and the expected values for the striped shiner ranged from $4.16 to $5.66 annually. The values associated with the striped shiner are somewhat lower as this is a relatively obscure and unknown species. The estimated annual WTP for the Northern Spotted Owl, a threatened species, is $49.72 (Rubin et al.,1991). The expected values obtained for the Newfoundland Pine Marten compare quite favourably to these other studies as the estimates fall within the range of these results.

In the Pine Marten case, the median is negative (-$45.76) in Hanemann's log specification. This negative estimate is a result of the functional form. Referring to Figure 4-1b, one can see that this specification leads to a yes response only 40% of the time. This is a bit surprising, but 50.98% of those that answered "no" indicated that the Pine Marten's continued existence was not important.

In both models, the 3 specifications, although they have similar statistical fits, result in very different equivalent surplus welfare measures. In the clearcutting contingent valuation question, Hanemann's log model resulted in an expected value two and one half times that of the linear model. In both models, the median seems to be slightly less sensitive to model specification.

Aggregate welfare measures were calculated for both the clearcutting and the Pine Marten models. The aggregate welfare measures for the Pine Marten, based on the 1991 population census of 538,099, is $15,271,250 for Hanemann's linear model and $25,656,560 for Hanemann's log model, a difference of over $10 million depending on the specification. As only 54% of the population that responded to the survey took an outdoor recreation trip in 1992, the relevant population used to calculate the aggregate welfare measure for the clearcutting question

was 290,573. The aggregate welfare measure was $29,292,664 for Hanemann's linear model and $72,102,784 for Hanemann's log model, over a twofold difference.

As a result of the Newfoundland Pine Marten's requirement for large areas of undisturbed mature forest, the conflict between forest management and marten management could be resolved through a benefit-cost analysis that examines the benefits of preserving the Pine Marten and the economic costs (lost jobs and timber revenues) associated with preservation. If the benefits outweigh the costs, those who benefit from preservation could compensate those who would suffer from preserving the threatened species.

Figure 4-1a

LOGIT CURVE FOR CLEARCUTTING

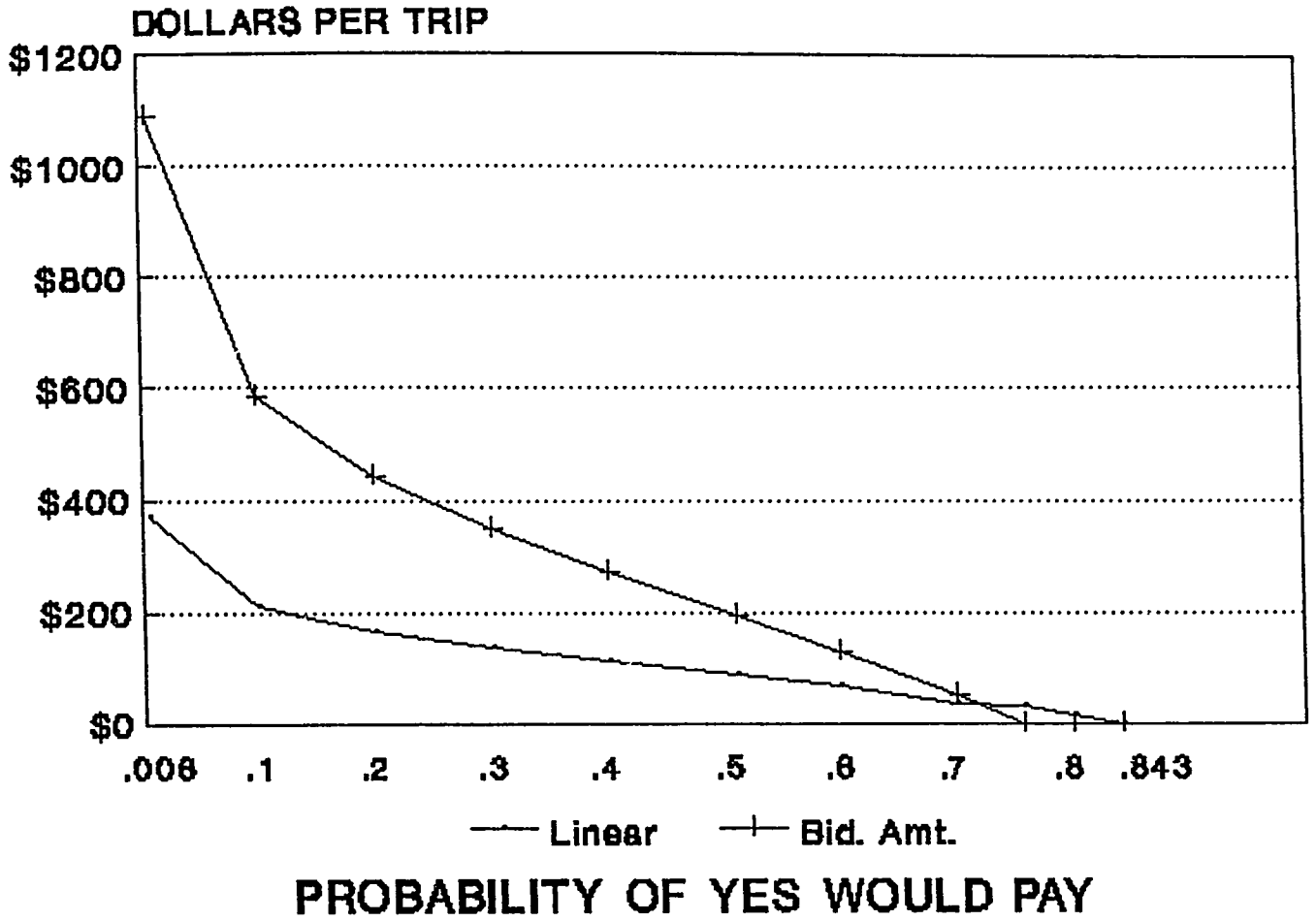

Figure 4-1b

LOGIT CURVE FOR PINE MARTEN

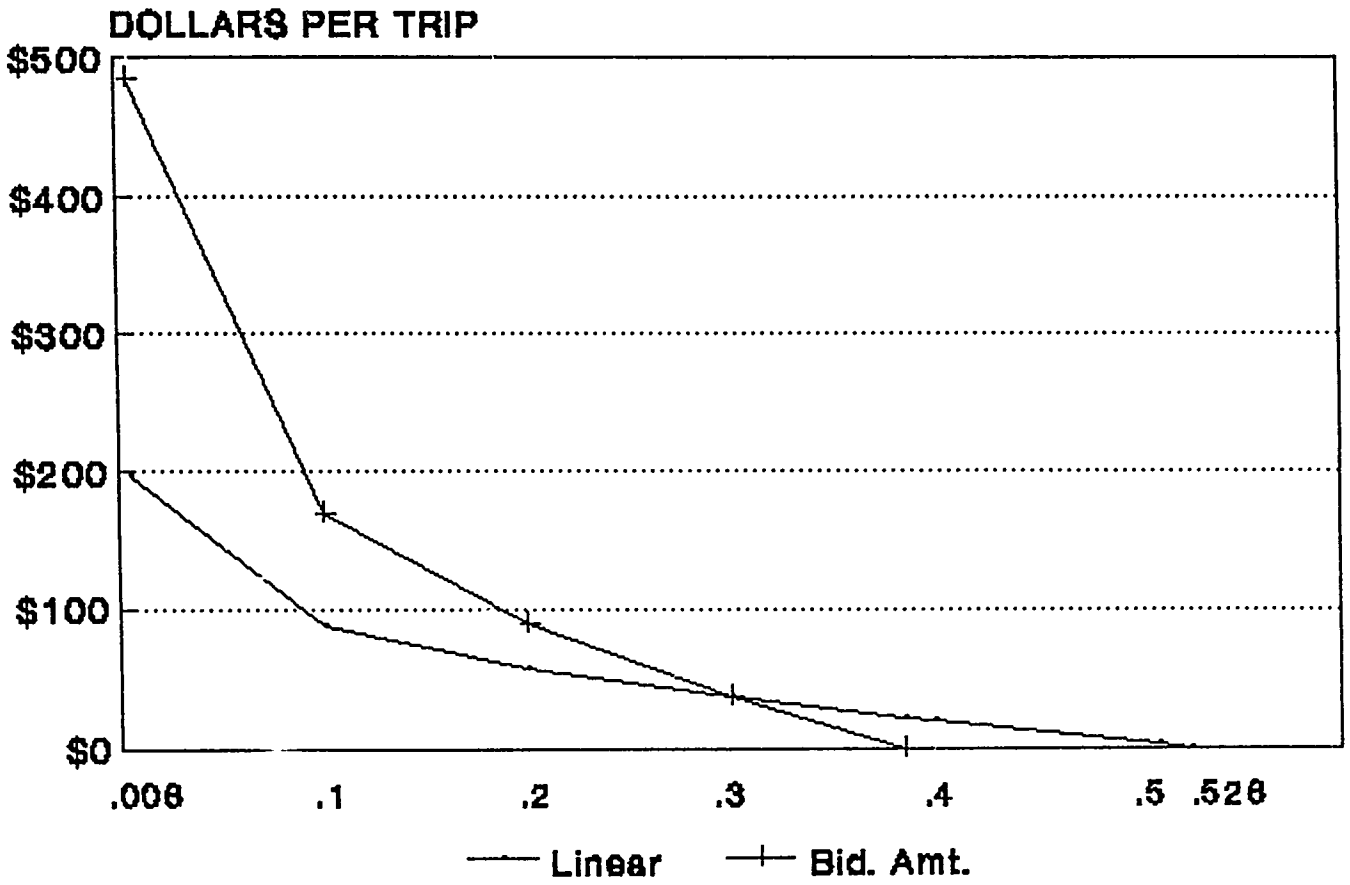

Table 4-2 Welfare measures for clearcutting and Pine Marten ($ per person)

CV Question		Welfare Measure	
		Mean	Median
Clearcutting	1) HM Linear Model	$100.81	$ 91.57
	2) HM Log Model	$248.14	$199.84
	3) Log Model		$142.49
Pine Marten	1) HM Linear Model	$ 28.38	$ 4.05
	2) HM Log Model	$ 47.68	$-45.76
	3) Log Model		$ 9.16

4.4 Other Results

The results of the second part of the clearcutting question are presented in Table 4-3. 77.65% of those that answered "yes" they would be willing to pay the specified amount to go to an area where an alternative method of harvesting was used were still willing to pay the specified amount if clearcutting was done in such a way that would reduce the visual impacts. Although the question attempted to deal only with the aesthetics of clearcutting, this high percentage of individuals who were still willing to pay the specified bid amount to go to an area where an alternative method of harvesting was used seems to indicate that individuals may be responding to preconceived ideas of the impact of clearcutting on the environment rather than basing their decision solely on the negative aesthetic value of clearcutting.

Table 4-3 Would you still be willing to pay $X if clearcutting was done in such a way to reduce the visual impacts?

Response	Freq.	%
Yes	278	77.65
No	78	21.79
Missing	2	0.56
Total	358	100.0

One of the shortcomings associated with discrete choice contingent valuation is that it is difficult to identify the reason that an individual will respond "no". Some individuals may answer "no" because they are protesting the question format, while others may answer "no" because the bid presented is too high. For this reason, respondents were asked why they answered "no" to determine whether the "no" response was due to a rejection of the hypothetical market developed (Table 4-4a,4-4b). These protest responses are responses that do not indicate the benefits received, rather they are protests against a part of the simulated market developed in the contingent valuation question. For example, a respondent may feel that clearcutting is not an environmentally sound method of harvesting and reject the hypothetical market developed. In this case the respondent would not reveal his/her true WTP. These bids were deleted from the analysis as the responses are not good indicators of benefits received from visiting an area where the forests were not clearcut. Those respondents who indicated they did not take outdoor recreation trips in the clearcutting contingent valuation question were also deleted from the analysis. In total, 42.31% of the "no" responses were deleted from the analysis.

