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Assessing national values to protect the health of the Great Barrier Reef

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Abstract

The Great Barrier Reef (GBR) is a vast iconic environmental asset covering an area of approximately 35 million hectares and as such is valued by people all over Australia, as well as overseas. While non-market values for the GBR will comprise both use and non-use values, the values of people who live closer and who can visit the GBR more frequently, are likely to be higher than those who live further away in more distant locations. The aim of the study outlined in this report was to estimate the values to protect the health of the GBR at the national level, and in doing so, examine the effects of distance decay on valuation estimates. A split sample choice modelling experiment was conducted in six locations: a regional town within the GBR catchment area (Townsville); Brisbane, the state capital approximately 450 km from the southern limit of the GBR and four other capital cities (Sydney, Melbourne, Adelaide and Perth) ranging from 730 km to over 3600 km from Brisbane.

The results indicate that the total national value for a 1% improvement in the health of the GBR ranges from between a low of approximately $433.6 million to a high of $811.3 million depending on the underlying assumptions made. There was some evidence of distance decay in values with most decline occurring once outside the home state, and little further decline occurring once away from the east coast. There was no evidence to suggest any difference in patterns of use and non use values but the values of the potential future users that were most influential in determining WTP estimates.

1. Introduction

A key issue in assessing values for environmental protection with stated preference techniques is identification of the relevant population base. It is generally assumed that as distance from the resource of interest increases and the population base increases, the values per person or household will decrease (Pate and Loomis 1997; Hanley et al. 2003; Bateman et al. 2006). This means that an inverse relationship can be expected between increasing the population base and the average protection values that are generated. A number of researchers have examined the importance of distance decay in stated preference experiments using the contingent valuation (CV) or choice modelling (CM) techniques (e.g., Sunderland and Walsh 1985; Pate and Loomis 1997; Hanley et al. 2003; Bateman et al. 2006; Concu 2007, Salazar and Menedez 2007). This has allowed the calculation of use and non-use values as a function of distance from the site of interest (e.g. Concu 2007).

Four groups of reasons can be identified why protection values might decline with increased distance. First, actual use of an environmental resource, such as for recreation, is likely to be lower for people who live further away from it (Sunderland and Walsh 1985; Pate and Loomis 1997; Hanley et al. 2003; Bateman et al. 2006). Second, there are more likely to be different substitutes available as the set of resource possibilities expands (Pate and Loomis 1997; Rolfe et al. 2002; Hanley et al. 2003; Bateman et al. 2006). Third, people may feel less responsible for more distant environmental assets in different jurisdictions (Rolfe and Bennett 2002; Hanley et al. 2003; Bateman et al. 2005, Bateman et al. 2006; Johnston and Duke 2009), and fourth, there may be lower awareness and knowledge of more distant environmental assets (Sunderland and Walsh 1985; Pate and Loomis 1997; Hanley et al. 2003). While the first reason helps to explain why use values may decline with distance, the other reasons suggest that both use and non-use values may decline with increased distance.

The relationship between environmental values and distance effects is less clear cut when iconic or special assets are involved (Pate and Loomis 1997; Loomis 1996). While access and availability can be expected to decline with increasing distance from an iconic resource, there may be little change in substitutes, responsibility or awareness with populations that live within reasonably proximate areas (such as within the same region or state). This is because iconic assets may be unique across population groups, so that non-use values remain relatively constant across distance. Most research on distance decay functions have focused on generic environmental or land assets (e.g. Johnston and Duke 2007), with few studies focusing on more definable assets (e.g. Bateman et al. 2006 valued protection of the Norfolk Broads in the UK).

In this report, the national values to improve protection of the Great Barrier Reef (GBR) are assessed in two split sample CM experiments across six geographically distant population samples. The report provides an update of results presented in Rolfe and Windle (2010) which examined the population effects of two population samples within Queensland; one located within the GBR area (Townsville) and one outside (Brisbane). In this report, the results from four other capital cities (Sydney, Melbourne, Adelaide and Perth) are included in the analysis. The *a priori* expectation is that willingness to pay (WTP) will be higher in the Townsville population where residents are able to use the GBR more frequently, and values would decay with distance form the GBR. A key aim of the study is to examine the extent of distance decay for a vast iconic resource.

This report makes an important contribution to the valuation literature in three main ways. First, it provides the first comprehensive valuation of both use and non-use values for the GBR. Second, it provides information about the effects of distance decay for an iconic and internationally significant marine ecosystem. Third, it demonstrates how the CM technique can be employed to distinguish distance-decay effects across choice attributes. The report is structured as follows. In the next section a brief overview is provided of the literature which guided the *a priori* expectations associated with the hypothesis. The case study details are presented in the third section followed by the results in section four. The discussion and conclusions are presented in the final section.

2. Background literature

Sometimes it is hard to tell whether values from distant respondents are driven by use or by non-use values (Bateman and Langford 1997). While there is a recognisable relationship between distance and a decline in use values (e.g. Salazar and Menedez 2007), the relationship with distance and non-use values is not so clear. Some researchers have asserted that there is no reason why these values should decline over distance (e.g. Bateman et al. 2006), while others have noted that non-use values are not always sensitive to proximity (Pate and Loomis 1997; Johnston and Duke 2009).

Hanley et al. (2003) found that more rapid distance decay exists for use values than non-use values. They suggest distance decay relationships will vary across different resource types and spatially within a type where there are many substitutes for the resource in question. Bateman et al. (2006) find that the choice of welfare measure will determine the influence of distance decay on the values of current non-users. They report significant distance decay in overall willingness-to-pay (WTP) but not in present non-use values when measuring an equivalent loss (future environmental condition remains the same as present levels). In contrast, when applying a welfare measure of compensating surplus (an improvement in environmental levels in the future) they find the effects of distance decay not only in the overall sample value but also in values stated by present non users.

There are few studies that provide guidance on how distance decay may affect values for well known iconic assets such as the GBR. Loomis (1996) estimate that while distance had an impact on WTP values, people across the whole USA had significant values for restoration of the well known, if not iconic, salmon species by removing two dams in the Elwha River in Washington State, suggesting only moderate distance decay effects. Other studies suggest that non-use values for notable assets will be constant. Pate and Loomis (1997) found no evidence of declining WTP for a salmon improvement program across more distant populations, while Bateman et al. (2006) found constant values for protection of the Norfolk Broads across more distant non-users.

There is potential for CM experiments to provide greater insight into distance decay functions because the attributes used to describe choice experiments can be related to the choices made (Concu 2007). Several CM studies have involved tests for values by population proximity. Morrison and Bennett (2004) explored how protection values for rivers in New South Wales, Australia, varied across within-catchment and out-of-catchment populations, finding that use values were higher for within-catchment populations, and that non-use values were higher for out-of-catchment populations. Van Beuren and Bennett (2004) found statistically equivalent within-region and out-of-region values for biodiversity protection, with lower values in the city samples likely to reflect lower use of assets by that group. In developing distance function for protection values for Kings Park in Perth, Western Australia with CM, Concu (2007) found that distance effects take different and sometimes complex forms across attributes, but that failure to account for spatial heterogeneity could bias results.

