LAND ENVIRONMENT & PEOPLE

New Zealand Big Game Hunting Values:

A benefit transfer study

Geoffrey N. Kerr

Amelia Woods

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Chapter 1
Introduction

New Zealand recreational hunting interests have argued that the larger introduced mammals, including deer (various species[1], but most prominently Red deer), chamois (*rupicapra rupicapra*), tahr (*Hemitragus jemlahicus*) and pigs (*Sus scrofa*), should be managed to enhance the recreational benefits from hunting. The New Zealand Game Animal Council (NZGAC) has been promoted as an agency that would be responsible for managing hunting on public lands that are not of critical importance for conservation purposes (GACEC, 2010). Part of the argument for establishment of the NZGAC is that hunting is a significant source of recreation benefits (GACEC, 2009). However, there are no national or regional estimates of the scale of those benefits, either for the current state of recreational game animal hunting, or under alternative future management strategies that could be implemented for the purposes of improving the quality of hunting experiences. There is limited and dated local information that may not be relevant to contemporary conditions.

Resource allocation decision makers encounter differential quality of information about values of competing resource uses. Some uses (such as forestry and farming) produce products that are traded in the market place. For example, the gross value of timber extracted from a forest is signalled by the market price[2]. Some resource products are not traded in markets. Examples include wildlife habitat, visual amenity and public land recreation. Such products clearly have value, despite absence of market prices. Accounting for these “non-market values” is important in determining the relative benefit obtained from alternative uses of resources. Information on non-market values can be important in comparing alternative resource uses, such as the decision about whether land should be used for agriculture or a national park, or for allocation between competing users. For example, recreational meat hunters, recreational trophy hunters, the wild game meat industry, and commercial hunting guides may sometimes compete for the same resource. While there are market indicators of the value of game to the commercial game meat industry and to commercial hunting guides, usually there is no such information about the value of game to recreational hunters.

Understanding the values of recreational activities, and how changes in the nature of the recreational experience influence values, has provided much of the stimulus for development of non-market valuation methods. For example, the travel cost method of non-market valuation was developed specifically to estimate recreational values. Recreational hunting has been the focus of a significant amount of valuation activity. Indeed, the first application of the contingent valuation method was Davis’ (1964) valuation of deer hunting in the Maine woods (Mitchell & Carson, 1989).

Three New Zealand studies have addressed the recreational benefits derived by big game hunters (Sandrey & Simmons, 1984; Nugent & Henderson, 1990; Kerr, 1996)[3]. All three studies were undertaken some time ago. Since then there may have been changes in the resource (game animal abundance was low at the time of these studies) and in the human population (changing recreation preferences, incomes, time availability, etc.). In addition, non-market valuation methodology has undertaken significant advances over the intervening period. Consequently, existing New Zealand studies may convey little information about the value of contemporary recreational hunting. They

1 Feral deer species established in New Zealand include Red deer (*Cervus elaphus scoticus*), Fallow deer (*Dama dama*), Sika deer(*Cervus nippon*), Whitetail deer(*Odocoileus virginianus*), Wapiti (Elk, *Cervus canadensis*, Sambar (*Rusa unicolor*), and Rusa (*Rusa timorensis*).

2 The net value of forestry is somewhat less than that though, because of the costs associated with establishing the forest, silvicultural costs and harvest costs, amongst others. Care needs to be taken to distinguish “benefits” (net value) from “revenue”.

3 Several New Zealand studies have addressed the value of another type of wild game harvest, recreational freshwater fishing (Beville & Kerr, 2009; Gluck, 1974; Kerr, 1996; Kerr & Greer, 2004; Kerr et al., 2004; McBeth, 1997)

provide no information on changes in recreational hunting values contingent upon management for the benefit of hunters.

Estimating non-market values is usually a slow and expensive activity, requiring design of appropriate survey instruments, identification of resource users (or potential users), making contact with them, collecting data from them and then analysing it. One alternative to collection of primary data is to utilise information from existing studies (source values or primary values) to provide an indication of the likely order of magnitude of benefits for the item of interest (target value), is a process known as benefits transfer or, more recently, value transfer. Identification of human and resource-related factors that influence values can be an important product from value transfer studies.

The purpose of this study is to apply value transfer to estimate the magnitude of New Zealand recreational big game hunting benefits and, if possible, to gain an understanding of the factors that affect big game hunting values.

1.1 Value Transfer Methods

Applications and developments of value transfer have become prominent in the economics literature[4]. State of the art assessments of value transfer have occurred in two academic journal special issues (*Water Resources Research*, Volume 28(3), 1992 and *Ecological Economics*, Volume 60(2), 2006). Assessments of the state of the art, alternative approaches to value transfer, value transfer reliability and conditions that improve quality of value transfers are provided in books by Ready & Navrud (2007) and Rolfe & Bennett (2006), book chapters by Vandenberg *et al*. (2001) and Rosenberger & Loomis (2003) and journal articles (e.g. Boyle *et al.,* 2009; Brouwer & Spaninks, 1999; Kristofersson & Navrud, 2005; Plummer, 2009; Rosenberger & Johnston, 2009; Stapler & Johnston, 2009). Nelson & Kennedy (2009) provide guidance on procedures for undertaking quality meta-analysis.

There are three main value transfer methods; point transfer, value function transfer, and meta-analysis. Point transfer is the simplest approach. It takes value estimates from one or more existing studies and uses those as estimates of value at the site of interest. In many situations there are multiple values estimated in single source studies and, in addition, there may be several source studies that provide values for the benefit transfer process. In such cases, some measure of central tendency amongst the source study values (such as the mean or the median) is required. There may also be some justification for trimming extreme source values to provide a more robust indicator of central tendency, or weighting to reflect source value quality.

The point transfer method assumes a close match between source and target sites and populations (Brouwer, 2000). If values are sensitive to environmental factors, such as terrain, game animal density, trophy potential, species availability or substitute site availability, then care needs to be taken to match site characteristics. For example, benefit estimates from a source site with low numbers of deer, where hunting of bucks is not permitted and where there are many neighbouring close substitute sites is unlikely to provide a reliable estimate of values obtained from a unique site with large numbers of trophy animals that may be legally harvested. Furthermore, demographic, social and cultural matters may also affect values, implying the need to closely match the valuing populations; communities with low incomes, poor health and a large proportion of elderly residents

4 A *Google Scholar* search in July 2010 on the term “benefit transfer” since 2005 identified 1930 items.

may, for example, yield relatively low big game hunting values. It is not always possible to identify sites and populations that closely match on both resource-related and human-related criteria.

Value function transfer addresses some of the concerns about non-matching resources and human populations. Many non-market valuation studies identify factors affecting values, typically through some form of regression analysis of value estimates on social, management or other characteristics. The resulting value functions may be used to adjust value estimates from the source site so they better reflect the conditions prevailing at the target site.

Meta-analysis employs value estimates from a large number of studies to determine the factors that affect value, usually by way of regression analysis. Many studies use ordinary least squares regression, but more advanced statistical methods are sometimes employed to address the panel nature of the data, stochasticity, heteroskedasticity, and data heterogeneity (Nelson & Kennedy, 2009). As with value function transfer, meta-function coefficients are used alongside target site parameters to predict money values at the target site.

1.2 Recreation Value Transfer

Outdoor recreation value transfer applications include Bateman & Jones (2003), Johnston *et al.* (2006), Kaval & Loomis (2003), Loomis (1992), Scarpa *et al*. (2007), Shrestha & Loomis (2001, 2003) and Zanderson & Tol (2009).

Benefit transfer studies that have specifically identified big game hunting values include Bolon (1994), Duffield (2003), Loomis (2005), Rosenberger & Loomis (2001), Shrestha *et al.* (2007) and Walsh *et al.* (1992). An electronic recreation value transfer tool – The Wildlife Habitat Benefits Estimation Toolkit (Kroeger *et al*., 2008; Loomis *et al*., 2008), available from Defenders of Wildlife (undated) has facilities for estimating big game hunting values.

1.3 International Transfer

International value transfer often requires translation to a common currency unit[5], using either official exchange rates or purchasing power parity indices. Shrestha & Loomis (2001) assessed international transfers of outdoor recreation values, adjusting for currency differences using purchasing power parities and per capita income differentials. Six hunting studies, including one from New Zealand (Kerr, 1996), were amongst the 28 studies analysed. Mean transfer error was 28%, and transferred values were highly correlated with values from original studies in other countries. However, transfer errors were statistically significant in many cases. Shrestha & Loomis (2001: 81) conclude “in general, our US studies-based meta-analysis has some potential for transferring recreation benefits to many of the unique recreation sites around the world”. In a related paper, Shrestha *et al.* (2007) note the consistent significance of differences between big game hunting values and other recreational values, leading them to conclude (page 175) “Possibly a more realistic approach [than treating all recreation as providing similar benefits] would be the assumption of meta-valuation functions for single or similar activities, such as winter sports, hunting, fishing, or sightseeing.”

Apart from the need for commensurability between currencies, adjustments which they argue should occur using purchasing power parity adjusted exchange rates, Ready & Navrud (2006) claim

5 But not between countries using a common currency, such as within the European Union.

the only differences between inter-country and intra-country value transfers are matters of degree. Based on their testing of international transfers of health benefits and a review of inter-country value transfers Ready & Navrud (2006: 433) conclude:

> "the average transfer error for international benefit transfers tends to be in the range 20% to 40%, but individual transfers have errors as high as 100-200%. These transfer errors are similar, both in the size of the average and the range, to those found in intra-country transfers."

Other recent health-related international transfer studies include Ready *et al.* (2004), who assessed health benefit transfer errors between five European countries. Transfer error was about 38% for each of the three transfer methods employed in the study – naive point value transfer, point values adjusted for income differences, and value function transfer. Brouwer & Bateman (2005) assessed health value transfers between countries with different exposure to and susceptibility to disease. Currencies were converted using purchasing power parity indices. In transfers between similar contexts point value transfers outperformed function transfers (mean transfer errors 0.4% and 18.7%, respectively). However, when the context differed point transfers were inferior to value function transfers that allowed for the different circumstances (mean transfer errors 31% and 9%, respectively.

Concurrent contingent valuation of freshwater fish in three Nordic countries using identical surveys by Kristoferson & Navrud (2007: p. 223) found that "WTP estimates are consistent between countries for all tested scenarios". They concluded "the accuracy of benefit transfer relies heavily on the similarity of populations and described scenarios in respect to environmental conditions in each country. ... the more similar the populations and environmental goods are the smaller the transfer errors."

Lindhjem & Navrud (2008) compared point and meta-analysis transfers of forest management values between three Scandinavian countries. Domestic transfers yielded mean transfer error of 86%, compared with 39-62% for point international transfers and 47-126% for meta-analysis international transfers, leading the authors to conclude that international transfer error is of the same order as domestic transfer error, but the additional work in undertaking meta-analysis does not appear to be justified.

The evidence suggests that international value transfer is no more problematic than intra-national transfer, whenever context is similar. This finding is supportive of transferring hunting value estimates of similar species in similar cultural contexts to New Zealand.