Respondents were given a list of options in which they could choose from if they answered "no" (Appendix B). As well as these choices, the respondent could choose an "other" category where he/she could express any other reasons for answering "no". The "other" category was chosen 7.05% of the time by respondents who answered "no" to the clearcutting contingent

valuation question. These "other" responses varied among respondents but two common responses were (i) respondents did not want to visit an area that had been logged in any fashion and (ii) respondents felt that they should not have to pay any money to visit an outdoor recreation area.

In the Pine Marten contingent valuation question, no "no" responses were deleted from the analysis. The "other" category was chosen 15.25% of the time. The reasons ranged 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. Almost a quarter (22.66%) of those that answered "no" would pay something other than the value stated.

Table 4-4a Reasons why respondents answered 'no' to the clearcutting WTP question

Justification	Freq.	%
1) I do not mind seeing clearcuts while I'm on an outdoor recreation trip.	67	21.47
2) I do not think clearcutting is environmentally sound, therefore I do not think there should be any clearcuts.	120	38.46
3) I never notice any evidence of logging on my outdoor recreation trips.	48	15.38
4) I would pay something other than the value stated above.*	36	11.54
5) I don't participate on outdoor recreation trips.	12	3.85
6) Other	22	7.05
7) 2 & 3	3	0.96
8) Missing values	4	1.28
Total	312	100.0

* The mean amount given by respondents was $22.40.

Table 4-4b Reasons respondents answered 'no' to the Pine Marten WTP question

Justification	Freq.	%
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	100.0

* The mean amount given by respondents was $16.41.

5.0 Contingent Valuation Results for the Moose Hunting Survey

Moose hunters were asked several dichotomous choice contingent valuation questions. The first contingent valuation question asked if costs increased during the season, would the respondent continue to hunt moose. This 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. This contingent valuation question attempted to determine whether there was any consumer surplus associated with moose hunting and the logit regression estimated the net willingness to pay for moose hunting under current conditions.

There were three other discrete choice contingent valuation questions that asked about changes in hunting quality that could result from management changes. Two questions asked how the value of a trip would change if the hunter saw half as many hunters or twice as many moose. Seeing half as many hunters may increase the quality of the hunting experience as the moose management area would be less congested. As well, seeing twice as many moose may increase the quality of hunting as there would be a greater chance of a successful hunt. Further, this may decrease the number of trips a hunter would have to take and therefore expenditures on trips. The third question asked how the value of the season would change if the season length doubled. This would allow the hunter to take more trips during the hunting season.

The discrete choice contingent valuation questions were divided among the sample so that each hunter only answered two contingent valuation questions. Each survey included the question that dealt with the net willingness to pay to hunt in a particular management area and the remainder of the questions were divided evenly among the sample. Uniform random dollar amounts between 1 and 100 were chosen as a result of the pretest which asked moose hunters open-ended contingent valuation questions.

Theory suggests that individual preferences are important in explaining economic demand

choice. Questions that were used in the survey were designed to measure individual preferences for various quality components of a moose hunting trip. The variables used in the regressions below include ordinal variables for travel time to the hunting site, the importance of moose hunting compared to other recreational activities, the importance of privacy from other hunters, and the importance of bagging a trophy moose. As can be seen by the significance of the variables, these preference measures are important explanatory components in determining whether the individual is willing to pay the bid amount.

5.1 Moose Hunting Contingent Valuation Models

The model that was used to explain the net economic value of moose hunting under current conditions is given by

(5-1) $CCWTP = \beta_0 - \beta_1(BID) + \beta_2(TRTIME) + \beta_3(IMP) + \beta_4(INC)$

where CCWTP = one if the hunter is WTP the bid amount, zero otherwise

BID = the dollar amount the moose hunter is asked to pay, a random number between 1 and 100

TRTIME[1] = an ordinal variable from 1 to 5 that reflects how enjoyable the moose hunter found travelling to the hunting zone on a typical trip where "1" is not enjoyable and "5" is very enjoyable

IMP = an ordinal variable from 1 to 5 indicating the importance of moose hunting as a recreation activity compared to other recreation activities where "1" is not important and "5" is very important

INC = a variable indicating the hunter's household income

The expected signs are indicated in equation (5-1). These variables were all expected to influence

[1] Ordinal variables were used in this analysis for individual's preferences for various quality components of a moose hunting trip. These variables were used as an approximation.

whether the hunter would be WTP the bid amount. The probability that the hunter is WTP the bid amount is inversely related to the bid amount and positively related to household income, the importance of moose hunting as a recreation activity, and how enjoyable the time was spent travelling.

The logit regression for willingness to pay to see half as many hunting parties is given by:

(5-2) $CRWTP = \beta_0 - \beta_1(BID) + \beta_2(EDUC) + \beta_3(PRIV) + \beta_4(INC)$

where CRWTP = one if the hunter is WTP, and zero otherwise

EDUC = the hunter's education in years

PRIV = an ordinal variable from 1 to 5 indicating the importance that the hunter places on privacy from other hunters

The variables BID and INC are the same as defined above. The expected signs are given in 5-2. The higher the bid amount, the less likely a hunter will pay, and the higher the education and household income and the more important privacy from other hunters is to the hunter, the more likely the hunter will pay the bid amount.

The logit regression for willingness to pay to double the season length is given by:

(5-3) $SLWTP = \beta_0 - \beta_1(BID) - \beta_2(CHILD) + \beta_3(IMP) + \beta_4(INC)$

where CHILD = the number of children under the age of 16 living in the household

All the other variables and signs are the same as above. The more children living in a household, the less likely the hunter will be willing to pay the bid amount. It is possible that the more children in a household, the less time available for hunting.

The logit regression for willingness to pay to see twice as many moose on a hunting trip is given by:

(5-4) $NMWTP = \beta_0 - \beta_1(BID) + \beta_2(IMPT) + \beta_3(IMP) + \beta_4(INC)$

where IMPT = an ordinal variable from 1 to 5 indicating the importance of bagging a trophy moose

All the other variables and signs on the coefficients are the same as indicated above. The more important bagging a trophy moose is to a hunter, the more likely he/she will be willing to pay the bid amount.

Tables 5-1a, 5-1b, 5-1c and 5-1d present the coefficients of the variables and the t-statistics of the 4 contingent valuation questions. The coefficients all had their expected signs and significance, although income was not significant in the crowding model. A dummy variable that indicated whether the hunter was male (1) or female (0) was significant at the 10% level in the crowding model. The ad hoc log model had a marginally superior statistical fit in the increased out-of-pocket expenses model and the season length model while the results are inconclusive as to whether the ad hoc log model or Hanemann's linear model is statistically superior in the crowding model and number of moose model (%correct predictions was higher in Hanemann's linear model and the H-J success index was higher in the log model). Hanemann's log model appears to have the poorest statistical fit in all models.

Table 5-1a Moose hunting dichotomous choice contingent valuation model: Increased out-of-pocket expenses

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	-0.49499	-1.0609[b]	-0.24981[b]
	(-0.98097)[a]	(-3.1054)	(-0.864)
Bid Amount		-0.01536[b]	
		(-5.9696)	
Bid/Income			-0.062451[b]
			(-7.2153)
Log Bid	-0.51972[b]		
	(-5.5076)		
Imp. of Hunting	0.19813[b]	0.20405[b]	0.19113[b]
	(3.6706)	(3.7951)	(3.5797)
Travel Time	0.36206[b]	0.36710[b]	0.35564[b]
	(5.4562)	(5.5180)	(5.3610)
Income		0.13521[b]	
		(5.4039)	
Log Income	0.83622[b]		
	(5.6680)		
Sum[c]	3.0261407	1.9168765	1.6930589
Correct Predictions (%)	74.9	74.4	74.5
H-J Normalized Success Index	0.122	0.121	0.113
N	1053	1053	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 Imp. of Hunting (3.7066), Travel Time (3.4710), Income (7.0057), and Log Income (1.8297).

Table 5-1b Moose hunting dichotomous choice contingent valuation model: Crowding

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	0.12726	-1.8836***	-1.8951***
	(0.12005)[a]	(-2.048)	(-2.0947)
Bid Amount		-0.027314*	
		(-6.2026)	
Bid/Income			-0.070237*
			(-3.8352)
Log Bid	-0.97702*		
	(-6.0169)		
M*/F	0.81910***	0.82438***	0.83407***
	(1.8131)	(1.8448)	(1.9308)
Education	0.16114*	0.13432**	0.098756***
	(2.6171)	(2.2270)	(1.8032)
Privacy From Other Hunters	0.19691**	0.17711**	0.11547
	(2.2976)	(2.0764)	(1.4282)
Income		0.013289	
		(0.34483)	
Log Income	-0.054335		
	(-0.22369)		
Sum[c]	3.5105352	1.2800973	.5292237
Correct Predictions (%)	65.3	65.6	62.5
H-J Normalized Success Index	0.161	0.155	0.094
N	352	352	352

[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 value of M*/F (0.91761), Education (13.457), Privacy From Other Hunters (2.858), Log Income (1.8325) and Income (7.0369).

Table 5-1c Moose hunting dichotomous choice contingent valuation model: Season length

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	2.4978[a]	0.25924	0.94488***
	(2.819)**[b]	(0.5365)	(2.2686)
Bid Amount		-0.028487*	
		(-5.8261)	
Bid/Income			-0.11821*
			(-5.3063)
Log Bid	-1.1510*		
	(-5.5983)		
No. of Children	-0.25982***	-0.27254***	-0.28146***
	(-1.9668)	(-2.0776)	(-2.1793)
Imp. of Hunting	0.20502***	0.20433***	0.14676
	(2.1918)	(2.2098)	(1.6079)
Income		0.12868*	
		(3.0411)	
Log Income	0.81321*		
	(3.0231)		
Sum[c]	4.4999753	1.662917	1.2297661
Correct Predictions (%)	68.7	68.0	68.3
H-J Normalized Success Index	0.184	0.178	0.156
N	294	294	294

[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 of No. of Children (.89796), Imp. of Hunting (3.6633), Log Income (1.8254) and Income (6.9932).

Table 5-1d Moose hunting dichotomous choice contingent valuation models: Number of moose

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	0.30979[a]	-.74853	-0.12746
	(0.39803)	(-1.5589)	(-0.31818)
Bid Amount		-0.020115[b]	
		(-4.8507)	
Bid/Income			-0.082212[b]
			(-4.9944)
Log Bid	-0.74795[b]		
	(-4.7879)		
Imp. of Hunting	0.22879[b]	0.21547[b]	0.22034[b]
	(2.6112)	(2.4873)	(2.5632)
Imp. of Trophy Moose	0.47298[b]	0.49374[b]	0.45626[b]
	(3.2063)	(3.3039)	(3.0961)
Income		0.12823[b]	
		(3.296)	
Log Income	0.83841[b]		
	(3.3902)		
Sum[c]	3.417556	1.7008501	1.4018943
Correct Predictions (%)	68.8	69.0	67.7
H-J Normalized Success Index	0.163	0.155	0.138
N	375	375	375

[a] Asymptotic t-values in parenthesis.
[b] Single asterisk indicates significance at 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 of Imp. of Hunting (3.7493), Imp. of Trophy Moose (1.5413), Log Income (1.8141) and Income (6.8667).

5.2 Welfare Measures

Figures 5-1, 5-2, 5-3 and 5-4 are the logit curves for Hanemann's utility-theoretic models. Table 5-2 presents the welfare measures for the four contingent valuation questions. The logarithmic model did not converge when integrated in all but one case, and therefore, expected values could not be obtained. In all cases, Hanemann's (HM) log model resulted in larger expected values than Hanemann's linear model. As well, in all cases, the median values are less than the mean values, which is consistent with expectations.

Other welfare estimates from contingent valuation studies on hunting are summarized in Table 5-3. These values compare favourably to the estimates obtained in this study.