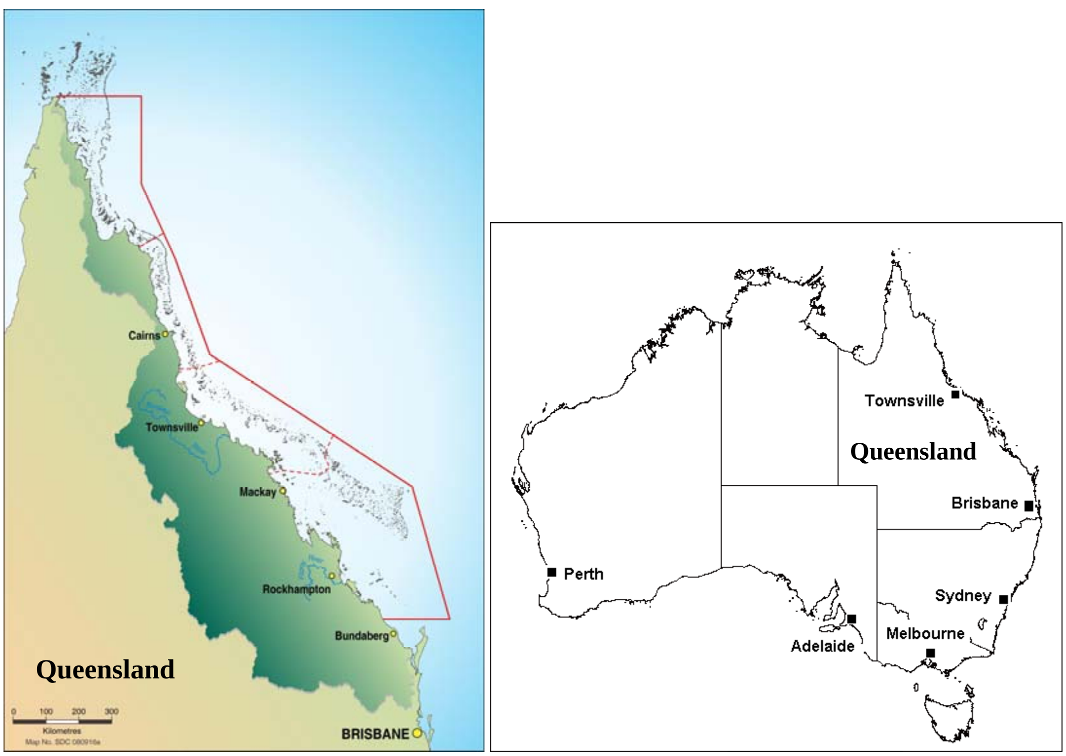
These results allow several key expectations to be identified. First, local populations with both use and non-use values are likely to have higher total values than distant populations which only hold non-use values (Bateman et al. 2006). Second, use values can be expected decay with distance from the site of interest. Third, the effect of distance on non-use values is much more open, with evidence of both declining and constant value effects. Fourth, there are a number of different effects likely to impact on value functions, most of which remain hidden in the experimental and decision processes.

3. The choice modelling case study

3.1 Sample populations

The research project outlined in this report was designed to assess the national values for the iconic GBR across two choice experiment formats. Both experiments involved a split sample CM survey with responses collected in Townsville, a regional centre located within the GBR catchment area; Brisbane, the State capital located outside the GBR catchment area, and four other capital cities (Sydney, Melbourne, Adelaide and Perth) which ranged from 730 km to over 3600 km from Brisbane (Figure 1).

Figure 1. Great Barrier Reef and population sample locations



Four main factors have been identified as potential reasons why WTP values for resource protection may decline with distance. The first relates to usage and the further away people are from the resource, the less likely they are to be able to use it. The second factor is that there are more likely to be different substitutes available as the set of resource possibilities expands with distance. It is difficult to fully understand what might be considered a substitute for an iconic resource like the GBR. There will obviously be other coastal recreational possibilities at other locations, but they may not be in tropical locations and are therefore more limited by seasonal weather conditions. In Sydney there is a range of nearby coastal recreational possibilities, more so than in Melbourne where water temperature and weather conditions are far more limiting. Western Australia (Perth) has access to tropical coral reefs in the northern part of the state. Adelaide is really the standout location where the availability of substitutes is most limiting. The third factor relates to a feeling of ownership or responsibility which may decline with distance. Discussions with focus group participants in Sydney and Melbourne indicated that the GBR is considered an Australian icon and as such, all Australians have a feeling of ownership and responsibility towards its protection. So it is unlikely that there is a strong influence of distance decay, particularly in the eastern states. The fourth factor relates to the fact there might be lower awareness and knowledge of the GBR and the pressures it is facing in more distant populations. This will be partly true because GBR issues will get more local state level media coverage. It is also likely that there is some interaction with personal first hand experience and usage patterns, so that people who have first hand experience may also have a better awareness of GBR issues. As such, it is likely that there will be some distance related decline with perhaps less effect in Perth as there are important coral reefs in the state that would get local media coverage.

An overview of some of the distance related characteristics of different locations is presented in Table 1.

Table 1. Distance related characteristics of different locations

	Location	Distance	Accessibility	Substitutes	Experience & awareness
Townsville	local	0	Direct	Many	High
Brisbane	Same state	450 km from GBR	Easy		Medium/high
Sydney	East coast	730 km from Bne	Close – easy flights	Many coastal recreational sites	Medium
Melbourne	South coast /east coast state	1370 km from Bne	A bit longer travel time c/f Sydney, fewer direct flights	Coastal sites: limited by cold water and weather	Medium/low
Adelaide	South coast	1600 km from Bne	Far from east coast	Coastal sites: far from tropical waters	Low
Perth	West coast	3600 km from Bne	Far from east coast	Reefs and tropical waters in state	Medium/low

3.2 Choice experiment formats

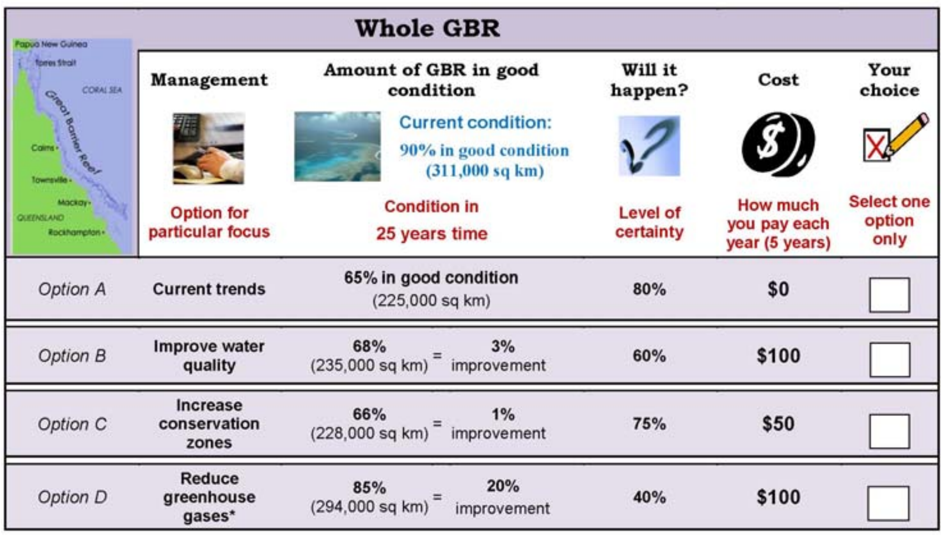
The format of the first split sample focused on protection of the GBR as a single attribute, but expanded the choice dimension in two key ways. Uncertainty was included as a primary attribute and related to the level of certainty associated with the predicted levels of improvement in the condition of the GBR in the choice profiles. The main reason uncertainty was included as an attribute was to help frame the uncertainty surrounding any predictions about current and future health of the GBR. The other key design feature was the use of labelled alternatives in each choice task which described the management option that would be applied to achieve the predicted benefits.

The second split sample focused on a multiple attribute version of the survey. Instead of describing the GBR as a single all encompassing attribute, it was disaggregated into three separate attributes, with no use of a certainty attribute or labels. The valuation scenario was described in terms of a cost attribute and three environmental attributes:

- Area of coral reef in good health
- No of fish species in good health
- Area of seagrass in good health

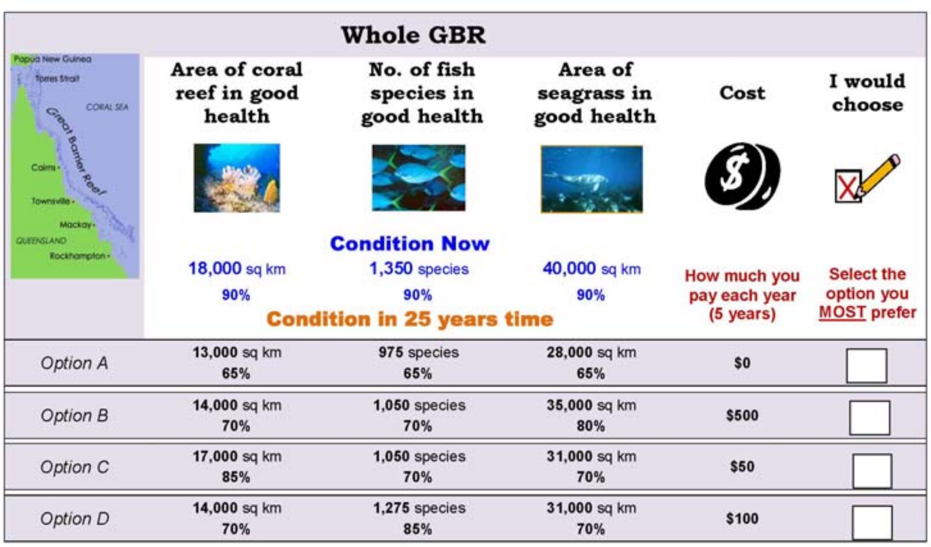
An example of the choice sets in both split-sample experiments is provided in Figure 2. There were four alternatives in each choice task in both experiments, with the first alternative constant across choice sets. One experiment involved three attributes and labelled alternatives, while the other involved four attributes but was unlabelled. This kept the choice dimensions relatively uniform. While the split sample experiments allowed a range of comparative tests to be conducted, only those relevant to the different population groups are presented in this report.