Chapter 2
Study Methods

Nelson and Kennedy (2009, pp.371-372.) provide 10 best-practice guidelines for meta-analysis – many of which are also relevant for point transfers. In brief, their guidelines are:

1. Ensure that the primary studies are measuring the same thing.
2. Clearly identify the primary study research strategy and procedures used for identifying relevant and irrelevant studies.
3. Report data coding and adjustments.
4. Undertake preliminary meta-analysis that tests for statistical issues.
5. Decide between fixed and random effect size models.
6. Use weighted least squares, panel-data regressions, robust covariance estimators and other suitable models.
7. Undertake model specification tests.
8. Undertake sensitivity analysis.
9. Test for publication bias.
10. Test fundamental hypotheses, out-of-sample predictive ability, in-sample predictions, and compare results to other meta-analyses.

The current study applies both the point and meta-analysis value transfer methods to estimate New Zealand hunting values. Because of the paucity of New Zealand studies it has been necessary to draw upon international studies – mostly from the United States. This presents some difficulties. As with any transfer study, adjustments must be made for the changing value of money over time. In this case values are adjusted to December 2009 levels using the **consumer price indices** published by the governments of the source study locations (Statistics Canada, nd; Statistics NZ, nd; UK Government, nd; US Government, nd). Second, currencies must be converted to a standard unit – in this case the New Zealand dollar. Purchasing power parity indices for 2009 were used for this purpose (OECD, 2010a, 2010b). The path dependency problem is acknowledged. The alternative approach of using purchasing power parities at the time of data collection to convert to New Zealand dollars and then inflating those values to a common time using the New Zealand consumers' price index may yield different results.

Source studies were identified in several ways. Many were already known to the authors. Others were identified using standard literature review techniques, including EVRI[6], Google Scholar[7] and electronic databases accessible through the Lincoln University library[8]. Some studies reported in Loomis (2005) provided sufficient information for inclusion in the present study, even though the original papers were not obtainable. Because many valuation studies are reported in grey literature the search techniques outlined above were supplemented by web site searches for prominent non-market valuation practitioners and agencies known to undertake valuation of hunting, and by examination of references cited in other studies. Many recent studies could be downloaded from the internet, however many earlier studies could not be sourced as either hard or electronic copies, so were excluded from analysis. Given the large number of recent value estimates, changes in valuation methodology, and changes in incomes and other factors affecting hunting values, inability to access these early studies is probably of little consequence. In the spirit of quick and inexpensive application of value transfer, which is its whole *raison d'être*, little effort was expended to source hard to find studies.

6 www.evri.ca
7 http://scholar.google.co.nz/
8 Including ABI/INFORM, CAB Abstracts, ProQuest, Science Direct.

Studies that did not address ungulates of the types hunted in New Zealand (e.g. studies of bird, varmint, small mammal and African big game species) and studies of hunting that did not differentiate between big game and other game species were excluded. Many hunting studies value changes in site conditions, experience attributes or game management. Some of these studies estimated values of hunting experiences as a whole and were used, but many such studies did not provide the type of value information sought here. A number of choice experiments appeared in this category (e.g. Mackenzie, 1990; Hunt *et al.*, 2005). A further set of studies that used hedonic approaches to value hunting-related attributes did not produce value estimates of the type required (e.g. Livengood, 1983; Messonier & Luzar, 1990; Pope *et al*., 1984; Pope & Stoll, 1985).

The Nelson and Kennedy (2009) guidelines were adhered to wherever possible (Table 1).

Table 1
Nelson & Kennedy Guideline Adherence

	Nelson & Kennedy guideline applying to both point and meta value transfers	**This study**
1	Effect-size measures from the primary studies all measure the same thing.	Care was taken to identify only studies that estimated values for hunting big game species similar to those found in New Zealand. Care was taken to identify the period for which values were estimated in primary studies – e.g. day, trip, or season. All values used were for an individual hunter, not for a party.
2	Clearly identify the primary study research strategy and procedures used for identifying relevant and irrelevant studies.	Key variables summarising methods were coded (e.g. TCM, CVM, CE, RPSP, etc.) as well as information on how travel costs were estimated, where available.
3	Data coding and adjustments.	See text. No adjustments were made to the data other than CPI and exchange rate adjustments which were required to ensure commensurability through time and across countries.
8	Sensitivity analysis.	Sub-population, outlier and meta-model specification effects were tested.
9	Test for publication bias.	The JOURNAL variable permitted tests for differences between papers appearing in peer-reviewed academic journals and elsewhere.
	Nelson & Kennedy guideline applying only to meta value transfers	**This Study**
4	Undertake preliminary meta-analysis that tests for statistical issues.	Preliminary analysis identified outliers. Sensitivity analysis identified the effects of outlier removal.
5	Decide between fixed and random effect size models.	Fixed effects models were used throughout
6	Use weighted least squares, panel-data regressions, robust covariance estimators and other suitable models.	Weighted least squares, panel data models were employed. Robust covariance estimators were used.
7	Undertake model specification tests.	Limited alternative functional forms were available because of the dummy coding of independent variables.
10	Test fundamental hypotheses, out-of-sample predictive ability, in-sample predictions, and compare results to other meta-analyses.	Results were compared with other meta-analyses.

Chapter 3
Results

3.1 Data

Sixty seven different source studies provided 579 different values (Table 2). Studies reported value estimates for different activity frames (day, trip or season), and some reported variances or standard errors for value estimates. The source studies are identified in a separate reference section at the end of this report. For some items, day, trip and/or season values are the same, such as in hunting areas that are open for only one day per year. It should be noted that hunting experiences are vastly different in many of the studies included here, with varying animal densities, access regulations, restrictions on types and numbers of animals killed, and so on. Hunt duration also varies dramatically. Species valued include moose, elk, deer (typically whitetail in North American studies), antelope, sheep and "big game".

Table 2
Data

	Number of studies	Number of values	No of studies reporting standard error	Number of values reported with standard error
All studies	67	579	26	133
Trip values	34	183	17	82
Day values	32	284	6	29
Season values	16	112	8	22

Table 3
Deer Hunting Data

	Number of Deer hunting studies	Number of deer hunting values	No of Deer studies reporting standard error	Number of values reported with standard error
All studies	30	217	10	48
Trip values	17	60	8	25
Day values	12	71	3	10
Season values	8	86	13	13

Of the 579 value estimates, 223 (39% - Table 4) do not clearly identify the big game species hunted – in some instances several species are available at the same site. Of the named species, deer are the most commonly valued, with 217 (37% of the total) value estimates, followed by elk (70 estimates, 12% of the total). The vast majority of values estimated (92%) are sourced from the USA. Numbers of non-USA value estimates are reported in parentheses in Table 4. Studies undertaken in other countries were identified in the literature review, but were all either unobtainable, or provided estimates of marginal values for attributes which were unsuitable for identifying values for the hunting experience as a whole.

Table 4
Species Valued, by Valuation period – USA unless noted otherwise

Species	Day	Trip	Season	All
Unspecified big game	170	49	3	222
Deer	71 (1 NZ, 1 Canada)	60 (4 NZ)	86	217 (5 NZ, 1 Canada)
Elk	32	31 (1 Canada)	7	70 (1 Canada)
Moose	3 (1 CAN)	35 (26 Canada)	6 (2 Canada)	44 (29 Canada)
Antelope	3	4	8 (8 Canada)	15 (8 Canada)
Mountain goat	2	3	2	7
Sheep	3 (1 Canada)	1	0	4 (1 Canada)
Total	**284 (1 NZ, 3 Canada)**	**183 (4 NZ, 27 Canada)**	**112 (10 Canada)**	**579 (5 NZ, 40 Canada)**

Three New Zealand studies have allowed derivation of value per trip.

- Nugent and Henderson’s (1990) Oxford RHA study: 1987 data. ($26.58)
- Sandrey and Simmons (1984) Kaimanawa study: 1982 data. ($88.03)
- Kerr’s (1996) Greenstone/Caples study (2 estimates based on different models): 1986 data. ($95.52, $127.21)

One New Zealand study reports value per day.

- Nugent and Henderson’s (1990) Oxford RHA study: 1987 data. ($18.88)

The data are graphically depicted in Figures 1-4.

Figure 1
Individual Deer Hunter Benefits per Trip Relative to the Median ($161.28), December 2009 NZ dollars

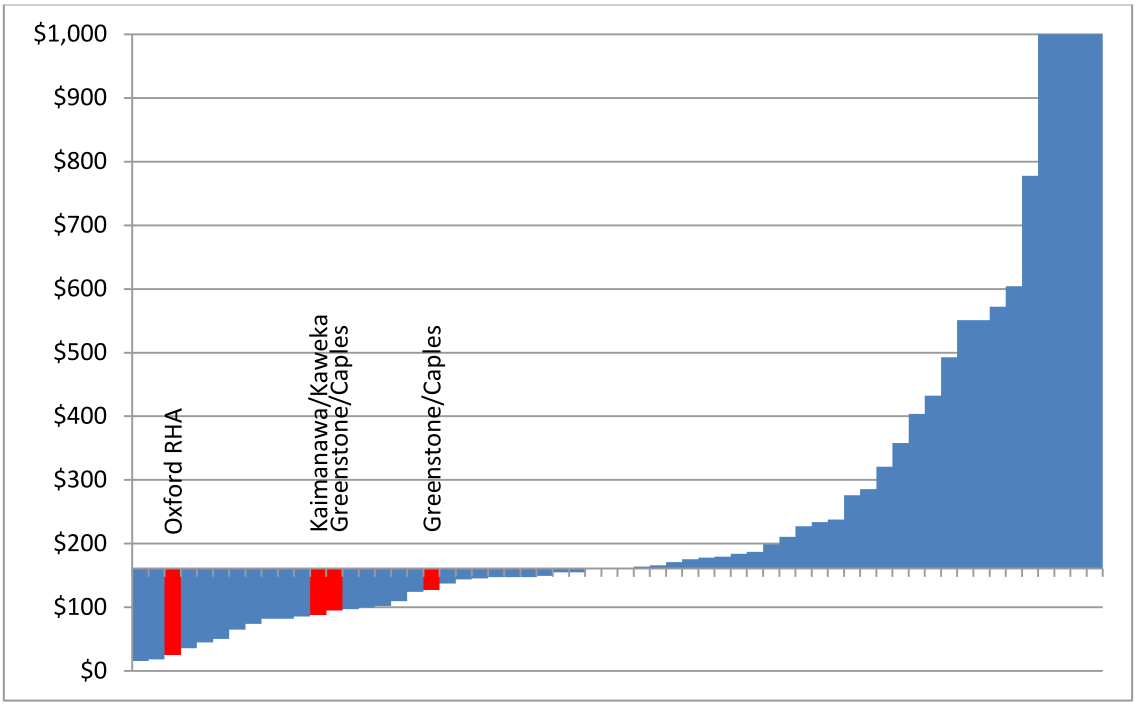


Figure 2
Individual Big-Game Hunter Benefits per Trip Relative to the Median ($197.35), December 2009 NZ dollars