A moose hunter's average expenditure was $185 per trip and the average hunter took 5 trips in the hunting season. Therefore, the estimated utility-theoretic welfare measures for the net economic value of moose hunting in a season may appear somewhat low ($122.54 to $212.90). It is possible that moose hunters spend a large portion of their WTP in travelling to the site and on other various expenses and therefore may have a relatively low consumer surplus. This is reinforced when examining the reasons respondents answered "no". For example, 45.89% indicated that they either could not afford, would not pay any more than they already pay, or already paid enough for licence fees in the contingent valuation question dealing with doubling the season length and/or increased out-of-pocket expenses. 46.43% of the hunters stated that they could not afford or would not pay any more than they already paid in the contingent valuation question dealing with seeing twice as many moose and/or increased out-of-pocket expenses during the season. Further, when hunters were asked to rank the reasons for moose hunting (choices given were sport, food, recreation, or other) in order of importance, food ranked first 66.7% of the time. 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.

Aggregate welfare measures were calculated based on 28,390 moose hunting licences that were obtained in 1992 (Table 5-4). Again, substantial differences in welfare measures exist between specifications where Hanemann's log model results in substantially higher aggregate welfare measures. Using Hanemann's linear specification, the most important quality changes, as indicated by aggregate WTP values, in descending order, are doubling the number of moose seen, seeing half as many hunters and doubling the season length. These results have some interesting policy implications. Lengthening the season does not seem to be as important for most hunters compared to other quality changes. Many respondents indicated that they would benefit much more from hunting on Sunday than lengthening the season (Sunday hunting is banned). On the other hand, doubling the number of moose seen appears to be quite important for most hunters indicating that a higher success rate on a hunting trip would result in substantial benefits. Forestry practices can have substantial impacts on moose habitat and moose populations generally benefit from timber cutting (Males and Stabb, 1987). Moose depend on young successional stands that are provided when the forests are cut; however, moose also depend on mature stands of conifers as wintering areas. Although moose do not benefit from large clearcuts, small clearcuts or strip cuts in rectangular blocks that maximize the edge and minimize the distance to cover, supply ideal habitat for moose populations. Generally, moose will not travel more than 200m into a clearcut, and therefore, cuts should not be more that 400m wide. Clearcuts greater than 100 ha should contain shelter patches of mixed wood and cuts larger than 120 ha are not recommended.