Figure 2. Example multiple and single attribute choice sets



Whole GBR

	Management	Amount of GBR in good condition	Will it happen?	Cost	Your choice
	Option for particular focus	Current condition: 90% in good condition (311,000 sq km) — Condition in 25 years time	Level of certainty	How much you pay each year (5 years)	Select one option only
Option A	Current trends	65% in good condition (225,000 sq km)	80%	$0	☐
Option B	Improve water quality	68% (235,000 sq km) = 3% improvement	60%	$100	☐
Option C	Increase conservation zones	66% (228,000 sq km) = 1% improvement	75%	$50	☐
Option D	Reduce greenhouse gases*	85% (294,000 sq km) = 20% improvement	40%	$100	☐



Whole GBR

	Area of coral reef in good health	No. of fish species in good health	Area of seagrass in good health	Cost	I would choose
Condition Now	18,000 sq km 90%	1,350 species 90%	40,000 sq km 90%		
Condition in 25 years time				How much you pay each year (5 years)	Select the option you MOST prefer
Option A	13,000 sq km 65%	975 species 65%	28,000 sq km 65%	$0	☐
Option B	14,000 sq km 70%	1,050 species 70%	35,000 sq km 80%	$500	☐
Option C	17,000 sq km 85%	1,050 species 70%	31,000 sq km 70%	$50	☐
Option D	14,000 sq km 70%	1,275 species 85%	31,000 sq km 70%	$100	☐

The attribute descriptions and levels used in the surveys are presented in Table 2. In both surveys, the first alternative was a constant base depicting the amount of the GBR expected to be in good condition in 25 years time under current policy settings and with no additional investment. Based on the predictions of Wolanski and De'ath (2005), Lough (2007) and Garnaut (2008) this was set at 65% of the GBR, down from approximately 90% in current times (GBRMPA 2009; Wolanski and De'ath 2005). The other alternatives provided scenarios where protection of the GBR could be improved through additional investment.

Table 2. Attribute levels[1] for choice alternatives

Attribute	Description	Base (Status quo)	Option levels
Single attribute survey[2]			
Cost	How much you pay each year (5 years)	$0	$20, $50, $100, $200. $300, $500
GBR	Amount of GBR in good condition	65% (225,000 sq km),	66%, 68%, 70%, 72%, 75%,76%, 80%, 85% (228,000 to 294,000 sq km)
Certainty	Will it happen? Level of certainty	80%	10%, 20%, 30%, 40%, 50%, 60%, 70%, 75%, 80%, 85%
Multiple attribute survey			
Cost	How much you pay each year (5 years)	$0	$50, $100. $200, $500
Reef	Area of coral reef in good health	65% (13,000 sq km)	70%, 80%, 85% (14,000, 16,000, 17,000 sq km)
Fish	No of fish species in good health	65% (975 species)	70%, 80%, 85% (1050, 1200, 1275 species)
Seagrass	Area of seagrass in good health	65% (40,000 sq km)	70%, 80%, 85% (31,000, 35,000, 38,000 sq km)

[1] All attribute levels were described both in absolute terms as well as percentage terms, but for brevity all results in this report are reported in percentage terms only.
[2] Attribute levels varied for each labelled alternative

Two D-efficient experimental designs were created, one for the single attribute profiles and one for the multiple attribute profiles. As both designs involved 12 choice sets, to avoid respondent fatigue they were blocked into two versions so that each respondent was assigned a random block of six choice sets. Surveys were collected in Townsville and Brisbane in both a paper-based and web-based modes. The paper-based surveys were collected to provide a check on the accuracy of the online responses. The effects of collection mode were tested for, but little significant difference could be identified, supporting the results of Olsen (2009). These surveys were collected between August and December 2009 and full details and results are reported in Rolfe and Windle (2010). Further surveys were collected in a web-based mode using an internet panel in September 2010 in Sydney, Melbourne, Adelaide and Perth.

3.3 Respondent characteristics

A total of 1919 surveys were collected across the two survey formats and from six population groups. The socio-demographic characteristics of survey respondents were well aligned with those of the population in terms of gender, age and income levels, but education levels were higher for the sample than the population. Full details are presented in Appendix 1: Table 1a.

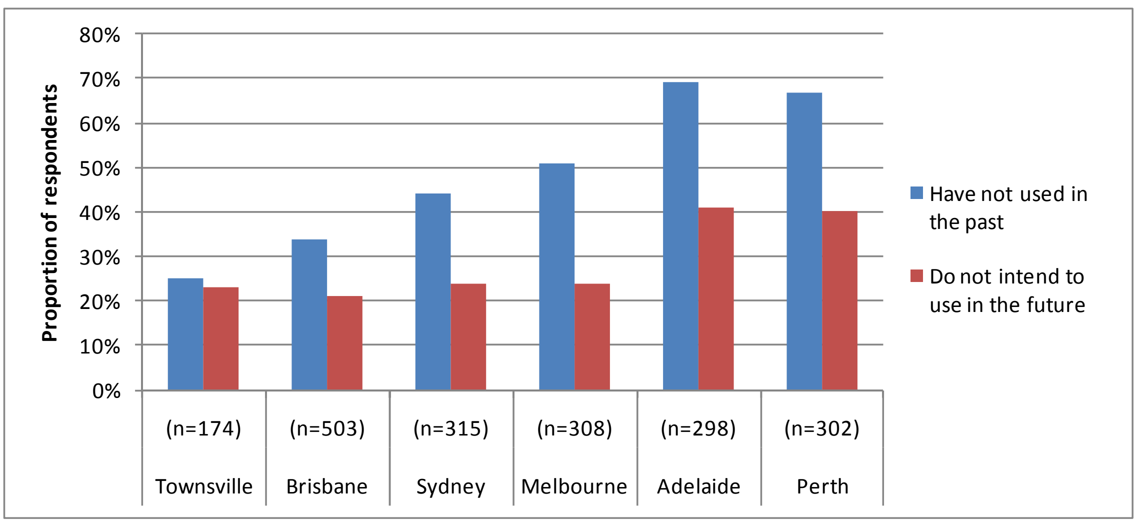
4. Results

The main aim of the research project was to assess national values for an iconic resource and to examine the effects of distance decay on both use and non-use values for the GBR across different state capital population samples. The results are presented in four main sections. First, details are presented of actual use and non-use patterns of behaviour across population samples, as well as attitudes to use and non-use values to protect the health of the GBR. In the second section, full details of the results of the single and multiple attribute choice experiments are outlined. In the third section some results from modifications to these models are presented to explore the preferences of, and differences between user and non users of the GBR. In the last section, the results are extrapolated to determine a national value for the GBR protection.

4.1 Usage and attitudinal difference between population samples

As expected, use of the GBR was much higher for local Townsville respondents, with the main difference being in the frequency of use generally, and for fishing in particular. However, it was difficult to accurately assess recreational fishing use, particularly in Townsville, as there was a high rate of missing values for this question in the paper-based survey (54% and 30% in the Brisbane and Townsville surveys respectively). Full details are presented in Appendix 1: Table 2a. There was a steady increase with distance in the proportion of respondents who had never used the GBR for recreational purposes (apart from Perth) (Figure 3.). In contrast, there was a more segmented increase in the proportion of respondents who had no intention of using the GBR in the future. There was little difference in the proportion of potential future users within the three more accessible eastern states (Townsville, Brisbane, Sydney and Melbourne) and those within the two least accessible states (Adelaide and Perth). The main differences appeared between the two groups (Figure 3).