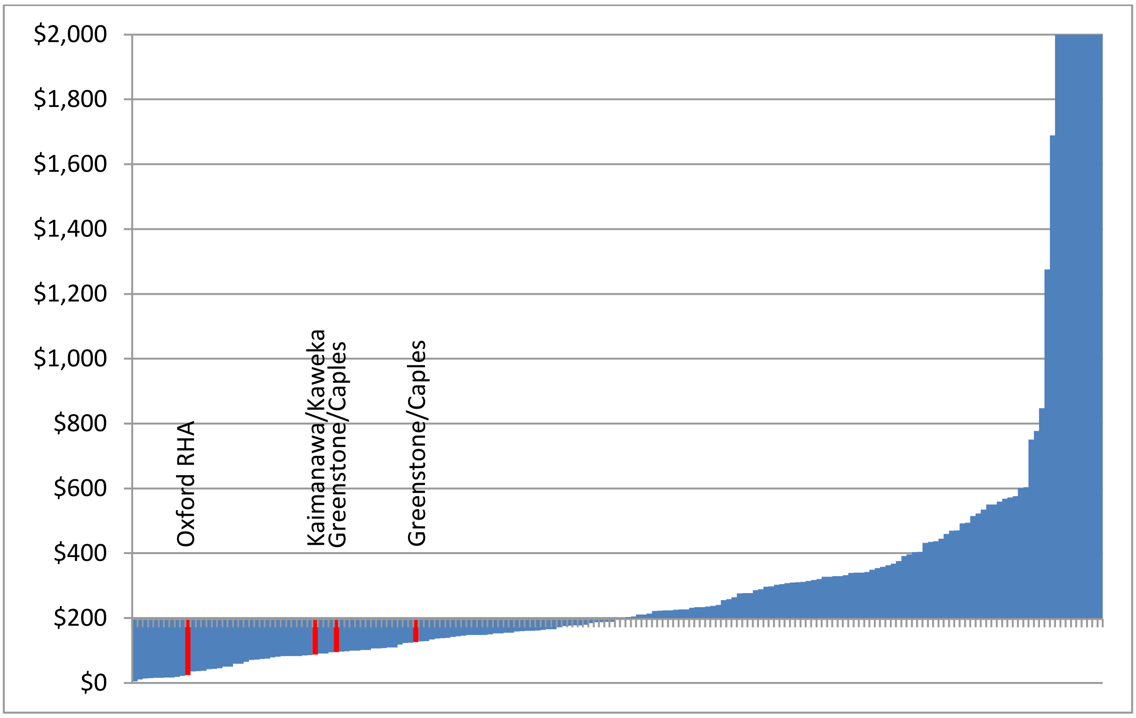


Figure 3
Individual Deer Hunter Benefits per Day Relative to the Median ($112.98), December 2009 NZ dollars

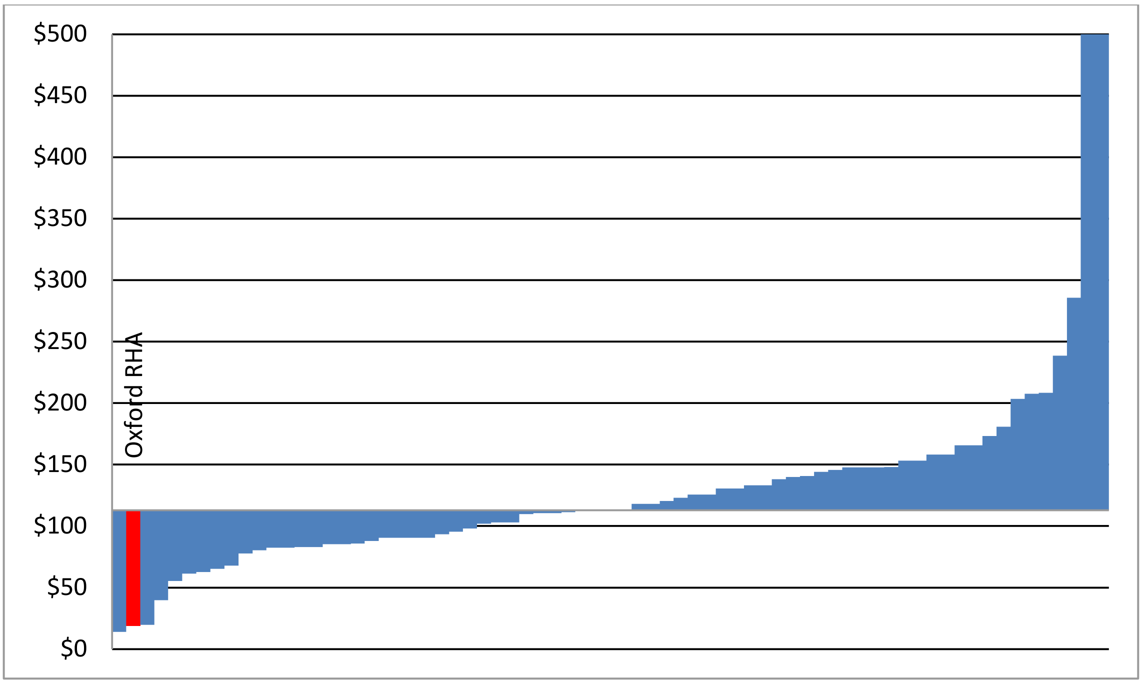
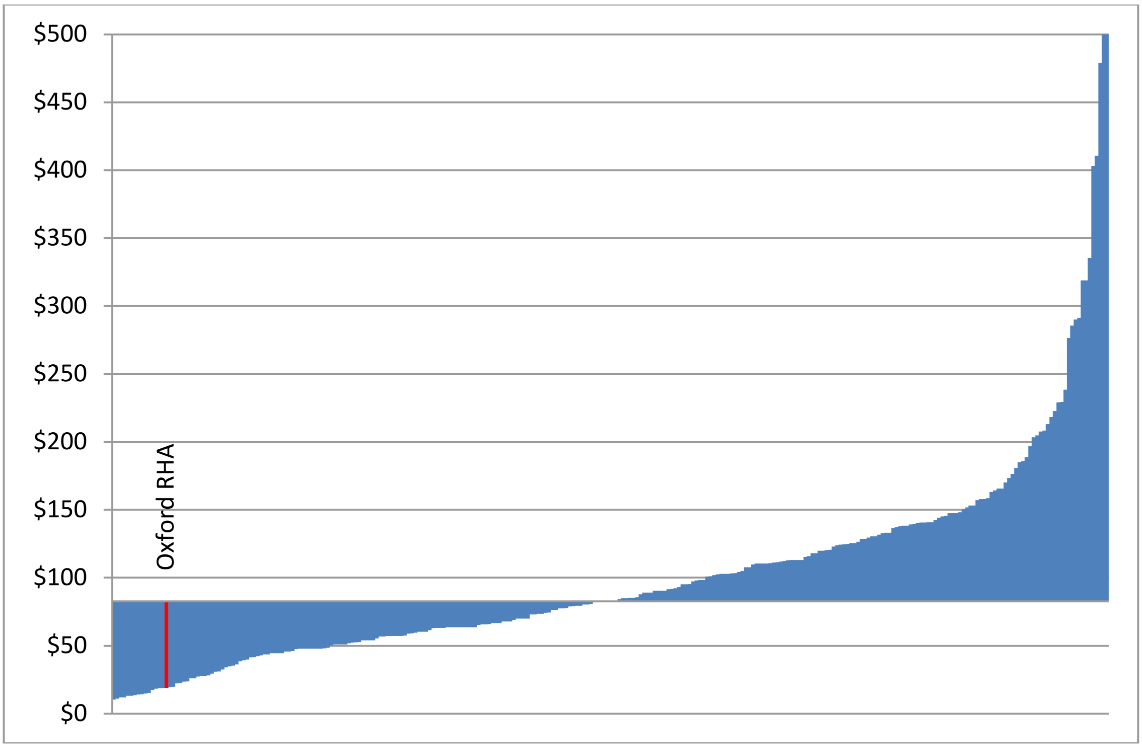


Figure 4
Individual Big-Game Hunter Benefits per Day Relative to the Median ($82.76), December 2009 NZ dollars



3.2 Point Value Transfer

Point transfer estimates are reported in Tables 5 and 6.

Table 5
Point Transfer Estimates (Trips)

Data	Trimmed	Mean	SE	Min	Median	Max	N
All species	No	372.84	46.71	5.30	197.35	4246.29	183
All species	>$2000	241.56	16.19	5.30	185.72	1688.37	174
All species, Journal	>$2000	254.04	18.73	15.98	200.24	1688.37	132
All species, non-Journal	>$2000	202.33	31.81	5.30	103.83	750.86	42
All species, SE data	No	466.13	87.59	36.10	229.58	4246.29	82
All species, SE data, weighted	No	152.43	10.98	36.10	229.58	4246.29	82
All species, SE data	>$2000	253.11	16.48	36.10	219.00	576.00	76
All species, SE data, weighted	>$2000	151.70	10.20	36.10	219.00	576.00	76
Deer	No	337.99	70.25	15.98	161.28	2859.91	60
Deer	>$2000	229.24	33.76	15.98	159.99	1688.37	57
Deer, SE data	No	230.81	33.34	36.10	155.00	571.93	25
Deer, SE data weighted	No	151.32	27.84	36.10	155.00	571.93	25
New Zealand	No	84.11	21.25	25.68		127.21	4

Benefits are for an individual hunter, measured in December 2009 New Zealand dollars.
Weights are inverse squared standard errors.

Table 6
Point Transfer Estimates (Day)

Data	Trimmed	Mean	SE	Min	Median	Max	N
All species	No	113.26	11.91	10.90	82.76	2859.91	284
All species	>$1000	97.93	4.06	10.90	82.65	479.01	282
All species, Journal	>$1000	109.62	25.67	13.68	93.20	285.69	11
All species, non-Journal	>$1000	97.46	4.11	10.90	82.63	479.01	271
All species, SE data	No	89.33	10.37	13.07	82.40	285.69	29
All species, SE data, weighted	No	20.43	4.26	13.07	82.40	285.69	29
Deer	No	178.13	44.60	15.86	112.98	2859.91	71
Deer	>$1000	117.37	5.84	15.86	112.98	285.69	69
Deer, SE data	No	116.67	22.95	15.86	97.85	285.69	10
Deer, SE data weighted	No	88.51	12.48	15.86	97.85	285.69	10
New Zealand	No	18.88	-	-	-	-	1

Benefits are for an individual hunter, measured in December 2009 New Zealand dollars.
Weights are inverse squared standard errors.

Maximum and minimum values in the raw data are dramatically different. Outlying values can be generated by extreme quality conditions, which is valid, but also by methodological issues, which can lead to misleading value estimates. Outliers can have a dramatic influence on the mean, but have little impact on the median, making it a more reliable indicator of central tendency. Susceptibility to outliers is assessed by trimming outliers. For the trip values seven estimates, all in excess of $2000 per hunter per day, were identified as exerting extreme influence and were removed. For day values, two estimates in excess of $1000 per day were removed. Trimming had little impact on medians, but reduced means, standard errors, skew and kurtosis. For deer studies the mean declined to 68% of its former level after trimming for trip values, and to 66% for day values. For all species the corresponding mean reduced to 65% for trip values and 86% for day values.