Figure 5-1

NET ECONOMIC VALUE

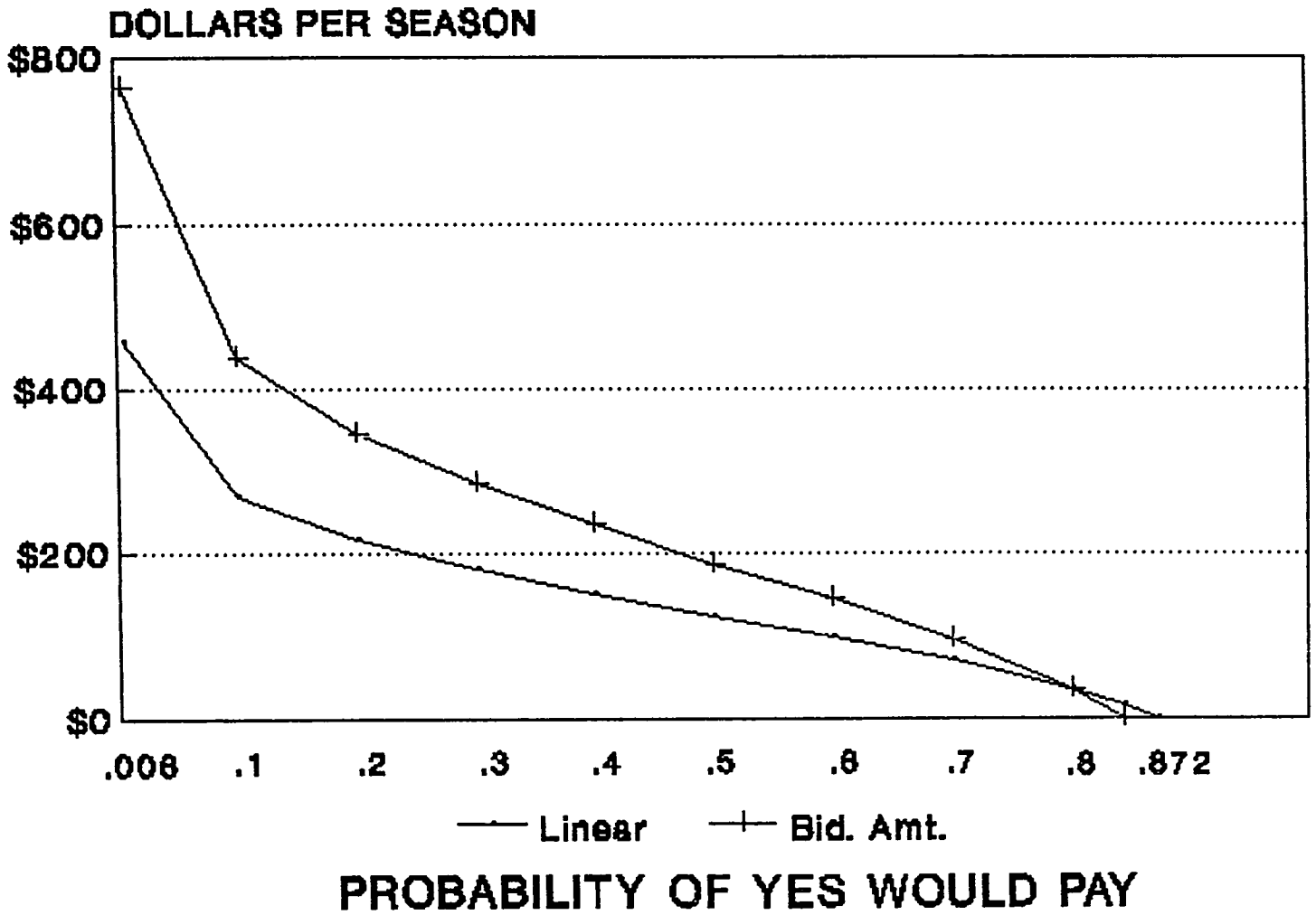

Figure 5-2

LOGIT CURVE FOR CROWDING

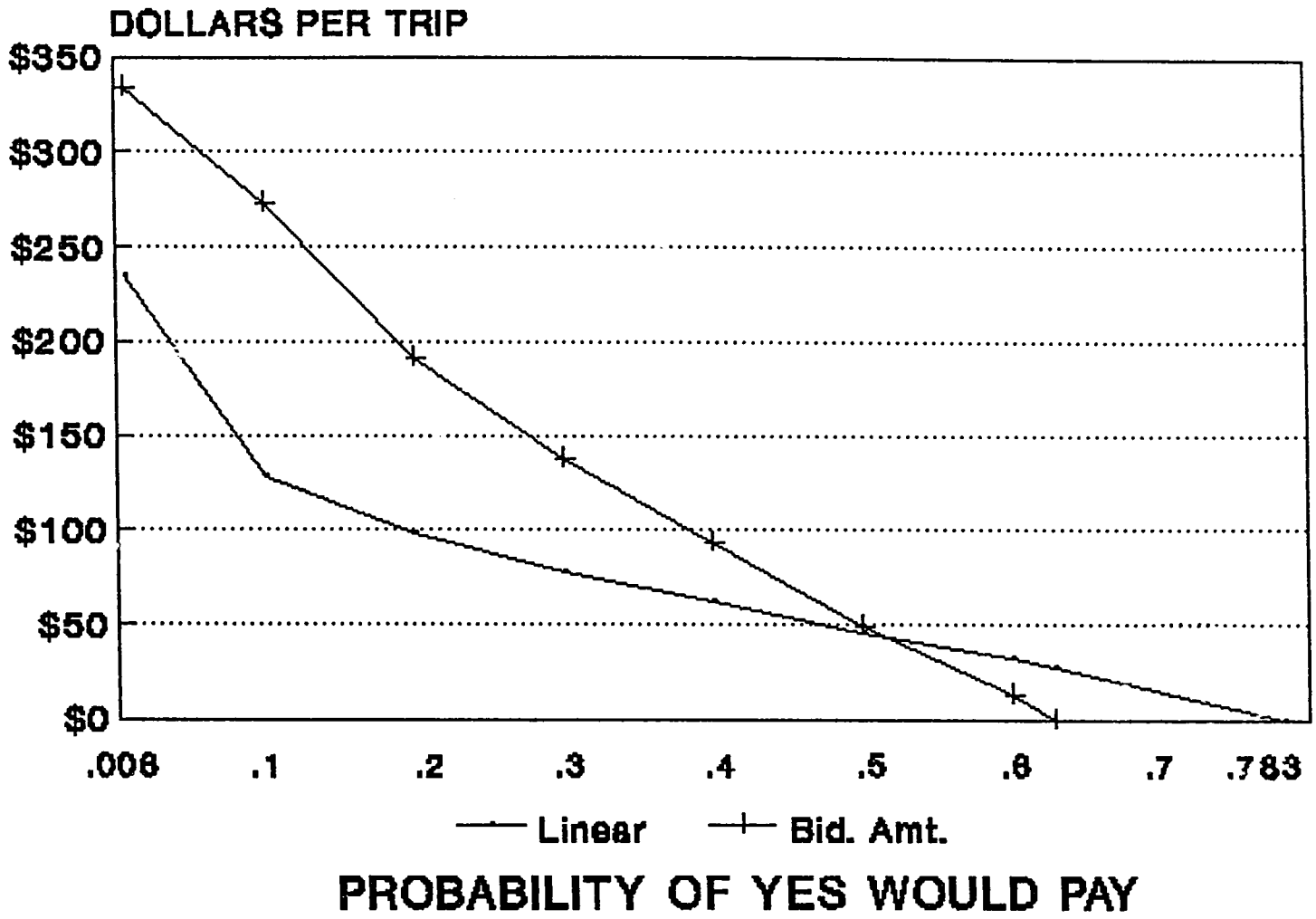

Figure 5-3

LOGIT CURVE FOR SEASON LENGTH

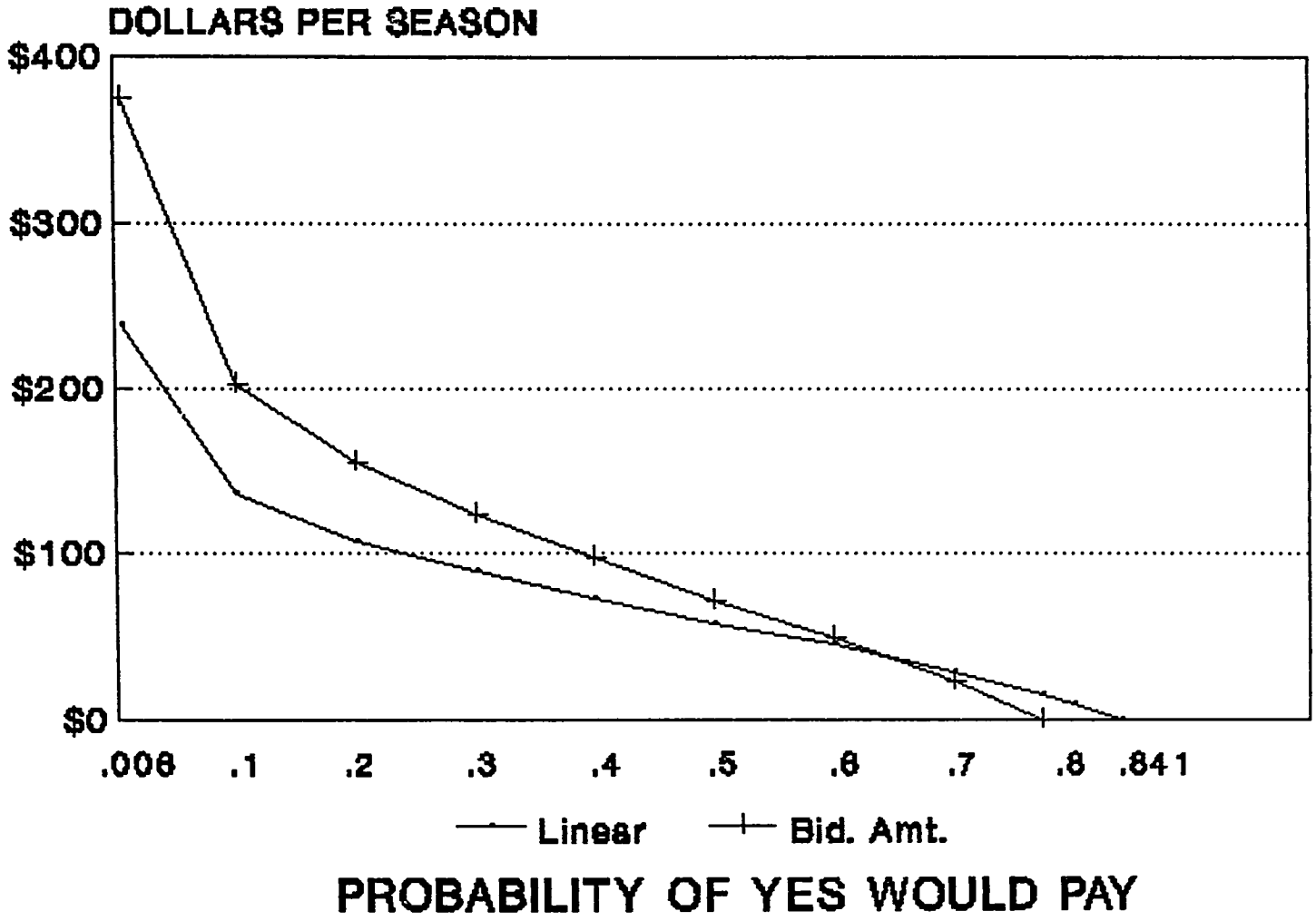

Figure 5-4

LOGIT CURVE FOR NUMBER OF MOOSE

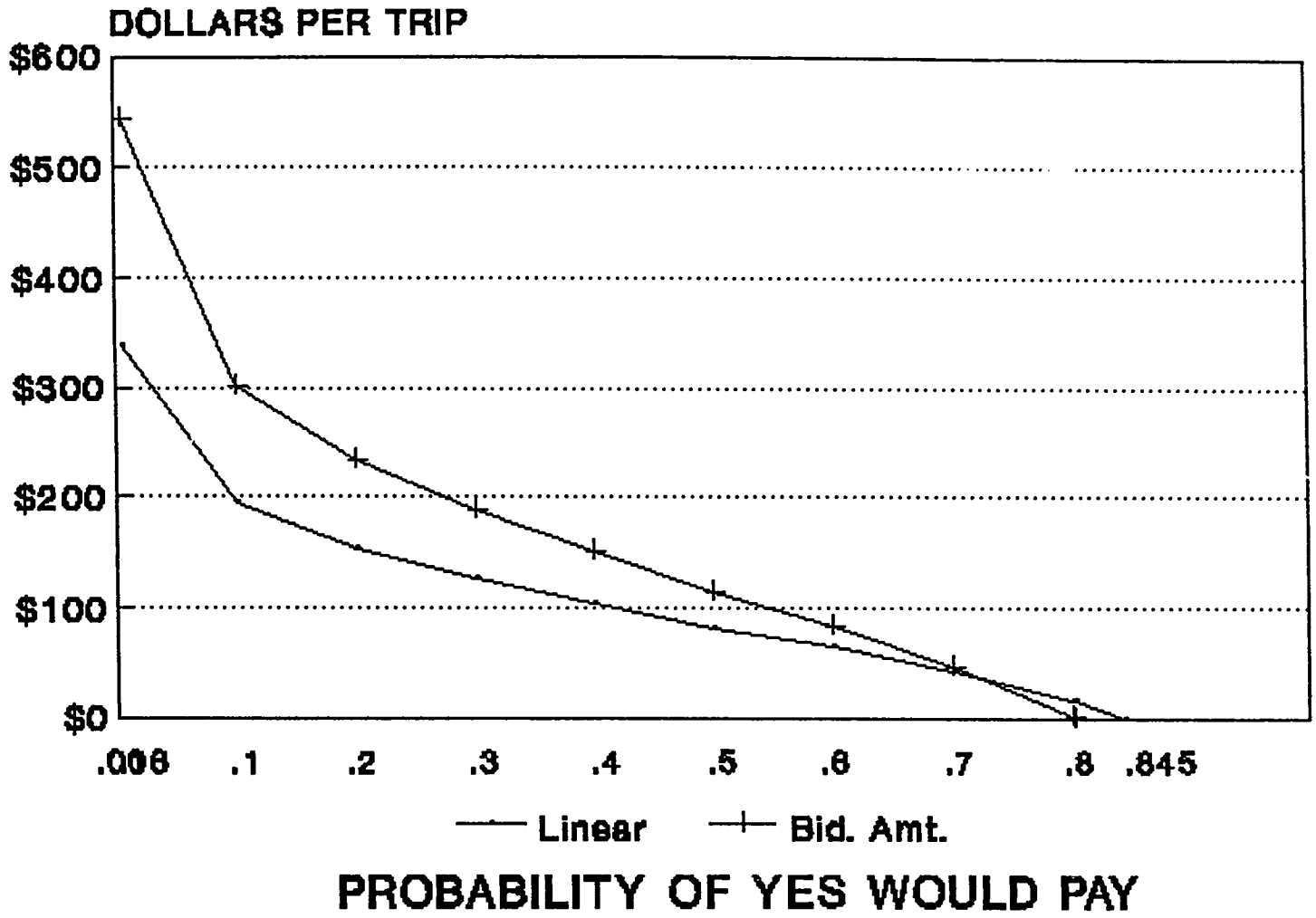

Table 5-2 Welfare Measures for Moose Hunting

CV Question	Welfare Measure	
	Mean	Median
Increased Out-of-Pocket Expenses[a]		
1) HM Linear Model	$131.01	$122.54
2) HM Log Model	$212.90	$193.18
3) Log Model		$316.36
Number of Moose		
1) HM Linear Model	$ 92.89	$ 84.56
2) HM Log Model	$135.47	$117.09
3) Log Model		$ 96.47
Crowding		
1) HM Linear Model	$ 55.85	$ 46.87
2) HM Log Model	$ 99.42	$ 53.02
3) Log Model		$ 36.35
Season Length		
1) HM Linear Model	$ 64.47	$ 58.37
2) HM Log Model	$ 87.92	$ 72.75
3) Log Model	$339.87	$ 49.88

[a] Welfare measures were calculated where the responses were deleted from the analysis if the hunter answered "no" the benefits were not worth the expenditure, and then "yes" they would pay $X to continue to hunt moose, as this behaviour seemed inconsistent with utility maximization. The results show that the welfare measures are relatively robust when the responses were deleted. Hanemann's linear model, mean $123.77, median $114.57; Hanemann's log model, mean $176.58, median $160.37; Log model, the mean did not converge, median $257.40.

Table 5-3 Comparison of Contingent Valuation Estimates of Hunting: Results from other studies

Object	Location	Source	Value
Big Game Hunting	Alberta	Asafu-Adjaye, 1989	$204.06/year
Deer Hunting	California	Loomis, 1989	
Net Economic Value			$164/season
Doubling Season Length			$234/season
Half as many hunting parties			$56.20[a]/trip
Seeing twice as many deer			$9.86/trip
Deer Hunting	Alaska	Walsh et al., 1989	$20-$ 59/day
Large Mammal Hunting	Canada	Filion et al., 1990	$200.90/year

[a] This value is applicable only to 5/34 hunting zones.

Table 5-4 Moose Hunting Aggregate Welfare Measures

CV Question	Aggregate Welfare Measure
Increased Out-of-Pocket Expenses	
1) HM Linear Model	$3,719,374/season
2) HM Log Model	$6,044,231/season
Number of Moose	
1) HM Linear Model	$2,637,147/trip
2) HM Log Model	$3,845,993/trip
Crowding	
1) HM Linear Model	$1,585,582/trip
2) HM Log Model	$2,822,534/trip
Season Length	
1) HM Linear Model	$1,830,303/season
2) HM Log Model	$2,496,049/season

5.3 Other Results

In the net economic value model, logit regressions were estimated that took into account the effects of different management areas to determine if there were differences in the responses between the areas. This information could be useful for site-specific management decisions. The management areas were grouped as many areas contained too few observations to be estimated separately. The island of Newfoundland was divided into six geographic zones. Only two regions, the Northern Peninsula and the North Central region, appeared to be significantly different in the logit regressions. The zone representing the Northern Peninsula had a positive influence on WTP, while the zone representing the North Central region had a negative influence on WTP. The Northern Peninsula zone contained six management areas and the North Central zone contained 9 management areas. Although these two zones were significant at the 10% level, the

management areas were highly aggregated and it was concluded that there were not substantial differences between management areas on WTP.

Again, if the hunters responded "no" to the contingent valuation question, he/she was asked why they answered "no". The results are presented in Tables 5-5a, 5-5b, 5-5c. The "other" responses varied among the contingent valuation questions. In the model that dealt with seeing half as many hunters, many respondents felt that if they were to see half as many hunters, there would only be half as many licences given out, and therefore, they would have to wait twice as long to get a licence. For the contingent valuation question dealing with doubling the season length, many hunters felt the season was long enough. 18.24% stated that doubling the season length would not increase their benefits from moose hunting. Another common response for all the moose hunting contingent valuation questions was that moose hunting is already too expensive and it is cheaper to buy meat from a market rather than pay more for hunting moose.

Table 5-5a **Reasons respondents answered 'no' to the contingent valuation question on doubling the season length and/or increased out-of-pocket expenses during the season.**

Reason	Freq.	%
1) The benefits I receive from moose hunting would not be worth the extra money	15	8.8?
2) I cannot afford or would not pay any more than I already pay	25	14.71
3) I do not believe any of the above would increase my benefit from moose hunting	31	18.24
4) I already pay enough for license fees	53	31.18
5) Other	16	9.41
6) More than one of the above	30	17.65
Total	170	100.01

Table 5-5b **Reasons respondents answered 'no' to the contingent valuation question on increasing license fees to reduce crowding and/or increased out-of-pocket expenses during the season.**

Reason	Freq.	%
1) The benefits I receive from moose hunting would not be worth the extra money	30	13.22
2) I cannot afford or would not pay any more than I already pay	28	12.33
3) I do not believe any of the above would increase my benefit from moose hunting	28	12.33
4) I thought my license fees would be increased	85	37.44
5) Other	24	10.57
6) More than one of the above	32	14.10
Total	227	99.99

Table 5-5c **Reasons respondents answered 'no' to the contingent valuation question on seeing twice as many moose and/o increased out-of-pocket expenses during the season.**

Reason	Freq.	%
1) The benefits I receive from moose hunting would not be worth the extra money	33	19.64
2) I cannot afford or would not pay any more than I already pay	78	46.43
3) Seeing more moose would not increase my benefit from moose hunting	26	15.48
4) Other	8	4.76
5) More than one of the above	23	13.69
Total	168	100.0

6.0 Implications of the Results and Direction for Future Research

6.1 Implications of the Results

The CVM has the potential to be a powerful tool in measuring the values associated with nontimber resources. As the various biases that have been identified to occur in the CVM may always be present to some degree, (although minimized through careful structuring of the survey question and techniques such as close-ended questioning) the goal of valuation must be to attempt to "decode" the signal, or the non-random portion of the response, from the noise, or the random portion of the response. This can be done, as Hanemann (1985) suggests, by specifying a specific, parametric random utility model, setting up a statistical model and estimating expected willingness to pay from the estimated utility model. Therefore, the focus of future research should be on how to separate the signal from the noise.

It then follows that the next step is how best to model the signal, or the systematic differences in preferences. From a theoretical standpoint, the ad hoc logarithmic model is not a correct measure of welfare as it is not consistent and it is not possible to extrapolate the results to others in the population. However, in some cases the logarithmic model has resulted in superior statistical results. In general, this does not seem to hold true for the contingent valuation models in this study. There appears to be little difference in the goodness-of-fit measures between specifications. Therefore, in this case, the advantages of adopting an explicit utility function to model responses and obtain theoretically correct measures of welfare appear to outweigh any advantages of improved statistical fit.