Figure 3. Proportion of past and future "non-users" of the GBR

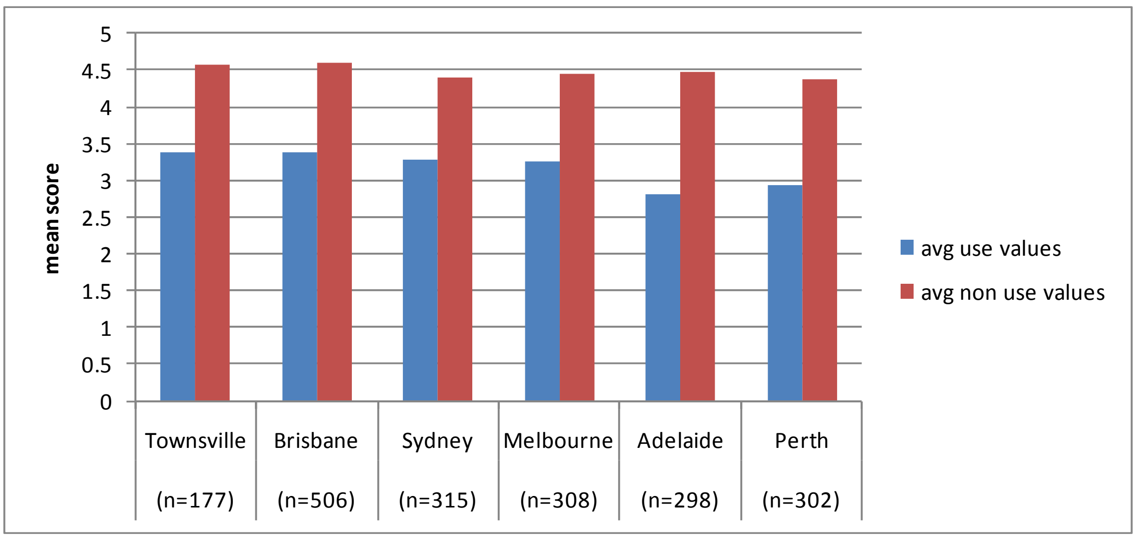


These results suggest that if current usage patterns are a major determinant of WTP values then a steady decline in values may be associated with increasing distance, whereas, if future usage patterns are the major determinant, then distance decay may be manifest in a two segment separation.

The frequency patterns of general recreational usage (ie. using it more than once a year) suggest there are four main distance related categories (Appendix 1: Table 2a): the local population (Townsville), the same state population (Brisbane), eastern states populations (Sydney and Melbourne) and then other states (Adelaide and Perth). It is more difficult to classify patterns of future use. In terms of the most frequent future usage, a three category distance function emerges: the local (Townsville), other Queensland and eastern states (Brisbane, Sydney and Melbourne), and the more remote states (Adelaide and Perth). On the other hand, if frequency is not taken into account, future usage follows a different three category pattern with the two Queensland populations, the two eastern state populations and the two more remote state populations.

To gauge the relative importance of the different components of total economic value (comprising use and non-use values) respondents were asked to rate a series of reasons for supporting increased protection of the GBR with a score from (1) NOT important to (5) VERY important. The reasons were designed to represent key categories of value as closely as possible. There was some consistency in the results. In all samples, existence values (e) were ranked the highest followed by bequest values (d) and quasi option values (f), while personal use values (a) and (b) were ranked the lowest (Appendix 1 : Table 3a). To more easily compare results, mean scores for the three non use options and the two personal use values were averaged and are presented in Figure 4.

Figure 4. Reasons for supporting environmental protection of the Great Barrier Reef



There appears to be little difference in the means scores of the different population samples, although there was a significant difference (Pearson's chi squared crosstab at 1%) in the different category scores. In terms of how these attitudes may impact of WTP values, there is some difference in use values with a potential three segment split with Queensland values slightly higher than those of the other eastern states and both these higher than in the more remote states. There is limited evidence to suggest a potential two segment split in non-use values, with higher levels of important in Queensland compared to other locations.

4.2. Results of the two choice modelling surveys

Mixed logit (ML) models were developed to explore the influence of population effects on protection values in both split sample experiments. Details of the attribute descriptions and levels were presented in Table 2 and other model variables are explained in Table 3.

Table 3. Model variables

Main variables	Description
ASC	Alternative specific constant
SQ…	Prefix to denote status quo (current situation) alternative
WQ…	Prefix to denote management option: Improve water quality (Experiment 1)
CZ…	Prefix to denote management option: Increase conservation zones (Experiment 1)
GG…	Prefix to denote management option: Reduce greenhouse gases (Experiment 1)
AGE	Age in years. Only categorical details were collected in the paper survey, so the mid point of each category was applied.
GENDER	Male = 0; Female = 1
CHILDREN	Children = 1; no children = 2
EDUCATION	Coded from 1= primary to 5 = tertiary degree or higher
INCOME	Categories 1-5 (see Appendix 1: Table 1a for details). The mid point of each category was used for analysis with an additional 25% added to the last category.

In all models presented in this section, a standard format was applied and the five main socio-demographic variables (Table 3) were included in all models whether or not they were significant. The extent of significance (or lack of it) provides important information for potential application in benefit transfer. The socio demographic variables were modelled to explain the choice of the base or status quo alternative. Only the ASCs were randomised which meant that all single GBR and multiple GBR attributes were treated in a uniform manner as non-random parameters.

4.2.1 Results of the single GBR attribute survey

Results of the single GBR attribute survey are presented in Table 4.

Table 4. Mixed logit models for the single GBR attribute survey

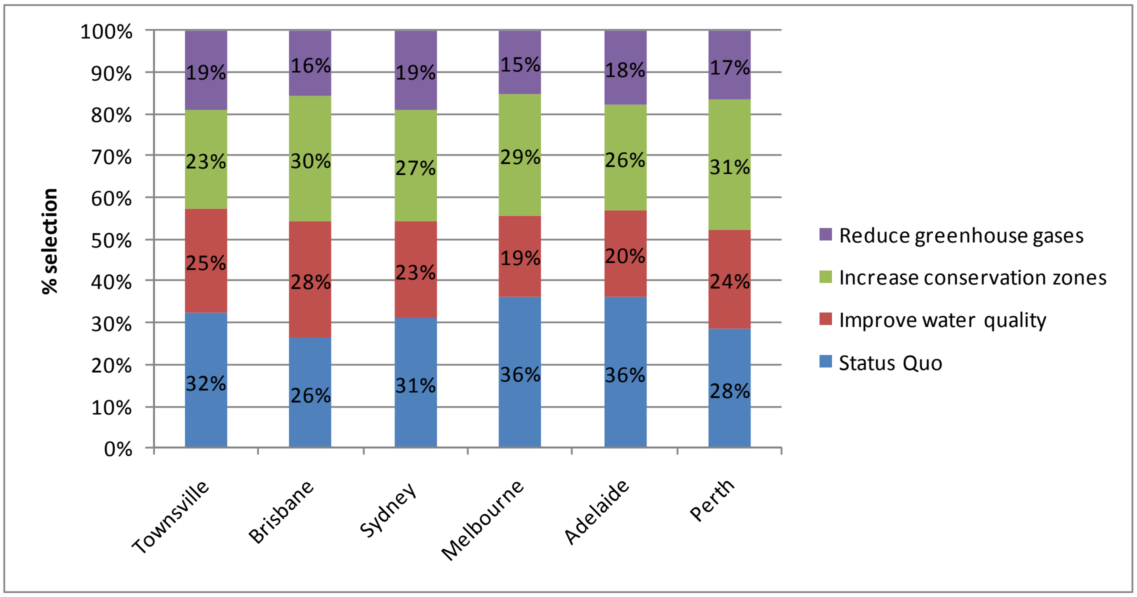
	Townsville	Brisbane	Sydney	Melbourne	Adelaide	Perth
Random parameters in utility functions						
WQ_ASC	-9.69***	-3.74***	-1.17	0.62	-3.22**	-1.78
CZ_ASC	-10.41***	-3.73***	-0.94	1.47	-3.25**	-1.65
GG_ASC	-12.62***	-5.92***	-2.01*	-0.84	-4.70***	-2.78*
Derived standard deviations of parameter distributions						
WQ_ASC	2.89***	2.19***	1.95***	2.42***	2.27***	2.21***
CZ_ASC	3.95***	2.28***	1.58***	2.25***	1.92***	2.02***
GG_ASC	5.25***	3.15***	2.78***	4.04***	3.39***	3.13***
Non Random parameters in utility functions						
COST	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
GBR CONDITION	0.19***	0.16***	0.13***	0.18***	0.18***	0.14***
CERTAINTY	0.01	0.02***	0.01**	0.02***	0.02***	0.02***
AGE	-0.07***	-0.01	0.01	0.01	-0.01	-0.01
GENDER	-0.35	-0.52*	0.28	1.10***	-0.60*	0.54*
CHILDREN	-1.68**	-0.38*	-0.04	0.36	0.56	-0.08
EDUCATION	-0.72***	-0.33***	-0.14	-0.29*	-0.78***	-0.41***
INCOME	-0.1-E05	-0.1-E05***	-0.1-E05***	-0.1-E06	-0.1-E05***	-0.1-E05**
Model statistics						
Observations	522	1500	954	924	888	906
Log L	-487	-1580	-1059	-910	-914	-956
AIC	1.92	2.12	2.25	2.00	2.09	2.14
McFadden R-sqrd	0.33	0.24	0.20	0.29	0.26	0.24
Chi Sqrd	473	999	528	741	635	599