3.3 Meta Analysis

Linear regression was used to model factors influencing estimated values for both value per day and value per trip dependent variables. The value transfer source studies identified a wide range of independent variables that influenced demand for hunting (Table 8). Ideally, information on a large number of these variables would be included as independent variables in meta analysis regressions. However, extremely limited data consistency between cases constrained the range of candidate independent variables. The main limitations were that source studies used different independent variables, and employed different measurement scales for independent variables[9].

Table 7
Independent Variables

Variable	Description	Coding
Study-related variables		
STUDY	Unique study identifier	
PUB1993	Year of publication relative to 1993	Publication year - 1993
DATA1993	Year of data collection relative to 1993	Data collection year - 1993
JOURNAL	Published in peer-reviewed journal	=1 if peer reviewed journal, else=0
USA	Study located in USA	=1 if USA study, else =0
CANADA	Study located in Canada	=1 if Canadian study, else=0
NZ	Study located in NZ	=1 if NZ study, else=0
CVM	Contingent valuation method	=1 if CVM, else=0
TCM	Travel cost method	=1 if TCM, else=0
CE	Choice experiment	=1 if CE, else =0
RPSP	Revealed & stated preference combined	=1 if RPSP, else=0
STDCOST	TCM costs estimated by analyst	=1 if estimated cost, else=0
REPCOST	TCM costs reported by hunters	=1 if reported cost, else=0
Hunt-related variables		
DEER	Species hunted was deer	=1 if hunted deer, else =0
ELK	Species hunted was elk	=1 if hunted elk, else =0
MOOSE	Species hunted was moose	=1 if hunted moose, else =0
SHEEP	Species hunted was sheep	=1 if hunted sheep, else =0
ANTELOPE	Species hunted was antelope	=1 if hunted antelope, else =0
MTNGOAT	Species hunted was mountain goat	=1 if hunted mountain goat, else =0
DAYSTRIP	Duration of trip (days)	

9 For example, some studies measured age on a cardinal scale, while others used a variety of discrete categories.

Table 8
Source Study Independent Variables

	TCM	CVM	CE	RP/SP
Site attributes				
Remoteness	X			
Beauty	X			
Other activities at site	X			
Public/private land	X	X		
Site suitability	X			
Season length	X			
License cost		X		
Species available		X		
Harvest rate	X			
Probability of getting a permit	X			
Animal density/population	X		X	X
Forest type	X			
Location satisfaction rating	X			
Road quality			X	X
Trails			X	X
Congestion		X	X	X
Recent logging			X	X
Availability of substitutes	X			
Price of substitutes		X		
Personal attributes				
Age	X	X		
Married	X	X		
Education	X	X		
Importance of hunting	X	X		
Household size	X			
Human population	X	X		
Club member	X	X		
Hunting experience	X	X		
Investment in equipment	X			
Urban/farm resident	X			
Race	X			
Previous site use	X	X		
Income	X	X		
Trip attributes				
Travel cost	X	X	X	X
Time cost/ travel time	X	X		
Travel distance	X	X		
Travel mode	X			
Animals seen	X	X		
Animal killed	X	X		
Time on site	X	X		
Opening day	X	X		

3.4 Models

Meta analysis models are reported in Tables 9-12. The models in Table 9 (A1-A6) use all trip value data, whereas the models in Table 10 exclude high value outliers. Tables 11 and 12 do similarly for day values. In each case models are fitted for all species combined, providing the opportunity to test for species effects, and for deer hunting alone. The first model in each scenario is the simple, unweighted OLS estimate with normal covariance estimation. The second model in each scenario uses a panel model and the White robust covariance estimator. There were adequate cases reporting standard error for the trips data to permit estimation of inverse variance weighted models, treated as a panel with robust covariance estimates. The number of data points for which standard error estimates were available was insufficient to fit inverse standard error-weighted models to day values for deer studies. Estimated mean values (at sample means) and standard errors of the predicted mean using 50,000 replications of the Krinsky and Robb (1986) Monte Carlo procedure are reported.

The trip value models (Tables 9 and 10) for all species have reasonably strong adjusted R^2 scores for this type of model. Trimming the sample reduced adjusted R^2 scores in most instances, but had a beneficial effect on AIC scores and estimated standard errors of the mean. The deer models were not as good as the all species models. In three models (A5, B4 and B5) there were no significant independent variables. For models A6 and B6 (which are the same) and models A4 and B3 there was only one significant independent variable. Estimated standard errors of the mean and AIC scores for the deer models are inferior to the all species models.

Day value models (Tables 11 and 12) mirror trip value results. Trimming the sample improved AIC scores and reduced estimated standard errors of the mean. Panel models and robust covariance estimates improved adjusted R^2 and did not detract from AIC scores, but increased standard error estimates. For Model C4, not only was there no significant independent variable, the constant was not significant either. The trimmed day value models (Table 12) are unique in that the deer models outperformed the all species models.

Table 9
Trip Value Models - All Data

	A1	A2	A3	A4	A5	A6
Constant	-1021.82*** (127.98)	-529.55** (213.85)	298.04*** (50.29)	188.00** (96.25)	294.63** (119.98)	256.03*** (55.74)
PUB1993	137.58*** (12.93)	108.04*** (23.05)				
DATA1993	-139.77*** (14.94)	-111.42*** (26.29)				
DEER			103.43** (47.01)			
ELK	-260.06** (97.87)		162.71** (69.67)			
MOOSE			-95.40** (41.57)			
USA	621.29*** (100.18)	472.97*** (167.11)				
CVM	542.64*** (80.96)	143.36** (70.18)	-305.80*** (60.09)	299.98** (136.12)	175.34 (140.57)	-147.94** (61.33)
STDCOST			-204.70*** (56.74)			
REPCOST	508.60*** (152.75)					
JOURNAL	142.54* (84.86)					
Species	All	All	All	Deer	Deer	Deer
Panel Model	No	Yes	Yes	No	Yes	Yes
Robust covariance	No	Yes	Yes	No	Yes	Yes
Weight	None	None	SE^{-}	None	None	SE^{-}
Sample mean	$372.84	$372.84	$152.43‡	$337.99	$337.99	$151.32‡
Sample SE	$46.71	$46.71	$10.98‡	$70.25	$70.25	$27.84‡
N	183	183	82	60	60	25
AIC	12.21	11.49	8.83	12.57	12.40	8.96
Adjusted R^2	.520	.795	.402	.061	.365	.674
Estimate at means	$372.84	$455.40	$138.70	$337.99	$382.30	$161.35
Estimated SEM	432.31	$72.58	$20.34	$67.84	$100.36	$37.85

‡ Weighted

Table 10
Trip Value Models - Values over $2000 per Trip Excluded

	B1	**B2**	**B3**	**B4**	**B5**	**B6**
Constant	-48.56	126.00**	186.04***	188.00***	235.86***	256.03***
	(78.32)	(56.30)	(25.62)	(46.25)	(57.08)	(55.74)
PUB1993	25.20***					
	(9.06)					
DATA1993	-24.44**					
	(9.76)					
SHEEP	471.02**					
	(201.15)					
MTN GOAT	354.11***	254.24**				
	(113.61)	(104.83)				
ANTELOPE		-297.20***				
		(107.71)				
USA	145.87***	146.08**				
	(47.88)	(64.39)				
CVM	129.13***	78.84**	-85.23**	87.05	70.72	-147.94**
	(38.38)	(38.21)	(37.96)	(67.21)	(69.07)	(61.33)
REPCOST	211.31***	197.31***				
	(66.63)	(66.18)				
Species	All	All	All	Deer	Deer	Deer
Panel Model	No	Yes	Yes	No	Yes	Yes
Robust covariance	No	Yes	Yes	No	Yes	Yes
Weight	None	None	SE^{-}	None	None	SE^{-}
Sample mean	$241.56	$241.56	$151.70‡	$229.24	$229.24	$151.32‡
Sample SE	$16.19	$16.19	$10.20‡	$33.76	$33.76	$27.84‡
N	174	174	76	57	57	25
AIC	10.55	10.31	8.77	11.10	11.02	8.96
Adjusted R^2	.197	.457	.268	.012	.276	.674
Estimate at means	$241.55	$277.37	$163.61	$229.24	$269.35	$161.35
Estimated SEM	$14.45	$27.25	$21.23	$33.55	$47.55	$37.85

‡ Weighted

Table 11
Day Value Models - All Data

	C1	C2	C3	C4	C5
Constant	91.64*** (13.53)	101.87*** (32.49)	217.90*** (26.20)	-267.54 (195.42)	78.79 (136.52)
DEER	86.49*** (27.07)	131.85** (57.52)	-131.30*** (35.36)		
CVM				357.83** (171.23)	271.48 (176.31)
DATA1993				-27.57** (11.97)	
Species	All	All	All	Deer	Deer
Panel Model	No	Yes	Yes	No	Yes
Robust covariance	No	Yes	Yes	No	Yes
Weight	None	None	SE-2	None	None
Sample mean	$113.26	$113.26	$20.43‡	$178.13	$178.13
Sample SE	$11.91	$11.91	$4.26‡	$44.60	$44.60
N	284	284	14	71	71
AIC	10.58	10.23	7.34	11.84	11.60
Adjusted R2	.032	.382	.763	.055	.342
Estimate at means	$113.26	$134.84	$172.62	$178.13	$319.68
Estimated SEM	$11.74	$27.40	$18.97	$43.41	$105.75

Table 12
Day Value Models - Values over $1,000 per Day Excluded

	D1	D2	D3	D4	D5
Constant	96.67*** (7.14)	115.74*** (11.96)	217.90*** (26.20)	128.74*** (7.85)	145.79*** (14.40)
DEER	27.95*** (9.71)		-131.30*** (35.36)		
MOOSE	-67.16* (39.01)				
SHEEP	-80.74* (46.71)				
MTNGOAT	81.76* (46.71)	125.32*** (45.98)			
TCM	-44.02* (23.94)	-54.97** (26.25)		-60.37** (28.73)	-62.43** (28.86)
STDCOST	56.34** (25.27)	44.20* (26.34)		54.85* (31.32)	63.33* (32.77)
REPCOST	92.08*** (31.56)	85.36*** (32.24)			
PUB1993				-14.29* (7.52)	-15.55** (7.56)
DATA1993	2.00*** (0.57)	1.75* (1.02)		15.61** (6.87)	18.42** (7.17)
JOURNAL	41.30* (22.32)	40.51* (23.05)		109.59*** (28.90)	118.61*** (30.16)
Species	All	All	All	Deer	Deer
Panel Model	No	Yes	Yes	No	Yes
Robust covariance	No	Yes	Yes	No	Yes
Weight	None	None	SE-2	None	None
Sample mean	$97.93	$97.93	$20.43‡	$117.37	$117.37
Sample SD	$4.06	$4.06	$4.26‡	$5.84	$5.84
N	282	282	14	69	69
AIC	8.35	8.28	7.34	7.56	7.60
Adjusted R2	.122	.250	.763	.245	.311
Estimate at means	$97.93	$105.30	$172.62	$117.37	$127.47
Estimated SEM	$3.81	$8.04	$18.97	$5.09	$9.35

Chapter 4
Discussion

4.1 Comparisons with Other Point Transfer Studies

Four existing studies provide point value transfer estimates for hunting (Table 13). Note, however, that Loomis (2005) is not restricted to big game species.