It can be seen from the results that there are substantial differences between the welfare measures obtained depending on the specification of the model and on the measure of central tendency. In the clearcutting model, welfare measures vary from $91.57 to $248.14 depending on the specification and the measure of central tendency. In the Pine Marten model with

Hanemann's log specification, the mean value is $47.68 and the median value is $-45.76. The policy implications resulting from the use of these two measures could be substantially different. When there is substantial variability among the welfare measures, the median may provide a more conservative estimate of WTP as the mean is sensitive to outliers in the data. In all of the contingent valuation models, the variability between the median values among the two specifications suggested by Hanemann is less than the difference between the mean values. Therefore, the median as well as being a more robust welfare measure, seems to have less variability across specifications. However, the choice will depend on whether the objective of welfare evaluation is to measure the welfare gain or loss to each individual or aggregate the gains and losses over all the members of the population.

One contentious issue surrounding the CVM is it's ability to capture non-use values. It has long been recognized that individuals have value for environmental goods and services in which they never intend to use. Although these values are difficult to measure in an economic framework, there are no barriers in welfare theory that preclude their measurement (Bishop and Walsh,1992). One important issue surrounding non-use values is the relevant population to be included in the benefit-cost analysis. For example, many individuals 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 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.

Another issue surrounding non-use values is valuing obscure or unknown species. 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. However, Bishop and Walsh (1992) argue that it is theoretically possible that existence values "exist" for even obscure or previously unknown species or resources.

Capturing non-use values may provide a new set of problems and challenges, but as Bishop and Walsh (1992) state "to ignore existence values would be to court the equally damning critism 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?"

Other issues surrounding the valuation of nontimber resources include the existence of an embedding effect and eliciting responses that reflect moral satisfaction rather than economic value (Kahneman and Knetsch,1992). The embedding effect occurs when WTP for a good varies depending on whether the good is valued on its own or as part of an inclusive group of goods. Kahneman and Knetsch (1992) in a contingent valuation survey show that WTP for narrowly defined goods was close to that of more inclusive categories. The moral satisfaction issue arises when WTP to prevent the loss of a public good is affected by moral considerations. In this case responses would not reflect the true economic value associated with the good. These issues are important and must be considered when developing contingent valuation questions and analysing the corresponding results.

6.2 Conclusions and Directions for Future Research

While society values nontimber goods and services, the decisions facing land managers is not whether or not to have nontimber resources, but how to jointly maximize the net benefits from wood production and the net benefits derived from nontimber resources. These decisions are incremental and site-specific issues and it is these decisions that are relevant to forest

management. In order to make these resource allocation decisions, the information has to be available on how social benefits change when the level of a resource increases or decreases from the current level. The theoretical models that have been developed for nontimber valuation allow these incremental values to be estimated.

In most cases of forest management, the crucial question will not be one of timber versus nontimber resources, but what combination of uses yield the highest social net benefits. There may be many competing uses for our forests, but these uses are not always incompatible, and whenever optimal, the resource should be used on a multiple use basis.

Although considerable controversy surrounds the validity and reliability of contingent valuation in valuing nonmarket goods and services, it appears to be one of the best available tools in dealing with this challenging task. One of the challenges of integrated resource management is that it involves so many different disciplines. Although economic valuation doesn't supply a perfect solution, it is an important component in recognizing the contribution of nontimber values to the overall value of the forest, facilitating in sound assessments of the tradeoffs between timber and nontimber goods and services and providing a systematic approach for understanding society's preferences for natural resource management.

The objective of this thesis was to estimate some of the economic values associated with the nontimber resources in Newfoundland and the services that these resources provide. The next step in this process is to identify methods for incorporating empirical results of nontimber resource valuation into integrated resource management decision support systems in a way that can assist forest managers in resource allocation decisions. This would set a framework which examines the tradeoffs between timber and nontimber resources.

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Appendix A

Contingent Valuation Results for the Personal Interview Survey

The personal interview survey served as a useful pretest to the household survey. The questions in the survey were tested to ensure that the wording of the questions was understandable, the market situation developed within the contingent valuation questions was believable, and the questions were eliciting appropriate responses. The dichotomous choice contingent valuation questions that were asked in the personal interview survey were the same as that of the household survey except the clearcutting question differed slightly. Instead of asking if an individual would pay a specified bid amount annually for a permit to enter an area where an alternative method of harvesting was used, the individual was asked if he/she would pay an entrance fee, a random number between 1 and 50 (the range of random numbers were selected from a pretest that asked individuals their maximum WTP), to enter an area where an alternative method of harvesting was used. The question was changed in the household survey as some respondents expressed confusion as to whether this entrance fee was a one time fee or payable each visit.

The total number of useable responses for the Pine Marten contingent valuation question was 114. The logit regression for willingness to pay for the Pine Marten is given by:

(A-1) $PMWTP = \beta_0 - \beta_1(BID) - \beta_2(\text{Pop. of Youth}) + \beta_3(EDUC) + \beta_4(INC)$

where PMWTP = one if the respondent is WTP the bid amount, zero otherwise

BID = the dollar amount the respondent is asked to pay, a random number between 1 and 100

Pop. of Youth = a variable which indicates the population of the area where the respondent spend the majority of his/her youth

EDUC = the individual's education in years

INC = a variable indicating the individual's household income

The expected signs are given in (A-1). The more years of education and the higher the household income, the more likely the respondent will be willing to pay the bid amount. The smaller the population of the area where the respondent spent the majority of his/her youth, the less likely he/she is willing to pay the bid amount.

The total number of useable responses for the clearcutting question is 108. The logit regression for the clearcutting question is given by:

(A-2) $$CLWTP = \beta_0 - \beta_1(BID) + \beta_2(INC)$$

where CLWTP = is one when the respondent answers "yes" to the WTP question and zero otherwise

BID = the dollar amount the respondent is asked to pay, a random number between 1 and 50

The variable INC is the same as defined above. The higher the respondent's household income, the more likely he/she is willing to pay the bid amount, and the higher the bid amount the less likely he/she would be willing to pay the bid amount.

Table A-1 and A-2 present the coefficients on the logit equations, their t-statistics, and the associated mean values of the two welfare models suggested by Hanemann (1984) and a general logarithmic form. The variables all had their expected signs and were significant, however, household income was not significant in the Pine Marten model. In the Pine Marten model, a dummy variable that indicated whether the individual was male (1) or female (0) was significant at the 5% level in the ad hoc log specification and significant at the 10% level in Hanemann's specifications. Figures A-1 and A-2 are the logit curves for the contingent valuation questions.

The welfare measures are summarized in Table A-3. All the welfare measures resulting from the clearcutting model are very close to one another, ranging from $31.34 to $38.30. On

the other hand, the logarithmic model resulted in substantially higher expected values in the Pine Marten Model.

Table A-1 Pine Marten Dichotomous Choice Contingent Valuation Models

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	1.6175 (0.83616)[a]	0.17160*[b] (0.11946)	0.97865 (0.68152)
Bid Amount		-0.035252 (-3.7020)	
Bid/ Income			-0.17661* (-3.1837)
Log Bid	-1.2043* (-3.3917)		
M*/F	-1.1489*** (-2.0015)	-1.0993*** (-1.8775)	-1.1273*** (-1.9329)
Pop. of Youth	-0.52592 (-1.4484)	-0.50517 (-1.3710)	-0.63086*** (-1.8807)
Education	0.18875*** (1.71)	0.18253*** (1.6564)	0.15931 (1.5004)
Income		0.10195 (0.98319)	
Log Income	0.97236 (1.2603)		
SUM[c]	4.2334263	1.6451883	1.0755723
Current Predictions (%)	77.11	79.52	78.31
H-J Normalized Success Index	0.255	0.267	0.246
N	83	83	83

[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 of M*/F (0.6747), Pop. of Youth (2.0241), Education (13.398), Log Income (1.9815) and Income (7.7711).

Table A-2 Clearcutting Dichotomous Choice Contingent Valuation Models

Variable	Model 1 Log	Model 2 Hanemann 1 (Linear)	Model 3 Hanemann 2 (Log)
Intercept	4.4581***[b] (2.0839)[a]	1.009 (1.1158)	3.4837* (4.6949)
Bid Amount		-0.10640* (-4.1059)	
Bid/Income			-0.80907* (-4.3708)
Log Bid	-2.8366* (-3.8115)		
Income		0.30720* (2.8344)	
Log Income	2.5761* (3.0951)		
SUM[c]	9.7720791	3.6144046	3.4837
Correct Predictions (%)	80.25	80.25	79.01
H-J Normalized Success Index	0.352	0.327	0.361
N	81	81	81

[a] Asymptotic t-values in parentheses.

[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 of Log Income (2.0628) and Income (8.5062).