*** significant at 1%; ** significant at 5%; * significant at 10%

The models for all population groups are significant (high chi-squared values) and the COST and GBR CONDITION attributes are significant and signed as expected. Higher levels of GBR CONDITION and lower levels of COST are consistently preferred across models.

Some difference in models can be identified. First the CERTAINTY attribute is not significant in the Townsville sample but is in all the other population samples. Second, parameters for the three randomised alternative labels vary in strength and significance across samples. There are significant unobserved reasons why respondents avoided selecting the different labelled (management options) alternatives in Townsville, Brisbane and Adelaide, but not in the three other capital cities. The coefficient values for the labelled alternatives are larger in the Townsville sample (a higher level of unexplained effects) but in all three cases the REDUCE GREENHOUSE GAS option was the least preferred. The standard deviations of random parameter estimates are all significant, indicating there is significant heterogeneity in influences underlying the selection of the management alternatives. There is a significant difference in the selection of management alternatives (Pearson's chi squared crosstab at 1%) with the IMPROVE WATER QULALITY option being selected less frequently in the Townsville sample and the INCREASE CONSERVATION ZONE option being selected more frequently in the Brisbane sample (Figure 5).

Figure 5. Selection of management options (labelled alternatives) by location

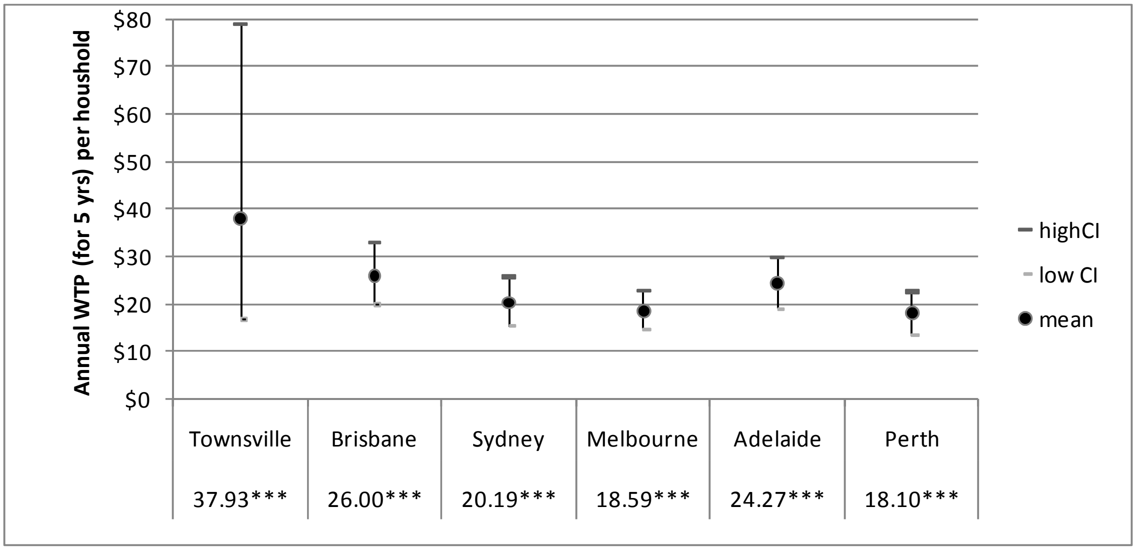


The third key difference between the models is in the significance of the socio-demographic variables, notably with the INCOME variable not significant in the Townville and Melbourne samples. The EDUCATION variable is a significant influence on choice selection in all locations apart from Sydney; people with higher education levels were more likely to select one of the improvement options. The fourth difference between the populations is in the proportion of potential protest votes. The biggest difference is in the two Queensland samples with 25% and 15% of respondents always selecting the status quo option in the Townsville and Brisbane samples respectively. In the other capital cities, 18%, 21%, 24% and 17% of respondents always selected the status quo option in Sydney, Melbourne, Adelaide and Perth respectively.

Log likelihood ratio tests indicate that there is no significant difference between the two Queensland samples, but there is between each of them and the other out of state samples. There is also a significant difference between the out of state samples, apart from between Perth and Sydney and between Perth and Melbourne where there is no difference between the models.

The final comparison to be made between population samples is in the WTP estimates. There is a clear decline in WTP estimates (annual household values for a 1% improvement in GBR CONDITON for a five year period) as distance from the GBR increases, with a flattening out in values after Sydney (apart from the anomaly of Adelaide) (Figure 6). Mean WTP estimates drop from $38 in Townsville to $20 in Sydney and then only drop off to $18 in the most distant capital city of Perth. The large range in confidence intervals (CI) is limited to the Townsville sample, with smaller and similar ranges in all other capital cities. A Poe et al. (2005) procedure, which calculates the proportion of differences greater than zero, indicates there is no significant difference (at the 5% level) between WTP estimates for the two Queensland samples (Townsville and Brisbane) or between either of them and Sydney or Adelaide. There is a difference between Townsville and Brisbane, and between Melbourne and Perth. Apart from Adelaide there is no difference in estimates between the more distant capital cities. There is a difference between Adelaide and Perth.

Figure 6. WTP estimates for a 1% improvement in GBR condition



*** significant at 1%;

Although there is large (31%) drop in the WTP estimate between Townsville and Brisbane, the difference is symptomatic of the wide range in confidence intervals in the Townsville sample and there is no statistical difference between the two samples. This might indicate that WTP estimates were being driven by potential patterns of future use where the proportion of respondents who stated they would visit the GBR in the future was similar for both samples (Appendix 1: Table 3a). However, predicted patterns of future use were also similar for Sydney and Melbourne, (involving 76% of respondents) and while there is no difference between the WTP estimates in the Queensland samples and Sydney, there is between them and Melbourne. As well, there was a distinct decrease in predicted future use in the Adelaide and Perth samples (only about 60% of respondents) but there is no difference in the WTP estimates between Perth and Sydney or Melbourne.

Excluding the anomaly of Adelaide, the results suggest some effect of distance decay may occur in two segments. WTP values are the same within the GBR state, and across out of state populations, with the main difference occurring across the two groups.

Given the significant influence of education on choice selection and the educational bias in all sample populations, further models were developed with separate education level samples, to explore the influence of education on WTP estimates. However, the results were inconclusive and while in Townsville, Brisbane and Melbourne, respondents with higher education levels had higher WTP values, the opposite was true in Sydney, Adelaide and Perth. Full details are presented in Appendix 1: Table 4a.