Table 13
Hunting Value Point Transfers

	Walsh et al. (1992)	**Bolon (1994)**	**Rosenberger & Loomis (2001)**	**Loomis (2005)**
Species	Big game	Elk	Big game	All species
Data	1968-1988	1968-1988	1967-1998	1967-2003
Unit	US$/person/day	US$/person/day	US$/person/day	US$/person/day
Reported mean (95% ci)	$45.47 ($38.67-$52.27)	$52.97 ($43.09-$62.84)	$42.92 na	$46.92[10] ($42.61-$51.23)
Time value	Q3_1987$US	1991$US	Q4_1996$US	1996
N	56	29	172	277
2009$NZ [PPI] (95% ci)	$137 ($116-$157)	$133 ($108-$158)	$83 na	$102 ($93-$112)

Corresponding point transfer estimates derived in our study are:

	All data	Trimmed data
N	284	282
Mean (95% ci)	$113 ($90-$137)	$98 ($90-$106)

Our results are very similar to the other studies, an outcome which is unsurprising given the number of common source studies utilised. In particular, our study used many of the same sources as Loomis (2005).

4.2 Comparisons with Other Meta-analysis Transfer Studies

There is limited opportunity to compare our meta analysis results with those of other big game hunting value transfer studies (Table 14).

10 Reported means (standard errors, N) for regions were: Intermountain $48.55 (3.35, 109), Northeast $47.45 (4.03, 87), Pacific $45.49 (7.73, 18), Southeast $35.36 (2.86, 44), Alaska $65.68 (4.81, 7). Multiply by 2.18 to convert to 2009$NZ.

Table 14
Hunting Value Meta Transfers[11]

	Walsh et al (1992)	Rosenberger & Loomis (2001)	Shrestha et al (2007)	Loomis & Richardson (2008)
Method	OLS	OLS with robust covariance matrix.	OLS, no panel effects.	Method not identified.
Dependent variable	Recreation	Recreation	Recreation	Big game hunting
Data	1968-1988	1967-1998	1967-1998	
Unit	$/person/day	$/person/day	$/person/day	$/person/day
Time value	Q3_1987$US	Q4_1996$US	1996$US	1996$US
BG role	Independent variable	Independent variable	Independent variable	Dependent
Coefficient (t-score)	$21.82 (5.33)	$15.39 (4.14)	$12.48 (3.65) [National]	
Model effects		SP<RP	CVM < TCM	CVM<TCM Data year<0 Public land<Private land Waterfowl<Other species Adjusted R^2=.116
Value estimate		$44.96		Intermountain $62.95 Northeast $51.46 Pacific $64.74 Southeast $48.80 Alaska $95.16 [Public land]
2009$NZ (PPI)		$98		Intermountain $137 Northeast $112 Pacific $141 Southeast $106 Alaska $208

Two studies (Walsh *et al*., 1992; Shrestha *et al*., 2007) include big game hunting as an independent variable in their meta-analyses of outdoor recreation values, but do not report their estimates of the value of big game hunting. In both these cases, and in Rosenberger & Loomis (2001), the big game variable was significant and positive, indicating that a big game hunting day is more valuable than other recreational activities included in these studies.

Rosenberger & Loomis (2001) and Loomis & Richardson (2008) provide estimates of the value of a big-game hunting day based on their meta-analyses. Neither provides confidence intervals around those estimates. Apart from Alaska (Loomis & Richardson, 2008), all these value estimates are broadly consistent with our point transfer estimates and the point estimates provided by earlier

11 Groothuis (2005) reports transfer functions of benefits from deer hunting in 31 US states, but does not undertake meta-analysis.

studies. Our estimates for all big game species combined (Models D1 – D3) are $98, $105 and $173, the first two of which are consistent with the Rosenberger & Loomis (2001) and Loomis & Richardson (2008) estimates[12]. Our adjusted R^2 statistics for Models D1-D3 range from .122 to .763, all exceeding the value for Loomis & Richardson (2008).

The hunting study (Loomis & Richardson, 2008) found differences in values between locations, land ownership (public land values were higher than private land values), species (waterfowl less valuable) and time of data collection (more recent data yielded lower values).

4.3 Transfer Method Effects

Weighting point transfer values by the inverse of their squared standard errors significantly reduced means. The biggest reduction occurred for the all species day values, the mean of which declined to 23% of its unweighted value (t = 18.0). The reduction in the trimmed all species trip value mean (weighted mean = 60% of unweighted mean) was somewhat less dramatic, but still highly significant (t = 19.6). Results were similar for deer values.

Weighting had a strong effect in meta-analysis models. Consistent with point estimate results, the weighted trip value estimates (A3, A6, B3, B6) all produced lower value estimates than corresponding unweighted models. Weighted models produced higher value estimates for day values, although the drop in sample size from 282 to 14 makes comparison somewhat moot. To eliminate sample effects, panel data models were estimated using the same samples as models B3, B6 and D3 (Table 15). The weighted models had superior AIC scores and value estimates at means that were significantly closer to sample means than were unweighted estimates.

12 Note that previous authors did not weight for standard error or use panel data models.

Table 15
Same Sample Test of Weighting Effects

	B3	**B3a**	**B6**	**B6a**	**D3**	**D3a**
Constant	186.04*** (25.62)	266.22*** (35.15)	256.03*** 955.74)	267.62*** (57.49)	217.90*** (26.20)	270.63*** (49.44)
DEER					-131.30*** (35.36)	-106.86* (59.50)
CVM	-85.23** (37.96)	23.20 (48.20)	-147.94** (61.33)	3.16 (57.86)		
Species	All		Deer		All	
Panel Model	Yes		Yes		Yes	
Robust covariance	Yes		Yes		Yes	
Weight	SE^{-2}	None	SE^{-2}	None	SE^{-2}	None
Sample mean	\$151.70‡		\$151.32‡		\$20.43‡	
Sample SE	\$10.20‡		\$27.84‡		\$6.50‡	
N	76		25		14	
AIC	8.77	9.74	8.96	9.31	7.34	8.25
Adjusted R^2	.268	.322	.674	.706	.763	.657
Estimate at means	\$163.61	\$272.35	\$161.35	\$269.64	\$172.62	\$233.78
Estimated SEM	\$21.23	\$29.39	\$37.85	\$48.85	\$18.97	\$34.42
t (v sample mean)	-0.51	-3.88***	-0.21	-2.10**	-7.59***	-6.09***

4.4 Species Effects

Differences in point value estimates between deer and all species are small for trip values. However, deer day values are larger. Species effects are more noticeable in the meta analysis models, however effects are not consistent. For the trimmed trip models sheep and mountain goats provide more valuable hunting experiences than do other species, whereas antelope are valued less. The day value models also indicate high values for mountain goat hunting compared with other species. Model D1, which does not address the panel nature of the data or estimate robust covariances, found a modest positive effect for deer hunting and low significance and negative effects for moose and sheep hunting. The sign on sheep hunting is different for trip and day values.

4.5 Primary Study Method Effects

Rosenberger & Loomis (2001), Shrestha *et al.* (2007) and Loomis & Richardson (2008) all found that stated preference methods produced lower day value estimates than revealed preference methods did. Our equivalent model is D1. The coefficient on TCM, a revealed preference approach, in model D1 is negative. However, other methodological variables entered this model. For some travel cost studies information was available on the way costs were estimated – either by analyst application of a mathematical formula to derive a standard cost estimate, or by self reports from hunters. In other cases this information was unavailable. The dummy variable for standardised cost (STDCOST) enters model D1 and is of slightly larger magnitude, but opposite sign to the travel cost dummy, effectively cancelling it out. The coefficient for the reported cost dummy in model D1 was approximately twice the size of the travel cost dummy, but of opposite sign. For the 91% of travel cost studies for which cost derivation information was available the overall effect of TCM was non-negative. Consequently, while the sign on TCM is negative, the overall effect is that TCM estimates were larger than CVM estimates, consistent with previous studies.

4.6 Publication Effects

There was some evidence in support of a positive publication effect. The point estimate of the mean for trimmed trip data was 25% greater for estimates obtained from peer-reviewed journal articles, but this difference was not significant (Z=1.40). The peer-reviewed mean for day values was 12% higher, again not significant (Z=0.47), although with only eleven peer-reviewed data points that is not surprising. Inclusion of a dummy variable is a common strategy to detect publication effects (Rosenberger & Stanley, 2006). Of the twenty two meta regression models estimated, the dummy variable JOURNAL was significant and positive in five models (A1, D1, D2, D3, D4), albeit at a low level of significance for three. These results provide some support for the hypothesis of publication bias towards higher value estimates (Rosenberger & Stanley, 2006).

4.7 Temporal Effects

The variables PUB1993 and DATA1993 measure the effects of publication and data collection dates respectively. These variables are highly correlated, so there is limited ability to model independent effects. In cases where both enter the models (Models A1, A2, B1, D4 and D5) the sign on PUB1993 is mixed (positive in A1, A2, B1 and negative in D4, D5). The sign on DATA1993 is positive in D4 and D5 and negative in A1, A2 and A3. In each case signs on PUB1993 and DATA1993 are opposite.

In some cases only one of these variables was significant. PUB1993 is negative in A6 (and B6, which is the same model). DATA1993 is Positive in D1, D2 and negative in C4, although C4 is an extremely poorly fitting model. Loomis and Richardson tested for the effects of time of data collection, finding a significant negative relationship, with more recent studies producing lower day value estimates. Our equivalent models (D1, D2, D4, D5) all had positive signs on DATA1993, contradicting the Loomis and Richardson (2008) result.

4.8 The Value of New Zealand Hunting

Most studies report values on a per day basis, including all of the meta-analyses in Table 14. Comparison of the New Zealand value estimates and other estimates (Table 15) indicate that New Zealand values are low compared with others.

The four New Zealand trip valuation studies are all at the low end of the value scale, with mean of $84 per trip compared with $241 for the trimmed sample (n=174) and estimated means of $164 to $277 for the three trimmed meta analysis models B1-B3 (Table 16). Models B1 and B2 were re-estimated with the USA country dummy replaced by the NZ country dummy. The NZ dummy coefficient was -$163 (SE=$99, p=.10) for modified Model B1 and was -$204 (SE=$110, p=.06) for modified Model B2, indicating that New Zealand hunting trips are valued much less than hunting trips elsewhere, albeit at relatively low levels of statistical significance.

Only one New Zealand study has estimated the value of a hunting day – Nugent and Henderson's (1990) Oxford RHA study using 1987 data ($18.88). The New Zealand mean is very small compared with other estimates, the next lowest being Rosenberger & Loomis' (2001) point transfer value of $94.