Figure A-1

LOGIT CURVE FOR CLEARCUTTING

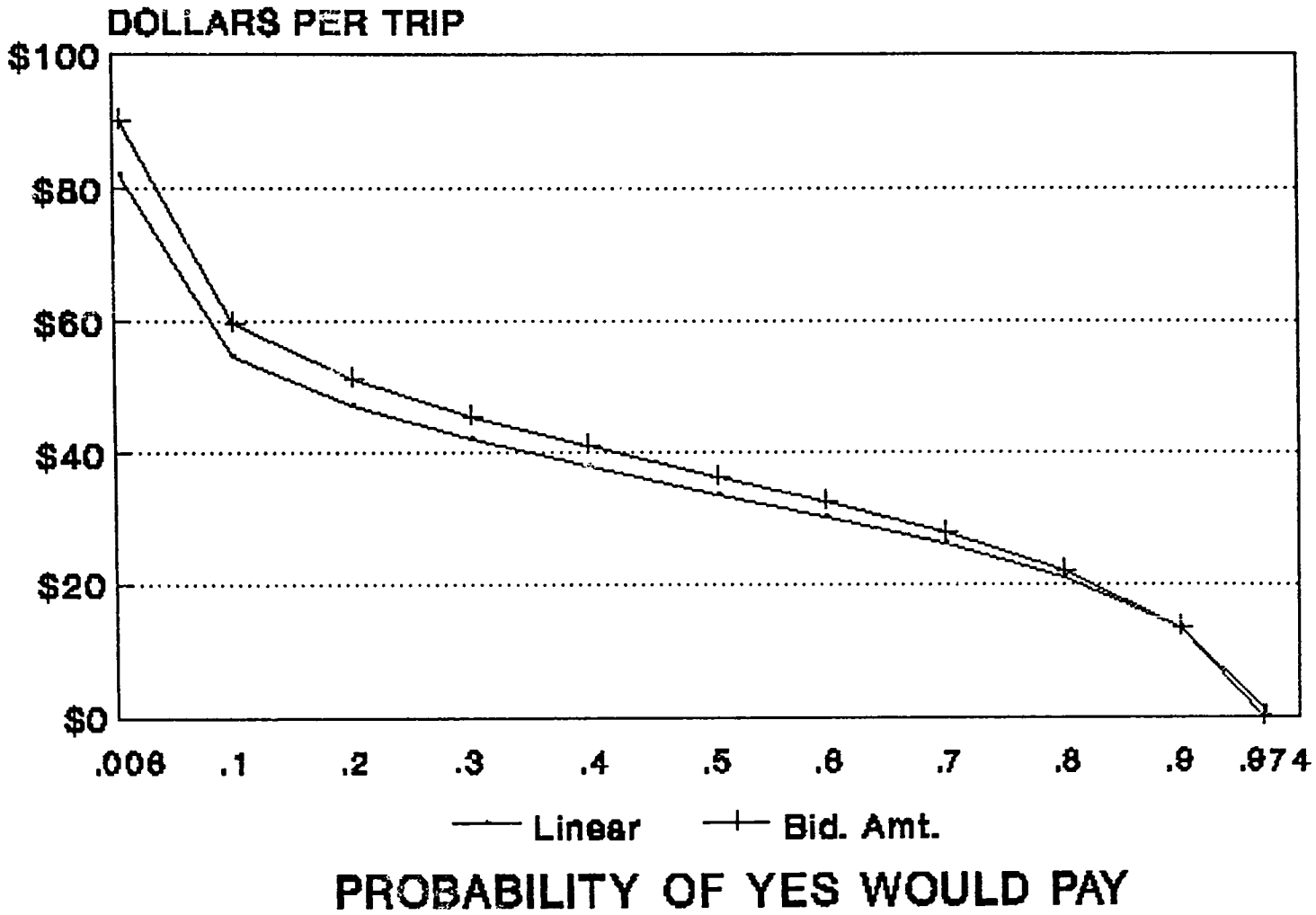

Figure A-2

LOGIT CURVE FOR PINE MARTEN

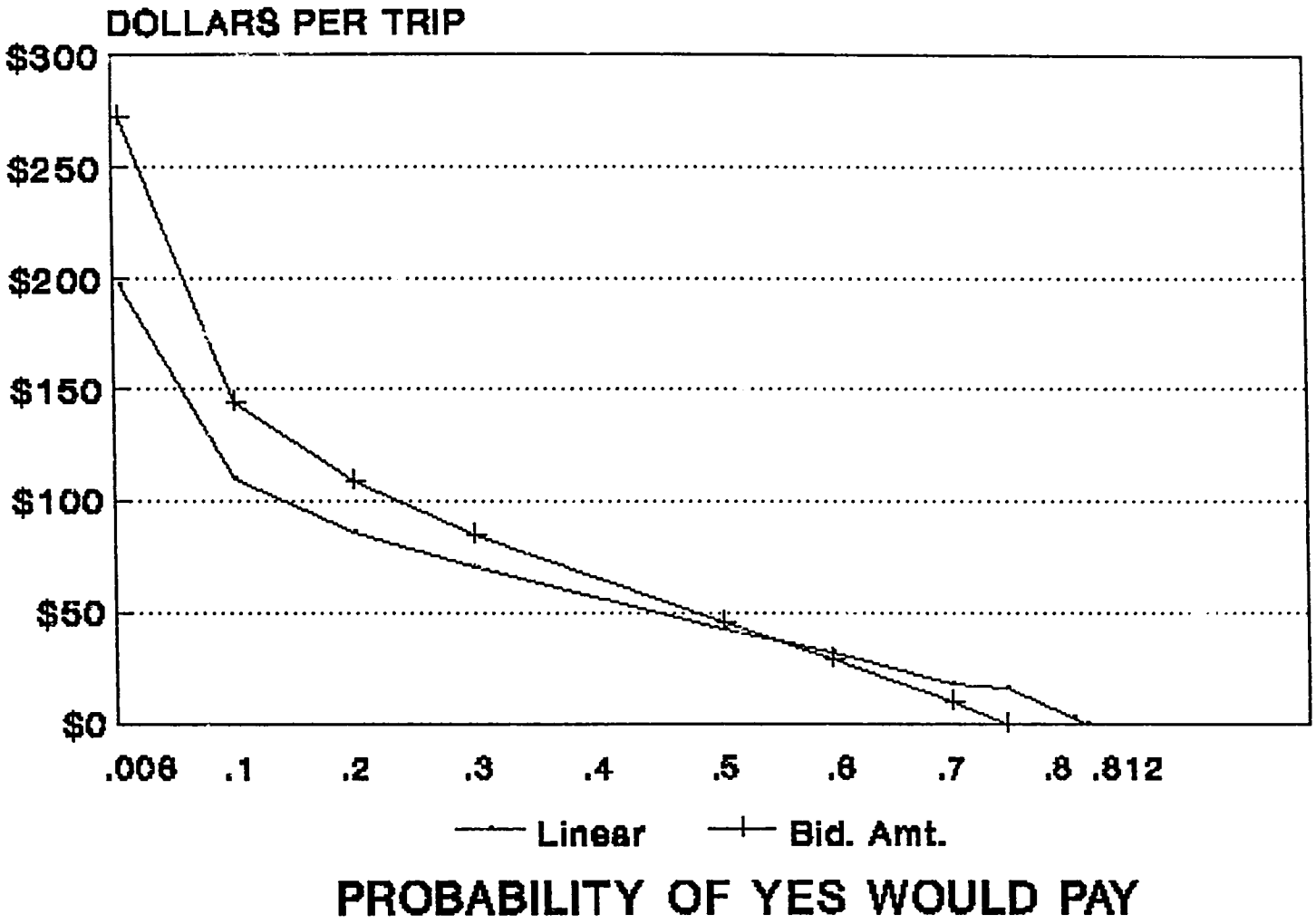

Table A-3 Welfare measures

CV Question		Welfare Measure	
		Mean	Median
Clearcutting	1) HM Linear Model	$ 34.22	$ 33.97
	2) HM Log Model	$ 36.94	$ 36.63
	3) Log Model	$ 38.30	$ 31.34
Pine Marten	1) HM Linear Model	$ 51.67	$ 46.68
	2) HM Log Model	$ 60.24	$ 47.33
	3) Log Model	$ 172.64	$ 33.62

If the respondents answered "no" to the bid amount, they were asked why they answered "no" (Table A-4, A-5). Those responses that were made in protest of some part of the hypothetical market developed were deleted from the analysis.

Table A-4 Reasons for answering 'No' to the Pine Marten WTP question

Justification	Freq.	%
1) I do not receive any benefits from the Pine Marten	12	18.75
2) I am not interested in donating any money towards the preservation of the Pine Marten	4	6.25
3) I do not think the Pine Marten should get in the way of the forest industry	5	7.81
4) I would pay something other than the value stated above *	33	51.56
5) I cannot afford it	9	14.06
6) Missing value	1	1.56

* Mean value $7.41

Table A-5 Reasons for answering 'no' to clearcutting WTP question

Justification	Freq.	%
1) I do not mind seeing clearcuts while I'm on an outdoor recreation trip.	10	27.78
2) I do not think clearcutting is environmentally sound, therefore I do not think there should be any clearcuts.	2	5.56
3) I never notice any evidence of logging on my outdoor recreation trips.	13	36.11
4) I would pay something other than the value stated above *	11	30.56

* Mean value $5.96

There are a few notable differences between the logit regressions in the household and personal interview survey. The differences in the models are likely due to a few factors. First, the personal interview survey was a non-random sample as it was done in preselected gravel pits, private parks, provincial parks and national parks. The island was arbitrarily divided into 4 quadrants; the Avalon, Eastern, Central, and Western and approximately 25 interviews were done in each quadrant. Second, the personal interview survey was a much smaller sample and therefore may not be representative of the general population. Third, the personal interview survey only sampled users of the resource, and generally only those users that were using camping facilities; this would account for only a small percentage of recreation users. Last, there may be differences in the models as a result of differences in the survey instrument used, ie., personal interviews versus mail-out surveys. Although the clearcutting contingent valuation question cannot be compared across models, the estimated expected values for the Pine Marten contingent valuation question appear to be higher in the personal interview survey. It is possible that this method of

surveying may have had a positive influence on WTP; the respondent may have felt more obligated to donate in the presence of an interviewer and/or the respondent may have wished to minimize the time spent being interviewed and felt a yes response would shorten the interview process. Although in the personal interview survey, the interviewer can motivate the respondent to cooperate and supply information on any confusing concepts, the responses in many of the personal interviews appeared to be "rushed". The interviews took place in outdoor recreation areas, and generally, respondents preferred to minimize the amount of time spent taking the interview. Therefore, it's possible that respondents did not carefully consider the market setting in which the environmental good was to be valued. If this was the case, the mail-out survey may have been able to obtain higher quality responses as the respondent would be under less time constraints and able to give more consideration to the market setting developed within the contingent valuation question. This appears to be the case when examining the extensive comments from individuals that accompanied the responses in the mail-out survey.

Appendix B

Household, Moose Hunting and Personal Interview Surveys for Newfoundland

Outdoor Recreation in Newfoundland

Section I

The following questions will give us an idea of the importance of outdoor recreation to you and your household and how you feel about forest management in Newfoundland. The information you provide will be extremely valuable in the management of Newfoundland's forestry resources.

1. Did you take any trips between May 1, 1992 and August 31, 1992 for which the primary purpose was outdoor recreation in Newfoundland (i.e., hiking, camping, fishing, etc.)? **(An outdoor recreation trip is defined as a trip that was at least 20 km from your home.)**

   _____ Yes [Please go to Question 2]

   _____ No [Please go to Page 5, Section II, General Wildlife]

2. For each outdoor recreation trip you took between May 1, 1992 and August 31, 1992, please complete the following information. Again, for the purpose of this survey, **an outdoor recreation trip is defined as a trip that was at least 20 km from your home.** If you took more than 10 trips, only list the first 10. Please indicate the location of your trip as accurately as possible (provincial park, closest town, etc.)

To indicate all the activities that you took part in, please write the letter given to the activity in the space provided below.

a gravel pit camping
b camping (provincial parks, national parks)
c camping (private parks)
d hiking
e viewing, studying, photographing wildlife
f boating
g fishing
h ATV, motorbiking
i picknicking
j swimming
k view parks, forests (sightseeing)
l walking
m other (please specify) _____

Trip No.	Activity	Location	Distance from Home to Site (km one way and travel time in hours)	No. of Individuals in Group	Length of Trip (in days)
Example:	b, c, f	Witless Bay	100 km, 1 1/2 hrs	4	3 1/2 days
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

If you took more than 10 outdoor recreation trips, how many trips in total did you take? _____ trips

3. Please indicate, for **ALL THE TRIPS LISTED ABOVE** in question #2, the total amount of money you spent (if any) on the following items.

Transportation (oil, gas, car rental, repairs, airfare, bus, ferries, etc.)	$ _____
Accommodation (hotels, motels, etc.)	$ _____
Campsite fees (private, provincial, etc.)	$ _____
Food - groceries (including alcohol)	$ _____
Restaurants	$ _____
Rentals (boats, horses, etc.)	$ _____
Equipment purchased specifically for the trip (i.e., propane, fishing equipment, etc.)	$ _____
Fishing licence	$ _____
Other	$ _____

4. Some people feel that time spent travelling is an inconvenience while others find it enjoyable. Please indicate how enjoyable you feel your travel time is for a typical outdoor recreation trip. Please circle only one number.

Not at all Enjoy		**Moderately Enjoyable**		**Extremely Enjoyable**
2		3	4	5

5. Recreational areas as are found in many areas throughout Newfoundland, and many other areas could potentially be marketed for outdoor recreation. What are the most important factors you consider when deciding to go on an outdoor recreation trip? (Please circle the number that best reflects the importance of each item.)

	Not Important				**Very Important**
Naturalness or lack of development	1	2	3	4	5
Privacy from other recreationalists	1	2	3	4	5
Familiarity with the area	1	2	3	4	5
Availability of nearby camping areas	1	2	3	4	5
Distance from home	1	2	3	4	5
Opportunities to take part in activities with family or friends	1	2	3	4	5
Opportunities to view wildlife	1	2	3	4	5
Opportunities to fish	1	2	3	4	5
Other (please specify)_____	1	2	3	4	5

6. Have you visited a cabin/cottage since May 1, 1992?

_____ Yes [Please continue with Question 7]

_____ No [Please go to Section II, Page 5]

7. How often do you visit a cabin/cottage?

_____ about once a week

_____ once every two weeks

_____ once a month

_____ only once or twice during the summer

_____ other (please specify)

_____

8. How far is the cabin/cottage from your home? If you have more than one cabin, please answer the question for the cabin you visit the most.

_____ less than 49 km

_____ between 50 km and 99 km

_____ between 100 km and 199 km

_____ between 200 km and 299 km

_____ between 300 km and 500 km

_____ other (please specify)

_____

Section II - General Wildlife

1. In 1992, did you contribute any time or money to a wildlife or environmental organization?

   _____ Yes

   _____ No [Please go to Question 2]

   If yes, how much did you spend and/or approximately how much time did you volunteer?