Further models were developed with the influence of the three main attributes separated out between the three labelled alternatives (management options). The results are inconclusive and do provide further insights into the impact of distance on WTP estimates.

4.2.2 Results of the multiple attribute survey

The second split sample experiment allowed more detailed tests by disaggregating values across different GBR attributes, with results presented in Table 5. Models for all population samples are significant (high chi-squared values) and coefficients for the four main attributes are all significant and signed as expected. Higher levels of REEF, FISH and SEAGRASS and lower levels of COST are all consistently preferred across models.

Table 5. Mixed logit models for the multiple attribute survey

	Townsville	Brisbane	Sydney	Melbourne	Adelaide	Perth
Random parameters in utility functions						
SQ_ASC	-17.553*	0.603	-2.149	4.434	4.526	2.474
Derived standard deviations of parameter distributions						
SQ_ASC	6.814***	6.086***	6.257***	5.992***	7.847***	7.565***
Non Random parameters in utility functions						
COST	-0.003***	-0.004***	-0.004***	-0.005***	-0.005***	-0.004***
REEF	0.045***	0.053***	0.044***	0.055***	0.065***	0.053***
FISH	0.039***	0.034***	0.031***	0.052***	0.065***	0.064***
SEAGRASS	0.027**	0.026***	0.013*	0.025***	0.032***	0.026***
AGE	0.166*	0.011	0.023	-0.046	0.011	-0.038
GENDER	3.605*	-0.624	-0.877	-0.912	-1.879	-1.691
CHILDREN	3.113	-0.754	-0.005	-1.335	-0.226	0.888
EDUCATION	-1.729	-0.156	0.189	0.367	-1.332*	-0.985
INCOME	0.4-E05	-0.3-E05**	0.3-E05*	-0.4-E05**	0.4-E05	0.1-E05
Model statistics						
Observations	522	1506	936	924	900	906
Log L	-556	-1550	-870	-886	-798	-845
AIC	2.17	2.07	1.88	1.94	1.80	1.89
McFadden R-sqrd	0.23	0.26	0.33	0.31	0.36	0.33
Chi Sqrd	335	1076	855	790	302	823

*** significant at 1%; ** significant at 5%; * significant at 10%

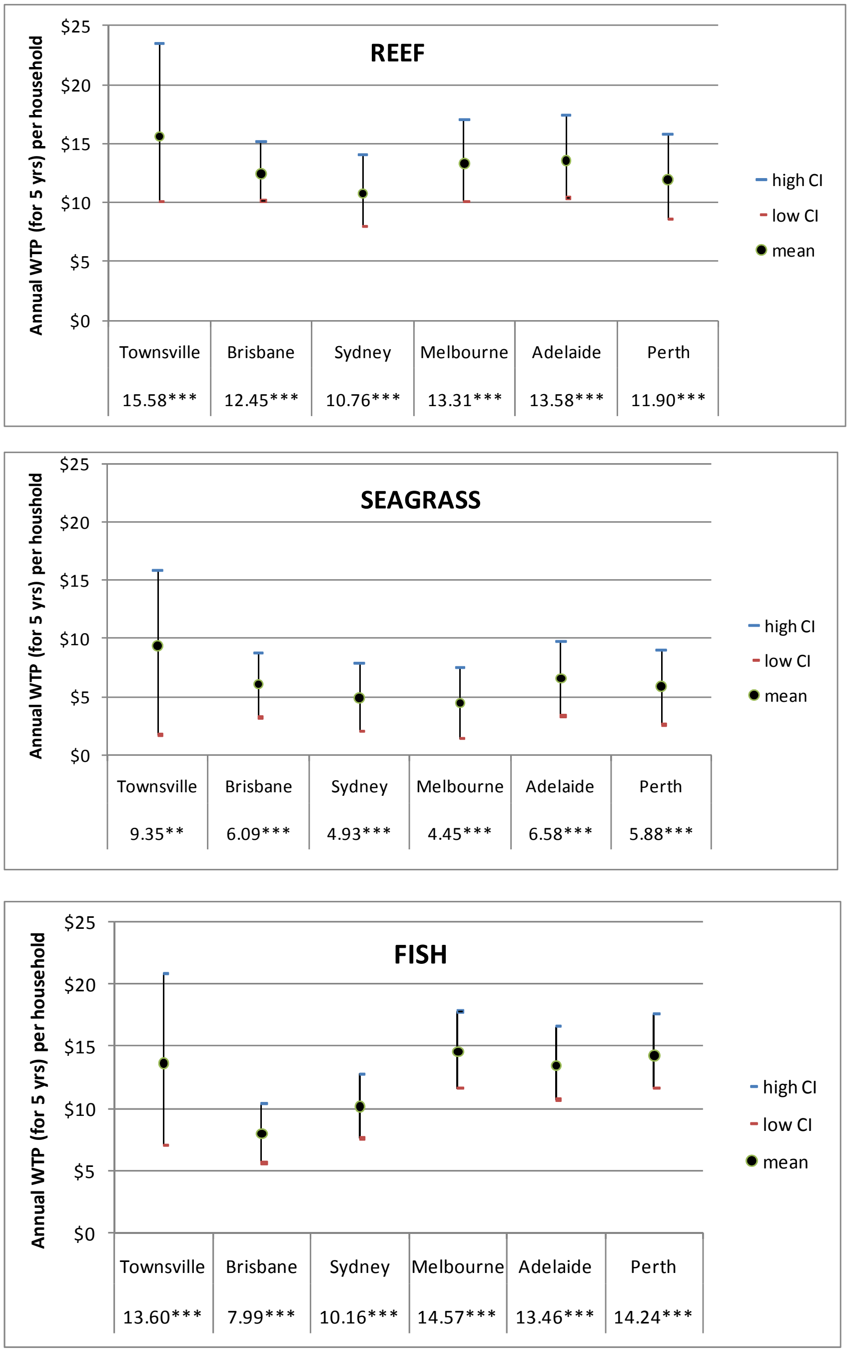
There are fewer differences between the models compared with the single attribute survey. First, the ASC is only significant in the Townsville model with very high negative values indicating there are unobserved reasons why respondents did not select the status quo option. Second, there is less influence associated with the socio-demographic variables compared to the single attribute survey, and therefore fewer differences across models. In particular, EDUCATION is only significant in the Adelaide model and then only at the 10% level. The INCOME variable is not significant in the Townville (as in the single attribute survey) and Adelaide samples (where it had been significant in the single attribute survey).

There is no difference in the proportion of potential protest votes across population samples with 16% and 15% of respondents always selecting the status quo option in the Townsville and Brisbane samples respectively. In the other capital cities, 18%, 14%, 23% and 18% of respondents always selected the status quo option in Sydney, Melbourne, Adelaide and Perth respectively.

Log likelihood ratio tests indicate that there is no significant difference between the two Queensland models, Townsville and Brisbane, but there is between Townsville and all the other out of state sample models. There is no difference between the Brisbane model and all other out of state models, and the only other difference amongst the more distant population samples is between Adelaide and Perth.

In contrast to the results from the single attribute survey, the WTP estimates from the multiple attribute survey do not show a consistent decline with distance, nor does Adelaide stand out as an anomaly (Figure 7). In terms of improvements in coral reef health, as well as in seagrass health, a Poe et al. (2005) procedure indicates there is no significant difference (at the 5% level) between WTP estimates across all samples and therefore no notable effects of distance decay.

Figure 7. WTP estimates for a 1% improvement in reef, fish and seagrass health



*** significant at 1%; ** significant at 5%;

In contrast, a number of differences appear in WTP estimates for improvement in the health of fish species. The most obvious is that estimates in the most distant populations are higher than those on the east coast (Figure 7). Poe et al. (2005) tests reveal that at the 5% level of significance, there is no difference between Townsville estimates or those from any of the other population samples. Estimates for Brisbane are particularly low and are significantly different to those from Melbourne, Adelaide and Perth, but not Sydney. Sydney estimates are significantly different from Melbourne, Adelaide and Perth, but there is no difference between estimates for Melbourne, Adelaide and Perth.

A comparison of the WTP estimates from the single attribute and multiple attributes (aggregated) experimental formats is provided in Table 6. There is no difference in values for Townsville and Brisbane across formats, but values for all other population samples are higher in the multiple attribute format, particularly in the non-east coast samples.