Table 16
Results Summary

Study	Type	Data	Mean	SE	95% ci	N
		Day values				
This study	Point	**NZ**	**$19**	na	na	1
This study	Point	Trimmed	$98	4.06	90-106	282
This study D1	Meta	Trimmed	$98	3.81	90-105	282
This study D2	Meta	Trimmed	$105	8.04	90-121	282
This study D3	Meta	Trimmed	$173	18.97	135-210	14
Walsh et al (1992)	Point		$137	10.45	116-157	56
Bolon (1994)	Point	Elk	$133	12.65	108-158	29
Rosenberger & Loomis (2001)	Point		$94	na	na	172
Rosenberger & Loomis (2001)	Meta		$98	na	na	172
Loomis & Richardson (2008)	Meta		$106-$208	na	na	na
		Trip values				
This study	Point	**NZ**	**$84**	16.19	42-126	4
This study	Point	Trimmed	$242	21.25	210-273	174
This study B1	Meta	Trimmed	$242	14.45	213-270	174
This study B2	Meta	Trimmed	$277	27.25	224-331	174
This study B3	Meta	Trimmed	$164	21.23	122-206	76

na: not available

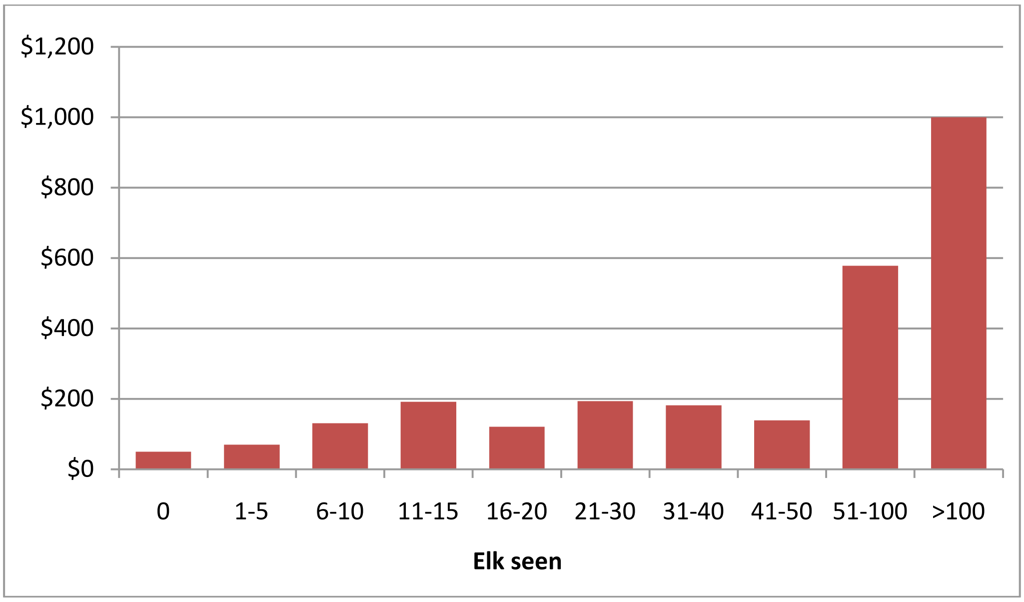
Hunter success in bagging game, access conditions and hunter congestion all influence the value of the hunting experience (Woods and Kerr, 2010). In general NZ hunter success and access conditions are consistent with low valued hunting experiences. The relatively low value of New Zealand hunting is not surprising given the low animal numbers at the time these studies were undertaken and the wide range of substitute hunting sites available. Success rates were extremely low in the Oxford RHA at the time of Nugent and Henderson's (1990) study[13], so it is not surprising that it produced values at the lower end of the distribution of the results analysed here[14].

Sorg and Nelson's (1986) Idaho elk hunting study illustrates the relationship between benefits and game abundance. They found that the benefits of elk hunting trips were highly correlated with the numbers of animals seen (Figure 5). The mean value of a trip on which no elk were seen was $62 (1984 US$), increasing by an average of $1.80 for each additional elk seen (R^2=0.48). The large numbers of animal encounters in North American hunting are notably different from New Zealand hunting conditions.

13 Nugent & Henderson (1990 p.39) report "legitimate hunters killed one big-game animal for every 14.5 days hunted ... well below the national average of one animal taken for every 3.2 days hunted".

14 The trimmed mean for deer studies was $117.37 (n=69). The minimum value estimate was $15.86.

Figure 5
Net Willingness to Pay per Hunting Trip as a Function of Number of Elk Seen (Sorg & Loomis, 1986)



Chapter 5
Conclusion

Historic New Zealand big game hunting values are low compared with values in other countries, although that may have changed somewhat in the long period since the New Zealand valuation studies were undertaken. The implication is that New Zealand has the potential to increase the value of hunting experiences through management activities that create the higher value conditions experienced elsewhere. Without information on game densities, trophy quality, hunting success rates, demographic and other factors it is not possible to use the information collected here to identify the sources of value differences. However, individual valuation studies provide a considerable amount of information on the effects of salient hunting attributes. For example, Groothuis (2005) presents a large number of models for US states that consistently indicate the positive influence of bagging a deer or a buck.

New Zealand game managers have little information from the valuation literature to assist with establishing their management objectives, or to argue for the value of preservation of hunting experiences. The relatively low values of New Zealand big game hunting suggest that game and/or hunter management could make a significant contribution to increasing the value of hunting.

In the absence of existing information on values and their relationship to hunting trip attributes the best option for investigating hunters' objective functions is stated preference research. Choice experiments undertaken with hunters would provide the opportunity to identify the value of hunting trip attributes, how those values are distributed across the hunter community and the potential increases in value that could arise from better management of hunting. A by product of such research would be better indications of the value of New Zealand big game hunting, that could form the basis for evaluation of the benefits arising from changes in hunting management.

References

Bateman, I.J. and Jones, A.P. (2003). Contrasting Conventional with Multi-Level Modeling Approaches to Meta-Analysis: Expectation Consistency in U.K. Woodland Recreation Values. *Land Economics* 79(2): 235-258.

Beville, S. and Kerr, G.N. (2009). Fishing for more understanding: a mixed logit-error component model of freshwater angler choice. Paper to the 53rd annual Australian Agricultural & Resource Economics Society conference. Cairns, Queensland, 10-13 February 2009. http://ageconsearch.umn.edu/handle/48038

Bolon, N.A. (1994). *Estimates of the values of elk in the Blue Mountains of Oregon and Washington: Evidence from the existing literature*. General Technical Report PNW-GTR-316, USDA Forest Service, Pacific Northwest Research Station, Portland Oregon. http://www.fs.fed.us/pnw/pubs/pnw_gtr316.pdf

Boyle, K.J., Kuminoff, N.V., Parmenter, C.F. and Pope, J.C. (2009). Necessary conditions for valid benefit transfers. *American Journal of Agricultural Economics* 91(5): 1328-1334.

Brouwer, R. (2000). Environmental value transfer: state of the art and future prospects. *Ecological Economics* 32: 137-152.

Brouwer, R. and Bateman, I.J. (2005). Benefits transfer of willingness to pay estimates and functions for health-risk reductions: a cross-country study. *Journal of Health Economics* 24: 591-611.

Brouwer, R. and Spaninks, F.A. (1999). The validity of environmental benefits transfer: Further empirical testing. *Environmental and Resource Economics* 14: 95-117.

Davis, R. K. (1964). The Value of Outdoor Recreation: An Economic Study of the Maine Woods. PhD thesis, Harvard University.

Defenders of Wildlife (undated). *The Wildlife Habitat Benefits Estimation Toolkit*. http://www.defenders.org/programs_and_policy/science_and_economics/conservation_economics/valuation/benefits_toolkit.php Accessed 6 August 2010.

Duffield, J.W. (2003). Economic valuation studies of fish and wildlife resources in Montana. Chapter in "Fish and Wildlife Economic Values: Changing Values/Changing Times". http://fwp.state.mt.us/tmc/reports/ecovalues.html Downloaded 2 July 2010.

GACEC (2009). Options for establishment of the New Zealand Game Animal Council: A discussion paper. Game Animal Council Establishment Committee, September 2009. http://www.midnightconcepts.net/nzgac/GAC%20discussion%20paper.pdf

GACEC (2010). Process for setting up the New Zealand Game Animal Council: Recommendations to the Minister of Conservation. Game Animal Council Establishment Committee, June 2010. http://www.nzgac.org.nz/GAC%20REPORT.pdf

Gluck, R.J. (1974) An economic evaluation of the Rakaia fishery as a recreational resource. MAgSci thesis, University of Canterbury (Lincoln College).

Groothuis, P.A. (2005). Benefit transfer: A comparison of approaches. *Growth and Change* 36(4): 551-564.

Hunt, L.M., Haider, W. and Bottan, B. (2005). Accounting for varying setting preferences amongst moose hunters. *Leisure Sciences* 27: 297-314.

Johnston, R.J., Ranson, M.H., Besedin, E.Y. and Helm, E.C. (2006). What determines willingness to pay per fish? A meta-analysis of recreational fishing values. *Marine Resource Economics* 21: 1-32.

Kaval, P. and Loomis, J.B. (2003). *Updated outdoor recreation use values with emphasis on national park recreation*. Report to National park service. Deepartment of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO.

Kerr, G.N. (1996). Recreation values and Kai Tahu management: the Greenstone and Caples Valleys. *New Zealand Economic Papers* 30(1): 19-38.

Kerr, G.N., Sharp, B.M.H. and Leathers, K.L. (2004). Instream Water Values: Canterbury's Rakaia and Waimakariri Rivers. Research Report No. 272, Agribusiness and Economics Research Unit, Lincoln University. http://hdl.handle.net/10182/734

Kerr, G.N. and Greer, G. (2004). New Zealand River Management: Economic Values of Rangitata River Fishery Protection. *Australasian Journal of Environmental Management* 11(2): 139-149.

Krinsky, I. and Robb, A.L. (1986). On approximating the statistical properties of elasticities. *Review of Economics and Statistics* 68(4): 715-19.

Kristoferson, D. and Navrud, S. (2005). Validity tests of benefit transfer – are we performing the wrong tests? *Environmental and Resource Economics* 30: 279-286.

Kristoferson, D. and Navrud, S. (2007). Can use and non-use values be transferred across countries? In Navrud, S. and Ready, R. (eds) *Environmental Value Transfer: Issues and Methods,* 207-225. Springer.

Kroeger, T., Loomis, J.B. and Casey, F. Introduction to the Wildlife Habitat Benefits Estimation Toolkit. Conservation Economics Program, Defenders of Wildlife, Washington DC 20036. http://www.defenders.org/resources/publications/programs_and_policy/science_and_economics/conservation_economics/valuation/introduction_to_the_wildlife_habitat_benefits_estimation_toolkit.pdf Accessed 6 August 2010.

Lindhjem, H. and Navrud, S. (2008). How reliable are meta-analyses for international benefit transfers? *Ecological Economics* 66: 425-435.