   $ _____

   _____ hours

2. If you were given $100 to donate to a wildlife organization, how would you allocate this money for the preservation of the following wildlife species? You must spend all the money but you do not have to contribute to all categories.

Large mammals (moose, caribou, bear)	$ _____
Furbearers (beaver, foxes, lynx, mink, etc.)	$ _____
Songbirds (robins, chickadees, etc.)	$ _____
Game birds (grouse, ptarmigan)	$ _____
Waterfowl (geese, ducks)	$ _____
Seabirds (puffins, turres, etc.)	$ _____
threatened * (i.e., pine marten) or endangered ** (i.e., harlequin duck) species	$ _____
Other wildlife species (please indicate) _____	$ _____
TOTAL	$ 100

* threatened - likely to be endangered if the pressures from humans or natural causes making them threatened are not reversed.

** endangered - threatened with immediate extinction or extirpation (no longer found in the wild in Canada although they may exist elsewhere).

3. Improving recreational opportunities and habitat enhancement for wildlife is often expensive. If these programs were to be put in place, please indicate how you would prefer the funds to be raised. (Please check all those you feel should be used)

a. _____ higher personal income taxes

b. _____ increase fishing/hunting fees

c. _____ lottery funds

d. _____ tax on outdoor recreation goods (i.e., binoculars, etc.)

e. _____ tourist tax (i.e., tax on hotels, car rentals, etc.)

f. _____ donations

g. _____ sale of wildlife stamps / memberships

h. _____ sale of provincial fish / wildlife magazines

i. _____ corporate tax

j. _____ other (please specify) _____

_____

4. If you checked more than one answer in Question 3, please indicate which you feel would be the most effective by writing the letter in the space _____.

Section III - Pine Marten

The following question asks about the amount of money you would be willing to pay for the preservation of the Pine Marten. Depending on your situation the amount of money may seem very high or low, but it is important to answer these questions to collect a wide range of opinions.

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 lives on the west coast of Newfoundland with the greatest concentrations between Grand Lake and Cornerbrook. 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 [Please go to Section IV, Page 8]

_____ No [Please continue]

If your answer in the previous question was no, please tell us why. **Please check only one.**

_____ 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) _____

_____

_____

Section III - Clearcutting

The following question asks about the amount of money you would be willing to pay for access to a specific recreation area. Depending on your situation the amount of money may seem very high or low, but it is important to answer these questions to collect a wide range of opinions.

1. There are many ways in which forests can be harvested. Clearcutting is one method where all the trees in an area of forest land are removed in a single cut and the area harvested is large enough to remove the forest influence. Clearcutting, as well as providing access to areas for recreational use, if carried out properly, is a safe, effective, and ecologically sound method of harvesting. Yet many individuals feel that clearcuts are generally not aesthetically appealing.

   If you had a choice of two identical outdoor recreation areas, both the same distance from your home and offering the same facilities and recreation opportunities (i.e. camping, fishing, hiking), but in one outdoor recreation area the forests were clearcut while in the other an alternative method of harvesting was used (such as a shelterwood cut where there is a gradual removal of the entire stand in a series of partial cuttings) that reduced the visual impact of harvesting, would you be willing to pay an annual fee of $ _____ for a permit to enter the area where the alternative method of harvesting was used?

   _____ Yes [Please go to Question 2]

   _____ No [Please go to Question 3]

2. If clearcutting was done in such a way that it was incorporated into the landscape, so as to reduce the visual impact of clearcuts, would you still be willing to pay $ _____ to go to an area with no clearcuts?

   _____ Yes [Please go to Section IV, Page 8]

   _____ No [Please go to Section IV, Page 8]

3. If your answer in question 1 was no, please tell us why. **Please check only one.**

   _____ I do not mind seeing clearcuts while I'm on an outdoor recreation trip.

   _____ I do not think clearcutting is environmentally sound and therefore I don't think there should be any clearcuts.

   _____ I never notice any evidence of logging on my outdoor recreation trips.

   _____ I would pay something other than the value stated above. Please indicate the value $ _____

   _____ Other (please explain) _____

   _____

   _____

Section IV

The following questions are designed to tell us a little bit about you. This information will only be used to report comparisons among groups of people and you will not be identified in any way. Your answers will be very helpful in analyzing the data in a meaningful way.

1. Are you: Male _____ Female _____

2. In which of the following age groups do you belong?

   _____ 18 - 25
   _____ 26 - 39
   _____ 40 - 49
   _____ 50 - 64
   _____ 65 years and over

3. How many years have you lived in Newfoundland?

   _____ all my life
   _____ 0 - 5 years
   _____ 6 - 10 years
   _____ 11 - 20 years
   _____ 21 - 40 years
   _____ other (please indicate)

4. How many people live in your household? _____

5. How many children under the age of 16 live in your household? _____

6. What is your place of residence (name of nearest city or town)? _____

7. Did you spend the majority of your youth in a:

   _____ rural area (under 1000)
   _____ small town (between 1000 - 5000)
   _____ urban area (over 5000)

8. Which category comes closest to the population of the area you live now?

   _____ less than 500
   _____ 500 - 999
   _____ 1,000 - 4,999
   _____ 5,000 - 9,999
   _____ 10,000 - 24,999
   _____ 25,000 - 49,999
   _____ 50,000 - 99,999

9. Please indicate the highest level of education you have completed. (Check the appropriate line)

____ primary school (kindergarten to grade 3)	____ university with degree
____ elementary school (grades 4 to 6)	____ university (not yet obtained degree)
____ high school (grades 7 to 11/12)	____ graduate degree
____ trade school or technical college	

10. Which of the following categories best represents your annual household income before taxes? (Please check the appropriate category)

____ $0 - $4,999	____ $25,000 - $29,999	____ $50,000 - $59,999
____ $5,000 - $9,999	____ $30,000 - $34,999	____ $60,000 - $69,999
____ $10,000 - $14,999	____ $35,000 - $39,999	____ $70,000 - $79,999
____ $15,000 - $19,999	____ $40,000 - $44,999	____ $80,000 - $99,999
____ $20,000 - $24,999	____ $45,000 - $49,999	____ Over $100,000

11. How many persons contribute to this income? _____

If you have any other comments, please list them below or on the back of this sheet.

Thank you for completing this survey. Your cooperation is essential for effective management of the forestry resources. The card provided is an entry form for our prize draw. If you wish to enter this draw, please write your name and address on this card. The card will be separated from your survey when we receive it, so that your responses will remain confidential. Please return this survey, and the card, in the stamped, self-addressed envelope.

Moose Hunting in Newfoundland

Section I

The following questions deal with the factors you feel are important in selecting a hunting area. The forests can be managed in many different ways and the information you provide is important in management decisions.

1. When you decide to go moose hunting, how important are the following factors in deciding where you want to hunt? Please circle one response for each question to indicate if the reason is important or not

	Not Important		Somewhat Important		Very Important
Good chance of bagging a moose	1	2	3	4	5
Good chance of bagging a trophy moose	1	2	3	4	5
Naturalness of the area or lack of development	1	2	3	4	5
Number and quality of access roads	1	2	3	4	5
Privacy from other hunters	1	2	3	4	5
Familiarity with the area	1	2	3	4	5
Distance from home	1	2	3	4	5
Opportunity to visit with family or friends	1	2	3	4	5
Availability of nearby areas for camping	1	2	3	4	5
How important is moose hunting as a recreation activity compared to your other recreation activities	1	2	3	4	5

2. Did you hunt moose this season? (Please check).

_____ Yes [Please continue with Question 3]

_____ No [Please go to Page 6, Section IV]

3. What management area did you hunt in this season (fall, 1992)?

_____

4. For each moose hunting trip you took in the 1992 hunting season, please complete the following information. If you took more than 10 trips, only list the first 10.

Trip No.	Distance from Home to Site (km one way and travel time in hours)	No. of Individuals in Group	Length of Trip (in days)	Did You or Anyone in Your Group Harvest a Moose
Example:	50 km, 1 1/2 hrs	4	5 days	yes
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

If you took more than 10 moose hunting trips, how many trips in total did you take?

_____ trips

5. Please indicate the amount of money spent on moose hunting trips during the fall of 1992.

Transportation (incl. oil, gas, repairs, airfare, bus, etc.)	$ _____
Accommodation (hotels, motels, lodges, etc.)	$ _____
Campsite fees (private, provincial, etc.)	$ _____
Food - groceries (including alcohol)	$ _____
Restaurants	$ _____
Rentals (boats, airplanes, etc.)	$ _____
Equipment purchased specifically for the trip (i.e., hunting equipment, etc.)	$ _____
Hunting licence	$ _____
Other (i.e., books, guide fees, etc.)	$ _____

Section II

Please answer the following questions for A TYPICAL HUNTING TRIP.

1. While moose hunting on your typical trip, did you (check applicable)

_____ use a vehicle

_____ use a trail bike or ATV

_____ use a snowmobile

_____ use an aircraft

_____ use horses

_____ hike or backpack

_____ boat

2. About how far from a road did you spend most of your time hunting?

_____ km

3. Was the access to the management area?

_____ poor

_____ just right

_____ too easy

4. Please rank the following in order of importance to you in terms of your reasons for moose hunting. (1st, 2nd, 3rd, etc.)

_____ recreation

_____ sport

_____ food

_____ other (please specify) _____

_____

5. Some people feel that time spent travelling to the hunting zone is an inconvenience while others find it enjoyable. Please circle the number that indicates how enjoyable you felt the travel time was on a typical hunting trip.

Not at all Enjoyable		**Moderately Enjoyable**		**Extremely Enjoyable**
1	2	3	4	5

Section III - Benefits to You of Improved Moose Habitat Management

The following questions ask about the value of moose hunting to you. The questions are asked in an attempt to develop information on hunter preferences and do not necessarily reflect actual changes in policy.

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

   _____ Yes

   _____ No

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

   _____ Yes

   _____ No

3. On **your most recent most hunting trip**, approximately how many moose did you see?

   _____ number of moose seen

4. On your most recent trip, if everything about moose hunting was the same except you saw twice as many moose (if you saw none, one moose) and your expenses increased by $ _____, would you incur the cost?

   _____ Yes

   _____ No

5. If you answered **no** to question 2 or 4, please answer the following question.

   Why did you answer no? (Please check only **one**).

   _____ 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

   _____ Seeing more moose would not increase my benefit from moose hunting

   _____ Other (please specify) _____

   _____

Section III - Benefits to You of Improved Moose Habitat Management

The following questions ask about the value of moose hunting to you. The questions are asked in an attempt to develop information on hunter preferences and do not necessarily reflect actual changes in policy.

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

   _____ Yes

   _____ No

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

   _____ Yes

   _____ No

3. If everything about moose hunting was the same except the season length doubled so there were twice as many legal days you could hunt, and your licence fees increased by $ _____, would you incur the cost?

   _____ Yes

   _____ No

4. If you answered **no** to questions 2 or 3, please answer the following question. Why did you answer no? (Please check only **one**).

   _____ 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

   _____ I do not believe any of the above would increase my benefit from moose hunting

   _____ I already pay enough for licence fees

   _____ Other (please specify) _____

   _____

Section III - Benefits to You of Improved Moose Habitat Management

The following questions ask about the value of moose hunting to you. The questions are asked in an attempt to develop information on hunter preferences and do not necessarily reflect actual changes in policy.

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

   _____ Yes

   _____ No

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

   _____ Yes

   _____ No

3. On **your most recent moose hunting trip**, how many other hunting parties did you see while hunting on a typical day? (Please circle **one**).

   0 1-2 3-5 6-10 11-15 16-20 21+

4. On average, how crowded did you feel this area was when you were hunting? (Please circle the appropriate number).

Not at all Crowded		Moderately Crowded		Extremely Crowded
1	2	3	4	5

5. If everything about moose hunting in the area you last visited was the same except you only saw half as many hunting parties and the licence fees increased by $ _____, would you incur the cost?

   _____ Yes

   _____ No

6. If you answered **no** to questions 2 or 5, please answer the following question. Why did you answer no? (Please check only **one**).