Table 6. A comparison of WTP values for a 1% improvement across survey formats

	Single attribute format	Aggregated multiple attribute format
Townsville	$37.93	$38.54
Brisbane	$26.00	$26.53
Sydney	$20.19	$25.85
Melbourne	$18.59	$32.32
Adelaide	$24.27	$33.62
Perth	$18.10	$32.01

4.3 Assessing the influence of use and non-use values

Two different approaches were applied to examine the relative influence of use and non use values. The first approach focused on including additional variables in the main modes and determining the influence each had on choice selection. The second approach separated respondents into two groups, users and non users, and then developed new main models with each group of respondents.

In the first approach, ten new variables were included based on responses to questions at the start of the survey. Three questions related to past recreational fishing use, past other recreational use and future recreational use of the GBR. An addition seven questions were included to gauge the relative importance of the different components of total economic value (comprising use and non-use values). Respondents were asked to rate a series of reasons for supporting increased protection of the GBR. The results from these questions have been discussed in the first part of this section and full details are presented in Appendix 1: Table 2a and Table 3a. The ten questions were included as an additional block of variables in the main multiple attribute models presented above.

The results indicated that these factors had very little influence on choice selection. Past use was not a significant influence at any of the locations. Future use was significant for Melbourne and Perth (10% significance level) and Adelaide (5% significance level). The more people intended to use the GBR in the future, the more likely they were to select an improvement option. These variables were only significant when the original categorical coding was applied. They were not significant when an effects code was applied. The only attitudinal question that was a significant influence on choice was the importance of our obligation to the international community to protect the GBR (Table 3a: question g). This was significant in Townsville and Brisbane (at the 5% and 10% level of significance respectively).

The second approach involved the development of new models for different user groups. Three separate user groups were defined; current users, future users and non-users, and separate models were developed for each location. A separation between current and future users was made because while the former may have practical experience of the GBR to guide their choices, the choice experiments were framed in terms of improvements in GBR condition in the future, which was of direct relevance to respondents who intended to use the GBR in the future. The third group of respondents who had never visited the GBR and never intended to in the future were identified as having mainly non-use values for the GBR. Comparing the WTP estimates of the different groups allowed some assessment of the relative importance of use and non-use values and how these may vary across locations. The results for the single attribute survey are presented in Table 7.

Table 7. Single attribute WTP estimates for user and non-users groups across locations

	Townsville	Brisbane	Sydney	Melbourne	Adelaide	Perth
All respondents						
No of observations	522	1500	954	924	888	906
WTP_ GBR CONDION	$37.93***	$26.00***	$20.19***	$18.59***	$24.27***	$18.10***
Current users						
No of observations	378	534	102	90	66	84
WTP_ GBR CONDION	$32.09***	$18.29***	ns	Ns	$17.26*	ns
Future users						
No of observations	396	1182	738	684	564	528
WTP_ GBR CONDION	$35.18***	$24.87***	$20.46***	$15.95***	$27.25***	$19.31***
Non users						
No of observations	54	120	126	180	240	288
WTP_ GBR CONDION	ns	$46.49**	$16.04***	$21.29***	$16.14***	$12.14***
Proportion: current/all WTP	0.85	0.70	-	-	0.71	-
Proportion: future/all WTP	0.93	0.96	1.01	0.86	1.12	1.07
Proportion: non user/all WTP	-	1.79	0.79	1.15	0.67	0.67

*** significant at 1%; ** significant at 5%; * significant at 10%; ns =not significant

In all locations, apart from Townsville, the highest proportion of total responses comprised those defined as future users, and these values had the biggest influence on total mean values. In the two Queensland samples, as well as in Adelaide, the WTP estimates are higher for future users than for current users. The WTP estimates are not significant for current users in the other three locations. Non-user values were calculated for all locations apart from Townsville. However, these values are not consistently higher or lower than total mean values. There is evidence that the non-use values were higher in Brisbane (within state) with a clear decline in out of state locations, but not across out of state locations.

Separate models were also developed for the same three user groups in the multiple attribute survey, with results presented in Table 8.

Table 8. Multiple attribute WTP values for user and non-users groups across locations

	Townsville	Brisbane	Sydney	Melbourne	Adelaide	Perth
No of observations						
All respondents	522	1506	936	924	900	906
Current users	360	546	156	84	44	102
Future users	414	1188	702	714	498	558
Non users	24	114	144	156	270	252
REEF						
All respondents WTP	$15.58***	$12.45***	$10.76***	$13.31***	$13.58***	$11.90***
Current users WTP	$15.55***	$13.45***	$15.94***	$46.17***	no model	ns
Future users WTP	$17.23***	$12.49***	$11.23***	$14.19***	$11.64***	$12.53***
Non users WTP	no model	ns	$7.99***	$12.67***	$19.93***	$13.59***
Proportion: current/all	1.00	1.08	1.48	3.47	-	-
Proportion: future/all	1.11	1.00	1.04	1.07	0.86	1.05
Proportion: non user/all	-	-	0.74	0.95	1.47	1.14
FISH						
All respondents WTP	$13.60***	$7.99***	$10.16***	$14.57***	$13.46***	$14.24***
Current users WTP	$9.33***	$9.16***	$17.73***	$47.11***	no model	ns
Future users WTP	$16.37***	$8.20***	$11.49***	$14.15***	$10.16***	$14.47
Non users WTP	no model	ns	$4.88*	$13.97***	$22.85***	$15.16
Proportion: current/all	0.69	1.15	1.74	3.23	-	-
Proportion: future/all	1.20	1.03	1.13	0.97	0.75	1.02
Proportion: non user/all	-	-	0.48	0.96	1.70	1.06
SEAGRASS						
All respondents WTP	$9.35***	$6.09***	$4.93***	$4.45***	$6.58***	$5.88***
Current users WTP	$8.98**	$9.95***	ns	ns	no model	$10.82*
Future users WTP	$9.65*	$5.28***	$5.02	$5.82***	$4.91**	$6.15***
Non users WTP	no model	ns	ns	ns	$12.27***	$8.14***
Proportion: current/all	0.96	1.63	-	3.02	-	1.84
Proportion: future/all	1.03	0.87	1.02	1.31	0.75	1.05
Proportion: non user/all	-	-	-	-	1.86	1.39

*** significant at 1%; ** significant at 5%; * significant at 10%; ns =not significant

In the two Queensland samples, there is little different in values between current and future users (apart from seagrass in Brisbane) and values for non users in Brisbane were not significant. There were too few non users in Townsville to run a model. In the other locations, where sufficient information was available, the results indicate that values are higher for current users compared with future users.

4.4 Extrapolating the results

Community values to improve the health of the GBR were collected within the GBR coastal population, and from five capital cities of the nations' seven states and territories. This accounted for 63% of the country's population. One of the main decisions that needs to be made to extrapolate the results to the whole country, is to decide what proportion of the population holds the same values as the sample. In paper-based surveys, the response rate is generally applied with some additional assumptions made about the remaining population that did not respond to the survey. In this study, the paper-based surveys yielded a high response rate of over 85% in both Townsville and Brisbane. It is not realistic to estimate accurate response rates for the online surveys because emails were sent to a large number of panellists and there is no way of knowing what proportion of panellists responded before the target sample size was attained and the survey closed. The use of age and gender quotas further confounded the issue. In the extrapolation results presented in Table 9, two separate assumptions were applied. The first, that 70% of the population had the same values as the sample, and the second that 90% of the population had the same values as the sample. In each extrapolation exercise it was also assumed that 70% of people in the rest of the state held the same values as those in the capital city. The values for Perth were used to represent the rest of the Australian population, and it was also assumed that 70% of people in the rest of the country held the same values as those in Perth.

The results from the two survey formats elicited household values for a 1% improvement in the health of the GBR over a five year period. Two separate discount rates; 5% and 10% were used to calculate the present values.

Values generated from the single attribute survey were generally lower than those from the multiple attribute survey. Overall, the total national present value ranged a low of approximately $449 million to a high of $815.5 million depending on the underlying assumptions made (Table 9).