Livengood, K.R. (1983). Value of big game from markets for hunting leases: The hedonic approach. *Land Economics* 59(3): 287-291.

Loomis, J.B. (1992). The evolution of a more rigorous approach to benefit transfer: benefit function transfer. *Water Resources Research* 28(3): 701-705.

Loomis, J.B. (2005). Updated outdoor recreation use values on national forest and other public lands. USDA Forest service General Technical Report PNW-GTR-658. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.159.8045&rep=rep1&type=pdf

Loomis, J.B., Kroeger, T., Richardson, L. and Casey, F. (2008).A benefit transfer toolkit for fish, wildlife, wetlands and open space. *Western Economics Forum* Fall: 33-44.

Loomis, J.B. and Richardson, L. (2008). Technical documentation of benefit transfer and visitor use estimating models of wildlife recreation, species and habitats. Defenders of Wildlife. pp.45. Available at: http://www.defenders.org/programs_and_policy/science_and_economics/conservation_economics/valuation/benefits_toolkit.php

Mackenzie, J. (1990). Conjoint analysis of deer hunting. *Northeastern Journal of Agricultural and Resource* Economics 19(2): 109-117.

McBeth, R. (1997) *The recreational value of angling on the Tongariro River. Non-market valuation using the travel cost method and contingent valuation method*. MA thesis, Department of Geography, University of Auckland.

Messonier, M.L.and Luzar, J. (1990). A hedonic analysis of private hunting land attributes using an alternative functional form. *Southern Journal of Agricultural Economics* 22(2): 129-135.

Mitchell, R.C. and Carson, R.T. (1989). *Using surveys to value public goods: the contingent valuation method*. Washington, DC: Resources for the Future.

Nelson, J.P. and Kennedy, P.E. (2009). The use (and abuse) of meta-analysis in environmental and natural resource economics: an assessment. *Environmental and Resource Economics* 42: 345-377.

Nugent, G. and Henderson, R. (1990). Putting a Value on Hunting in the Oxford RHA. *New Zealand Wildlife*, Summer: 39-40.

OANDA (2009). The Economist Big Mac Index. http://www.oanda.com/currency/big-mac-index

OECD (2010a). Purchasing power parities and exchange rates. http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE4

OECD (2010b). Purchasing power parities. http://www.oecd.org/dataoecd/61/54/18598754.pdf

OECD (2010c). Comparative price levels December 2009. http://www.oecd.org/dataoecd/48/18/18598721.pdf

Plummer, M.L. (2009). Assessing benefit transfer for the valuation of ecosystem services. *Frontiers in Ecology and the Environment* 7(1): 38-45.

Pope, C.A., Adams, C.E. and Thomas, J.K. (1984). The recreational and aesthetic value of wildlife in Texas. *Journal of Leisure Research* 16: 51-60.

Pope, C.A. and Stoll, J.R. (1985). The market value of ingress rights for whitetailed deer hunting in Texas. *Southern Journal of Agricultural Economics* 17(1): 177-182.

Ready, R. and Navrud, S. (2006). International benefit transfer: methods and validity tests. *Ecological Economics* 60: 429-434.

Ready, R., Navrud, S., Day, B. Dubourg, R., Fernando, M., Mourato, S., Spanninks, F. and Rodriquez, M.X.V. (2004). Benefit transfer in Europe: How reliable are transfers between countries? *Environmental and Resource Economics* 29: 67-82.

Rolfe, J. and Bennett, J. (eds) (2006). *Choice modelling and the transfer of environmental values*. Edward Elgar: Cheltenham, UK.

Rosenberger, R.S. and Johnston, R.J. (2009). Selection effects in meta-analysis and benefit transfer: Avoiding unintended consequences. *Land* Economics 85(3): 410-428.

Rosenberger, R.S. and Stanley, T.D. (2006). Measurement, generalization, and publication: Sources of error in benefit transfers and their management. *Ecological economics* 60: 372-378.

Rosenberger, R.S. and Loomis, J.B. (2003). *Benefit transfer*. Chapter 12 in Champ, P.A., Boyle, K.J. and Brown, T.C. (eds) A primer on nonmarket valuation. Kluwer: Dordrecht. pp. 445-482.

Sandrey, R.A. and Simmons, D.G. (1984). *Recreation demand estimation in New Zealand: an example of the Kaimanawa and Kaweka Forest Parks*. Bulletin No. 40, Department of Horticulture Landscape and Parks, Lincoln College.

Scarpa, R., Hutchinson, W.G., Chilton, S.M. and Buongiorno, J. (2007). Benefit value transfers conditional on site attributes: Some evidence of reliability from forest recreation in Ireland. In Navrud, S. and Ready, R. (eds) *Environmental Value Transfer: Issues and Methods,* 179-205. Springer.

Shrestha, R.K. and Loomis, J.B. (2001). Testing a meta-analysis model for benefit transfer in international outdoor recreation. *Ecological Economics* 39: 67-83.

Shrestha, R.K. and Loomis, J.B. (2003). Meta-analytic benefit transfer of outdoor recreation economic values: testing out-of-sample convergent validity. *Environmental and Resource Economics* 25(1): 79-100.

Shrestha, R.K., Rosenberger, R. and Loomis, J.B. (2007). Benefit transfer using meta-analysis in recreation economic valuation. In Navrud, S. and Ready, R. (eds) *Environmental Value Transfer: Issues and Methods,* 161-177. Springer.

Smith, V.K. (1993). Nonmarket valuation of environmental resources: an interpretative appraisal. *Land Economics* 69(1): 1-26

Sorg, C. F. and Nelson, L. J. (1986). *Net economic value of Elk hunting in Idaho*. USDA Forest Service Resource bulletin RM-12, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Stapler, R.W. and Johnston, R.J. (2009). Meta-analysis, benefit transfer, and methodological covariates: Implications for transfer error. *Environmental and Resource Economics* 42: 227-246.

Statistics Canada (nd). Consumer Price Index, historical summary. http://www40.statcan.gc.ca/l01/cst01/econ46a-eng.htm

Statistics NZ (nd). CPI All groups for New Zealand. www.stats.govt.nz/infoshare

UK Government (nd). National Statistics Onlne. www.statistics.gov.uk/statbase/TSDdownload2.asp

US Government (nd). ftp://ftp.bls/gov/pub/special.requests/cpi/cpiai.txt

Vandenberg, T.P., Poe, G.L. and Powell, J.R. (2001). *Assessing the accuracy of benefits transfers: Evidence from a multi-site contingent valuation study of ground water quality*. Chapter 6 in Bergstrom, J.C., Boyle, K.J. and Poe, G.L. (eds) The economic value of water quality. Edward Elgar: Cheltenham, UK. pp.100-120.

Walsh, R.G., Johnson, D.M. and McKean, J.R. (1992). Benefit transfer of outdoor recreation demand studies, 1968-1988. *Water Resources* Research 28(3): 707-713.

Zanderson, M. and Tol, R.S.J. (2009). A meta-analysis of forest recreation values in Europe. *Journal of Forest Economics* 15: 109-130.

Source Studies

Adamowicz, W.L.; Jennings, S.; Coyne, Alison (1990). A Sequential Choice Model of Recreation Behavior. *Western Journal of Agricultural Economics* 15(1): 1-99. **[Results reported in Loomis (2005)].**

Adamowicz, W.L.; Swait, J.; Boxall, P.C.; Louviere, J.; Williams, M. (1997). Perceptions versus objective measures of environmental quality in combined revealed and stated preference models of environmental valuation. *Journal of Environmental Economics and Management* 32: 65-84.

Akabua, K.M.; Adamowicz, W.L.; Phillips, W.E.; Trelawny, P. (1999). Implications of realization uncertainty on random utility models: The case of lottery rationed hunting. *Canadian Journal of Agricultural Economics* 47: 165-179.

Balkan, E.; Kahn, J.R. (1988). The value of changes in deer hunting quality: a travel cost approach. *Applied Economics* 20: 533-539.

Bergstrom, J.C.;Bowker, J.M.; Cordell, H.K.; Bhat, G.; English, D.B.K.; Teasley, R.J.; Villegas, P. (1996). Ecoregional estimates of the net economic value of outdoor recreational activities in the United States: individual model results. Final report submitted to Resource Program and Assessment Staff USDA Forest Service, Washington D.C..

Bishop, R.C.; Heberlein, T.A.; Welsh, M.P.; Baumgartner, R.M. (1984). Does contingent valuation work? Results of the Sandhill experiment. Invited paper, *Joint meetings of the Association of Environmental and Resource Economists, the American Agricultural Economics Association, and the Northeast Agricultural Economics Council*, Cornell University, August 5-8, 1984.

Bowker, J.M.; Starbuck, C.M.; English, D.B.K.; Bergstrom, J.C.; Rosenberger, R.S.; McCollum, D.W. (2009). Estimating the net economic value of national forest recreation: An application of the national visitor use monitoring database. *Faculty Series Working Paper, FS 09-02*, Department of Agricultural and Applied Economics, the University of Georgia.

Boxall, P.C. (1995). The economic value of lottery-rationed recreational hunting. *Canadian Journal of Agricultural Economics* 43: 119-131.

Boyle, K.J.; Phillips, M.L.; Reiling, S.D.; Demirelli, L.K. (1988). Economic values & Economic Impacts Associated with Consumptive Uses of Maine's Fish & Wildlife Resources. University of Maine, pp 41.

Boyle, K.J.; Reiling, S.D.; Phillips, M.L. (1990). Species substitution and question sequencing in contingent valuation surveys evaluating the hunting of several types of wildlife. *Leisure Sciences* 12: 103-118.

Boyle, K.J.; Reiling, S.D.; Teisel, M.; Phillips, M.L. (1990). A study of the impact of game and nongame species on Maine's economy. Department of Agricultural and Resource Economics, University of Maine. **[Paper not obtained. Results reported in Loomis (2005)].**

Boyle, K.J., Roach, B.; Waddington, D.G. (1998). 1996 Net Economic Values for Bass, Trout and Walleye Fishing, Deer, Elk and Moose Hunting, and Wildlife Watching: Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. *US Fish and Wildlife Service Report 96-2* pp.36. **[Paper not obtained. Results reported in Loomis (2005)].**

Brooks, R. (1988). The net economic value of deer hunting in Montana. Montana Department of Fish, Wildlife and Parks. **[Paper not obtained. Results reported in Loomis (2005)].**

Brown, G.; Hay, M. (1987). Net economic recreation values for deer and waterfowl hunting and trout fishing. *USDI Fish and Wildlife Service, Division of Policy and Directives Management Working Paper No. 23*. **[Paper not obtained. Results reported in Loomis (2005)].**

Buschena, D.E.; Anderson, T.L.; Leonard, J.L. (2001). Valuing non-marketed goods: The case of elk permit lotteries. *Journal of Environmental Economics and Management* 41: 33-43.

Capel, R.E.; Pandey, R.K. (1972). Estimating benefits from deer and moose hunting in Manitoba. *Canadian Journal of Agricultural Economics* 20(2): 7-16.

Cory, D.C.; Martin, W.E. (1985). Valuing wildlife for efficient multiple use: elk vs. Cattle. *Western Journal of Agricultural Economics* 10(2): 282-293.