   _____ 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

   _____ I do not believe any of the above would increase my benefit from moose hunting

   _____ I already pay enough for licence fees

   _____ Other (please specify) _____

   _____

   _____

Section IV

The following questions are designed to tell us a little bit about you. This information will only be used to report comparisons among groups of people and you will not be identified in any way. Your answers are very helpful for analyzing the data in a meaningful way.

1. Are you: Male _____ Female _____

2. In which of the following age groups do you belong?

   _____ 18 - 25
   _____ 26 - 39
   _____ 40 - 49
   _____ 50 - 64
   _____ 65 years and over

3. How many years have you lived in Newfoundland?

   _____ all my life
   _____ 0 - 5 years
   _____ 6 - 10 years
   _____ 11 - 20 years
   _____ 21 - 40 years
   _____ other (please indicate)

4. How many people live in your household? _____

5. How many children under the age of 16 live in your household? _____

6. What is your place of residence (name of nearest city or town)? _____

7. Did you spend the majority of your youth in a:

   _____ rural area (under 1000)
   _____ small town (between 1000 - 5000)
   _____ urban area (over 5000)

8. Which category comes closest to the population of the area you live now?

   _____ less than 500
   _____ 500 - 999
   _____ 1,000 - 4,999
   _____ 5,000 - 9,999
   _____ 10,000 - 24,999
   _____ 25,000 - 49,999
   _____ 50,000 - 99,999

9. Please indicate the highest level of education you have completed. (Check the appropriate line)

____ primary school (kindergarten to grade 3)	____ university with degree
____ elementary school (grades 4 to 6)	____ university (not yet obtained degree)
____ high school (grades 7 to 11/12)	____ graduate degree
____ trade school or technical college	

10. Which of the following categories best represents your annual household income before taxes? (Please check the appropriate category)

____ $0 - $4,999	____ $25,000 - $29,999	____ $50,000 - $59,999
____ $5,000 - $9,999	____ $30,000 - $34,999	____ $60,000 - $69,999
____ $10,000 - $14,999	____ $35,000 - $39,999	____ $70,000 - $79,999
____ $15,000 - $19,999	____ $40,000 - $44,999	____ $80,000 - $99,999
____ $20,000 - $24,999	____ $45,000 - $49,999	____ Over $100,000

11. How many persons contribute to this income? _____

If you have any other comments, please list them below or on the back of this sheet.

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OUTDOOR RECREATION IN NEWFOUNDLAND

PERSONAL INTERVIEW

TIME AND DATE_____

LOCATION _____

Resident (on the island of Newfoundland) _____

Nonresident _____

If nonresident:

Where do you live? _____

How many years have you been coming to Newfoundland? _____

What is your primary reason for coming?_____

SECTION I

The following questions will give us an idea of the importance of outdoor recreation to your household and how you feel about forest management in Newfoundland. The information you provide will be extremely valuable in the management of Newfoundland's forestry resources.

1. We would like some information on your current outdoor recreation trip (or any other trips made this year since May 1,1992) where an outdoor recreation trip is defined as a trip that was farther than 20 km from your home. Please indicate all the activities you took part in during your trip. Please do not include trips to cabins/cottages in the chart below. [Length of trip for current trip is the expected length of trip].

a gravel pit camping
b camping (provincial parks, national parks)
c camping (private parks)
d hiking
e viewing, studying, photographing wildlife
f boating
g fishing
h ATV, motorbiking
i picnicking
j swimming
k viewing parks, forests (sightseeing)
l walking
m other (please specify) _____
_____
_____

Trip No.	Activity	Location	Distance from Home to Site (km one way and travel time in hours)	Number of Individuals in Group	Length of Trip (in days)
example	b,c,f	Witless Bay	100km,1 1/2hrs.	4	3 1/2 days
current					
2					
3					
4					
5					
6					

If there were more than 6 trips taken, list the information on the back on the sheet.
If more than 10 outdoor recreation trips were taken, please indicate the number of additional trips that were taken.

_____ trips

2. Please indicate, for **ALL THE TRIPS LISTED ABOVE** in question #1, the amount of money you spent (if any) on the following items.[For current trips, use expected expenditures for the trip]

Transportation (including car rentals,oil,

gas, airfare, bus, ferries, etc.) $_____

Accommodation (hotels, motels, etc) $_____

campsite fees (private, provincial, etc.) $_____

food - groceries (including alcohol) $_____

restaurants $_____

rentals (boats, horses, etc.) $_____

equipment purchased specifically for the trip (ie. binoculars,fishing equipment, etc.) $_____

fishing licence $_____

other $_____

total $_____

3. Some people feel that time spent travelling is an inconvenience while others find it enjoyable. On a scale of 1 to 5, where 1 is not at all enjoyable and 5 is extremely enjoyable, please state how enjoyable you find time spent travelling on a typical outdoor recreation trip in Newfoundland. [current trip for nonresidents].

not at all enjoyable		moderately		extremely enjoyable
1	2	3	4	5

4. Recreation areas are found in many areas throughout Newfoundland, and many other areas could potentially be managed for outdoor recreation. On a scale of 1 to 5 where 1 is not very important and 5 is very important, please state how important the following characteristics are to you on a **TYPICAL** outdoor recreation trip in Newfoundland. [current trip for nonresidents; D. is not applicable to campers]

	NOT IMPORTANT				VERY IMPORTANT
A. naturalness or lack of development	1	2	3	4	5
B. privacy from other recreationalists	1	2	3	4	5

C. familiarity with the area	1	2	3	4	5
D. availability of nearby camping areas	1	2	3	4	5
E. close to home	1	2	3	4	5
F. opportunities to take part in activities with family or friends	1	2	3	4	5
G. opportunities to view wildlife	1	2	3	4	5
H. opportunities to fish	1	2	3	4	5
I. other (please specify) _____	1	2	3	4	5

5. Have you visited a cabin/cottage since May 1, 1992? [Questions 5,6,7 are not applicable to nonresidents]

_____ YES

_____ NO

6. How often do you visit the cabin/cottage?

_____ about once a week

_____ once every two weeks

_____ once a month

_____ only once or twice during the summer

_____ other _____

7. How far is the cabin/cottage from your home? If you have more than one cabin, please answer the question for the cabin you visit the most.

_____ less than 49 km

_____ between 50 km and 99 km

_____ between 100 km and 199 km

_____ between 200 km and 299 km

_____ between 300 km and 500 km

_____ other_____

SECTION II

GENERAL WILDLIFE

1. In 1992, did you contribute any time or money to an environmental or wildlife organization?

_____ YES

_____ NO

If yes, how much did you spend or approximately how much time did you volunteer?

$_____

_____ hours

2. If you were given $100 to donate to a wildlife organization, how would you allocate this money for the preservation of the following wildlife species? You must spend all the money (but you do not have to contribute to all categories).

large mammals (moose, caribou, deer, bear) $_____

furbearers (beaver, lynx, foxes, etc) $_____

songbirds (robins chickadees etc) $_____

game birds (grouse, pheasants) $_____

waterfowl (geese, ducks) $_____

seabirds (puffins, turres, etc) $_____

threatened* (ie. pine martin) or
endangered* (ie. harlequin duck) species $_____

other wildlife species (please indicate)
_____ $_____

*threatened - likely to be endangered if the pressures from humans or natural causes making them threatened are not reversed
*endangered - threatened with immediate extinction or extirpation (no longer found in the wild in Canada although they may exist elsewhere)

3. Improving recreational opportunities and habitat enhancement for wildlife is often expensive. If these programs were to be put in place, please indicate how you would prefer the funds to be raised. (Please check applicable)

a._____ higher personal income taxes

b._____ increase fishing/hunting fees

c._____ lottery funds

d._____ tax on outdoor recreation goods (ie. binoculars etc.)

e._____ tourist tax (ie. tax on hotels, car rentals etc.)

f._____ donations

g._____ sale of wildlife stamps / memberships

h._____ sale of provincial fish/wildlife magazines

i._____ corporate tax

j._____ other (please specify)

_____

4. If you choose more than one answer, please indicate which you feel would be the most effective. _____

SECTION III - CLEARCUTTING

1. There are many ways in which forests can be harvested. Clearcutting is one method where all the trees in an area of forest land are removed in a single cut and the area harvested is large enough to remove the forest influence. Clearcutting, as well as providing access to areas for recreational use, if carried out properly, is a safe, effective, and ecologically sound method of harvesting. Yet many individuals feel that clearcuts are generally not aesthetically appealing.

   If you had a choice of two identical outdoor recreation areas, both the same distance from your home and offering the same facilities and recreation opportunities (i.e. camping, fishing, hiking), but in one outdoor recreation area the forests were clearcut while in the other an alternative method of harvesting was used (such as a shelterwood cut where there is a gradual removal of the entire stand in a series of partial cuttings) that reduced the visual impact of harvesting, would you be willing to pay an entrance fee of $ _____ per trip to enter the area where the alternative method of harvesting was used?

   _____ YES

   _____ NO

2. If clearcutting was done in such a way that it was incorporated into the landscape, so as to reduce the visual impact of clearcuts, would you still be willing to pay $ _____ to go to an area with no clearcuts?

   _____ YES

   _____ NO

3. If your answer in question 1 was no, please tell us why. **Please check only one.**

   _____ I do not mind seeing clearcuts while I'm on an outdoor recreation trip.

   _____ I do not think clearcutting is environmentally sound and therefore I don't think there should be any clearcuts.

   _____ I never notice any evidence of logging on my outdoor recreation trips.

   _____ I would pay something other than the value stated above. Please indicate the value $ _____

   _____ Other (please explain) _____

   _____

   _____

SECTION III

PINE MARTIN

The Newfoundland pine martin 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 martin lives on the west coast of Newfoundland with the greatest concentrations between Grand Lake and Cornerbrook. 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 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. Please only check one.

_____ 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 forestry industry

_____ I would pay something other than the value stated above. Please indicate the value. $_____

_____ other (Please specify)_____

_____

_____

SECTION IV

The following questions are designed to tell us a little bit about you. This information will only be used to report comparisons among groups of people and you will not be identified in any way. Your answers will be very helpful for analyzing the data in a meaningful way, and again, will be strictly confidental.[Allow the individual to fill in this section out on their own to ensure confidentiality; Questions 3-7 are not applicable to nonresidents]

1. Are you male _____

female _____

2. Which of the following age groups do you belong?

_____ 18-25

_____ 26-39

_____ 40-49

_____ 50-64

_____ 65 years and over

3. How many years have you lived in Newfoundland?

_____ all my life

_____ 0 - 5 years

_____ 6 - 10 years

_____ 11 - 20 years

_____ 21 - 40 years

_____ other (please indicate)_____

4. How many people live your household?_____

5. How many children under the age of 16 live in your household?_____

6. Did you spend the majority of your youth in a:

_____ rural area (under 1000)

_____ small town (between 1000 - 5000)

_____ urban area (over 5000)

7. Which category comes the closest to the population of the area in which you live now?

_____ less than 500
_____ 500 - 999
_____ 1000 - 4999
_____ 5000 - 9999
_____ 10,000 - 24,999
_____ 25,000 - 49,999
_____ 50,000 - 99,999

8. Please indicate the highest level of education you have completed. (Check the appropriate line)

_____ primary school (Kindergarten to grade 3)
_____ elementary school (grades 4 to 6)
_____ high school (grades 7 to 11/12)
_____ trades school or technical college
_____ university (with degree)
_____ university (without degree)
_____ graduate or Phd.

9. Which of the following categories best represents your annual household income before taxes? (Please check the appropriate category)

___ $0 - $4999
___ $5000 - $9999
___ $10,000 - $14,999
___ $15,000 - $19,999
___ $20,000 - $24,999
___ $25,000 - $29,999
___ $30,000 - $34,999
___ $35,000 - $39,999
___ $40,000 - $44,999
___ $45,000 - $49,999
___ $50,000 - $59,999
___ $60,000 - $69,999
___ $70,000 - $79,999
___ $80,000 - $99,999
___ over $100,000

10. How many persons contribute to this income? _____

Please list any comments you have on the back of the sheet.