Creel, M.D.; Loomis, J.B. (1990). Theoretical and empirical advantages of truncated count data estimators for analysis of deer hunting in California. *American Journal of Agricultural Economics* 72: 434-441.

Creel, M.D.; Loomis, J.B. (1992). Modeling hunting demand in the presence of a bag limit, with tests of alternative specifications. *Journal of Environmental Economics and Management* 22: 99-113.

Davis, R.K. (1964). The value of big game hunting in a private forest. *Transactions of the twenty-ninth North American Wildlife and Natural Resources Conference*, March 9-11 1964.

Donnelly, D.M.; Nelson, L.J. (1986). Net economic value of deer hunting in Idaho. *USDA Forest Service Resource Bulletin RM-13*, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Duffield, J. (1988). The net economic value of elk hunting in Montana. Montana Dept of Fish, Wildlife and Parks. **[Paper not obtained. Results reported in Loomis (2005)].**

Duffield, J.; Neher, C. (1990). A contingent valuation assessment of Montana deer hunting: Hunter attitudes and economic benefits. Report prepared for Montana Department of Fish, Wildlife & Parks.

Feltus, D.G.; Langenau, E.E. (1984). Optimization of firearm deer hunting and timber values in Northern Lower Michigan. *Wildlife Society Bulletin* 12(1): 6-12.

Fix, P.J.; Manfredo, M.J.; Loomis, J.B. (2005). Assessing validity of elk and deer license sales estimated by contingent valuation. *Wildlife Society Bulletin* 33(2): 633-642.

Fried, B.M.; Adams, R.M.; Berrens, R.P.; Bergland, O. (1995). Willingness to Pay for a Change in Elk Hunting Quality. *Wildlife Society Bulletin* 23(4): 680-686.

Garrett, J.; Pon, G.; Arosteguy, D. (1970). Economics of big game resource use in Nevada. Agricultural Experiment Station, University of Nevada. **[Paper not obtained. Results reported in Loomis (2005)].**

Gonzalez-Caban, A.; Loomis, J.B.; Griffin, D.; Wu, E.; McCollum, D.; McKeever, J.; Freeman, D. (2003). Economic value of big game habitat production from natural and prescribed fire. *USDA Forest Service Research Paper PSW-RP-249*.

Goodwin, B.K.; Offenbach, L.A.; Cable, T.T.; Cook, P.S. (1993). Discrete/continuous contingent valuation of private hunting access in Kansas. *Journal of Environmental Management* 39: 1-12.

Gum, R.L. and Martin, W.E. (1975). Problems and solutions in estimating the demand for and value of rural outdoor recreation. *American Journal of Agricultural Economics* 57(4): 558-566.

Hansen, C. (1977). A report on the value of wildlife. *USDA Forest Service, Intermountain Region Miscellaneous Publication No.1365*. **[Paper not obtained. Results reported in Loomis (2005)].**

Heberlein, T.A.; Bishop, R.C. (1985). Assessing the Validity of Contingent Valuation: Three Field Experiments. Paper presented at the International Conference, Man's Role in Changing the Global Environment, Italy.

Hussain, A.; Zhang, D.; Armstrong, J.B. (2004). Willingness to pay for hunting leases in Alabama. *Southern Journal of Applied Forestry* 28(1): 21-27.

Kerr, G.N. (1996). Recreation values and Kai Tahu management: the Greenstone and Caples Valleys. *New Zealand Economic Papers* 30(1): 19-38.

Knoche, S.D (2006). Travel cost models of deer hunting in Michigan. Master of Science thesis, Department of Agricultural Economics, Michigan State University.

Lee, H-C.; Chun, H-S. (1999). Valuing environmental quality change on recreational hunting in Korea: A contingent valuation analysis. *Journal of Environmental Management* 57: 11-20.

Loomis, J.B. (1982). Use of travel cost models for evaluating lottery rationed recreation: Application to big game hunting. *Journal of Leisure Research* 14: 117-124.

Loomis, J.B. (2005). Updated outdoor recreation use values on national forest and other public lands. USDA Forest service General Technical Report PNW-GTR-658. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.159.8045&rep=rep1&type=pdf

Loomis, J.B.; Cooper, J. (1988). The Economic Value of Antelope Hunting in Montana. Montana Department of Fish, Wildlife and Parks pp.28. **[Paper not obtained. Results reported in Loomis (2005)].**

Loomis, J.B.; Cooper, J.; Allen, S. (1988). The Montana Elk Hunting Experience: A Contingent Valuation Assessment of Economic Benefits to Hunters. Department of Fish, Wildlife & Parks, Montana. pp47. **[Paper not obtained. Results reported in Loomis (2005)].**

Loomis, J.B.; Creel, M.; Cooper, J. (1989). Economic benefits of deer in California: hunting and viewing values. College of Agricultural and Environmental Sciences, University of California, Davis. **[Paper not obtained. Results reported in Loomis (2005)].**

Loomis, J.B.; Creel, M.; Park, T. (1991). Comparing benefit estimates from travel cost and contingent valuation using confidence intervals for Hicksian welfare measures. *Applied Economics* 23(11): 1725-1731.

Loomis, J.B.; Donnelly, D.M.; Sorg, C.F.; Oldenburg, L. (1985). Net economic value of hunting unique species in Idaho: Bighorn Sheep, Mountain Goat, Moose, and Antelope. *USDA Forest Service Resource Bulletin RM-10*, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Loomis, J.B., Pierce, C; Manfredo, M. (2000). Using the demand for hunting licenses to evaluate contingent valuationestimates of willingness to pay. *Applied Economics Letters* 7:435-438.

Loomis, J.B.; Updike, D.; Unkel, W. (1989). Consumption and Nonconsumption Values of a Game Animal: The Case of California Deer. *Transactions of the 54th North American Wildlife & Natural Resources Convention* pp. 640-650. **[Paper not obtained. Results reported in Loomis (2005)].**

Luzar, E.J.; Hotvedt, J.E.; Gan, C. (1992). Economic valuation of deer hunting on Louisiana public land: A travel cost analysis. *Journal of Leisure Research* 24(2): 99-113.

Martin, W.; Gum, R.; Smith, A. (1974). The demand for and value of hunting, fishing and general rural outdoor recreation in Arizona. Agricultural Experiment Station. **[Paper not obtained. Results reported in Loomis (2005)].**

McCollum, D.W.; Bishop, R.C.; Welsh, M.P. (1988). A probabilistic travel cost model. Department of Agricultural Economics, University of Wisconsin. **[Paper not obtained. Results reported in Loomis (2005)].**

McCollum, D.W.; Boyle, K.J. (2005). The effect of respondent experience/knowledge in the elicitation of contingent values: An investigation of convergent validity, procedural invariance and reliability. *Environmental and Resource Economics* 30: 23-33.

McCollum, D.W.; Miller, S.M. (1994). Alaska Voters, Alaska Hunters and Alaska Non-resident Hunters: Their Wildlife Related Trip Characteristics and Economics. Alaska Department of Fish and Game. **[Paper not obtained. Results reported in Loomis (2005)].**

McCollum, D.W.; Peterson, G.L.; Arnold, J.R.; Markstrom,D.C.; Hellerstein, D.M. (1990). The Net Economic value of Recreation on the National Forests: Twelve Types of Primary Activity Trips Across Nine Forest Service Regions. *USDA Forest Service, Research Paper RM 89*.

Miller, J.; Hay, M. (1984). Estimating substate values for fishing and hunting. *Transactions of the North American Wildlife and Natural Resources Conference* 49: 345-355. **[Paper not obtained. Results reported in Loomis (2005)].**

Nugent, G.; Henderson, R. (1990). Putting a Value on Hunting in the Oxford RHA. *New Zealand Wildlife*, Summer: 39-40.

Offenbach, L.A.; Goodwin, B.K. (1994). A Travel-Cost Analysis if the Demand for Hunting Trips in Kansas. *Review of Agricultural Economics* 16: 55-61.

Park, T.; Loomis, J.B. (1992). Comparing models for contingent valuation surveys: Statistical efficiency and the precision of benefit estimates. *North Eastern Journal of Agricultural and Resource Economics* 21(2): 170-176.

Park, T.; Loomis, J.B.; Creel, M. (1991). Confidence intervals for evaluating benefits estimates from dichotomous choice contingent valuation studies. *Land Economics* 67(1): 64-73.

Pattison, W.S.; Phillips, W.E. (1971). Economic evaluation of big game hunting: An Alberta case study. *Canadian Journal of Agricultural Economics* 19(2): 72-85.

Sandrey, R.A.; Buccola, S.T.; Brown, W.G. (1983). Pricing policies for antlerless elk hunting permits. *Land Economics* 59(4): 432-443.

Sandrey, R.A.; Simmons, D.G. (1984). Recreation demand estimation in New Zealand: an example of the Kaimanawa and Kaweka Forest Parks. *Bulletin No. 40*, Department of Horticulture Landscape and Parks, Lincoln College.

Sarker, R.; Surry, Y. (2003). The fast decay process in recreational demand activities and the use of alternative count data models. *Department of Agricultural Economics and Business Working Paper WP03/01*. University of Guelph.

Scrogin, D.; Berrens, R.P.; Bohara, A.K. (2000). Policy changes and the demand for lottery-rationed big game hunting licenses. *Journal of Agricultural and Resource Economics* 25(2): 501-519.

Sorg, C.F.; Nelson, L.J. (1986). Net economic value of Elk hunting in Idaho. *USDA Forest Service Resource Bulletin RM-12*, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Swanson, C.S.; Thomas, M.; Donnelly, D.M (1989). Economic value of big game hunting in Southeast Alaska. *USDA Forest Service Resource Bulletin RM-16*, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Taylor, J.; Marsh, T.L. (2003). Valuing Characteristics of Transferable Deer Hunting Permits in Kansas. Paper presented at the Western Agricultural Economics Association Annual Meeting, Denver, Colorado.

Teisl, M.F.; Boyle, K.J.; McCollum, D.W.; Reiling, S.D. (1995). Test-retest reliability of contingent valuation with independent sample pretest and post test control groups. *American Journal of Agricultural Economics* 77: 613-619.

von Haefen, R.H.; Phaneuf, D.J. (2008). Identifying demand parameters in the presence of unobservables: A combined revealed and stated preference approach. *Journal of Environmental Economics and Management* 56: 19-32.

Waddington, D.G.; Boyle, K.J.; Cooper, J. (1991). 1991 Net Economics Values for Bass and Trout Fishing, Deer Hunting, and Wildlife Watching. Division of Federal Aid, US Fish and Wildlife Service. 39p. **[Paper not obtained. Results reported in Loomis (2005)].**

Wilman, E.A. (1984). Benefits to deer hunters from forest management practices which provide deer habitat. *Transactions of the North American Wildlife and Natural Resources Conference* 49: 334-344. **[Paper not obtained. Results reported in Loomis (2005)].**

Wilman, E.A. (1987). A simple repackaging model of recreational choices. *American Journal of Agricultural Economics* 69(3): 603-612.