Table 9. National values for a 1% improvement in the condition of the GBR

Total no of households **7,656,648**	**Total value over 5 years @ 5% discount**	**Total value over 5 years @ 10% discount**
Single attribute format: WTP values from Table 6		
Population extrapolation:		
70% of GBR communities 70% of capital cities (sampled) 70% rest of state 70% rest of Australian population	$495.2m	$433.6m
Population extrapolation:		
90% of GBR communities 90% of capital cities (sampled) 70% rest of state 70% rest of Australian population	$585.6m	$512.7m
Multiple attribute format: WTP values from Table 6		
Population extrapolation:		
70% of GBR communities 70% of capital cities (sampled) 70% rest of state 70% rest of Australian population	$685.9m	$600.6m
Population extrapolation:		
90% of GBR communities 90% of capital cities (sampled) 70% rest of state 70% rest of Australian population	$811.3m	$710.4m

5. Discussion and conclusions

Populations were sampled across the country, not only to more accurately determine a national value to protect the health of the GBR, but also to examine the effects of distance decay for this iconic natural asset. The results indicate that the present value of Australian households' value for a 1% improvement in the health ranges from a low of approximately $433.6 million to a high of $811.3 million depending on the underlying assumptions made. There are two main groups of results that provide insights into the influence of distance decay on protection values for the GBR. The first is the main models and the WTP estimates from the two model formats while the second is the influence of the three different user groups: current users, futures users and non-users.

In the single attribute survey, there was a large range and high average WTP estimate for the local Townville population. These values reflected the importance of direct access, and are not suitable for benefit transfer to populations outside of the GBR area. The average WTP values for Brisbane were approximately 30% lower, but still higher than the other out-of-state populations, reflecting the strong influence of accessibility and possibly also feelings of responsibility. Values in Sydney were approximately 20% lower than Brisbane, and in terms of direct accessibility as well as knowledge and awareness, WTP estimates in Brisbane may be more comparable with Sydney than with other remote regional populations within Queensland. Values in the other capital cities were very similar and approximately 30% lower than Brisbane. The lower range in WTP values for all but the local town, make the average values more robust and potentially more transferable to other locations.

Information from the separate user groups, in the single attribute models, indicates that WTP estimates were generally higher in the future user group than those in the current user group, suggesting option values are an important component of total economic value. There was no clear indication of differential influences across locations. There was some evidence that the non-user values did decline with distance.

The results from the multiple attribute survey indicate some distance related differences in the way respondents related to the two survey formats. The WTP estimates for Townsville and Brisbane were virtually the same across formats, but in the other four capitals values were much higher (to a lesser extent in Sydney) compared with the single attribute format. This would suggest that disaggregating the GBR into separate attributes makes each attribute more specific and realistic, which elevates its relative importance and value compared with the very general single GBR attribute. This did not occur in the Queensland populations and to a lesser extent in Sydney because these respondents had a better understanding and awareness of the GBR as a whole ecosystem.

Overall, the results indicate some decline in values with most decline occurring once outside the state, and little further decline occurring once away from the east coast. There was no evidence to suggest any difference in patterns of use and non use values. In all locations, it was the values of the potential future users that were most influential in determining WTP estimates. This meant that even in the more distant populations, WTP values to protect the health of the GBR there were still high because there was a relatively high proportion of potential future users. Finally, the higher WTP values for the disaggregated GBR survey format in the more distant populations, means an analyst needs to be cognisant of this when designing a valuation survey.

References

Bateman, I. and Langford, I. 1997 Non-users' willingness to pay for a national park: an application and critique of the contingent valuation method. *Regional Studies,* 31(6): 571-582.

Bateman, I.J., Cooper, P., Georgiou, S., Navrud, S., Poe, G.L., Ready, R.C., Reira, P., Ryan, M. and Vossler, C.A. 2005 Economic valuation of policies for managing acidity in remote mountain lakes: examining validity through scope sensitivity testing. *Aquatic Sciences,* 67 (3): 274–291.

Bateman, I., Day, B., Georgiou, S. and Lake, I. 2006 The aggregation of environmental benefit values: Welfare measures, distance decay and total WTP. *Ecological Economics*, 60: 450-460.

Concu, G. 2007 Investigating distance effects on environmental values: a choice modelling approach. *Australian Journal of Agricultural and Resource Economics*, 51: 175-194.

Garnaut, R. 2008 *The Garnaut Climate Change Review*, Cambridge University Press, Melbourne.

Great Barrier Reef Marine Park Authority (GBRMPA) 2009 *Great Barrier Reef Outlook Report 2009*, Great Barrier Reef Marine Park Authority, Townsville.

Hanley, N., Schlapfer, F. and Spurgeon, J. 2003 Aggregating the benefits of environmental improvements: distance decay functions for use and non-use values. *Journal of Environmental Management*, 68: 297-304.

Johnston, R. and Duke, J. 2009 Willingness to pay for land preservation across States and jurisdictional scale: Implications for benefit transfer. *Land Economics,* 85: 217-237.

Loomis, J. 1996 How large is the extent of the market for public goods: evidence from a nationwide contingent valuation survey. *Applied Economics,* 28(7): 779-782.

Lough, J. 2007 Climate and climate change on the Great Barrier Reef, in J. Johnson and P. Marshall (eds), *Climate Change and the Great Barrier Reef: A vulnerability assessment*, Great Barrier Reef Marine Park Authority and Australian Greenhouse Office.

Morrison, M. and Bennett, J. 2004 Valuing New South Wales rivers for use in benefit transfer, *Australian Journal of Agricultural and Resource Economics*, 48: 591-611.

Olsen, S.B. (2009). Choosing between internet and mail survey modes for choice experiments surveys considering non-market goods. *Environmental and Resource Economics,* 44(4): 591-610.

Pate, J. and Loomis, J. 1997 The effect of distance on willingness to pay values: a case study of wetlands and salmon in California. *Ecological Economics,* 20: 199 -207.

Poe, G.L., Giraud, K.L. and Loomis, J.B. 2005 Computational methods for measuring the differences of empirical distributions. *American Journal of Agricultural Economics,* 87(2):353-365.

Rolfe, J.C. and Bennett, J.W. 2002 Assessing rainforest conservation demands, *Economic Analysis and Policy*. 32(2): 51-67.

Rolfe, J.C., Bennett, J.W. and Louviere, J.J. 2002 Stated values and reminders of substitute goods: Testing for framing effects with choice modelling. *Australian Journal of Agricultural and Resource Economics*, 46: 1-20.

Rolfe, J. and Windle, J. 2010. Do values for protecting iconic assets vary across populations? A Great Barrier Reef case study. ERH Research Report No. 65. http://www.crawford.anu.edu.au/research_units/eerh/publications.php.

Salazar, S. and Menedez, L. 2007 Estimating the benefits of an urban park: Does proximity matter? *Land Use Policy*, 24: 296-305.

Sutherland, R.J. and Walsh, R., 1985. Effect of distance on the preservation value of water quality. Land Economics., 61: 281-291.

van Bueren, M. and Bennett J. 2004 Towards the development of a transferable set of value estimates for environmental attributes. *Australian Journal of Agricultural and Resource Economics*, 48:1-32.

Wolanski, E. and De'ath, G. 200. Predicting the impacts of present and future human land-use on the Great Barrier Reef. *Estuaries, Coastal and Shelf Science*, 64: 504-508.

Appendix 1

Table 1a. Sample and population[1] characteristics

		Townsville		Brisbane		Sydney		Melbourne		Adelaide		Perth	
		Smpl	*Popln*	*Smpl*	*Popln*	*Smpl*	*Popln*	*Smpl*	*Popln*	*Smpl*	*Popln*	*Smpl*	*Popln*
Gender	Female	52%	50%	50%	50%	51%	51%	48%	51%	50%	51%	48%	51%
Children	Have children	71%	na	67%	na	62%	na	53%	na	62%	na	59%	na
Average age	Online respondents			43 yrs	43 yrs	43 yrs	46 yrs	42 yrs	43 yrs	45 yrs	45 yrs	44 yrs	44 yrs
Education	Post school qualification	54%	45%	63%	56%	77%	61%	73%	60%	59%	55%	70%	60%
	Tertiary degree	35%	15%	37%	24%	51%	28%	53%	30%	36%	24%	42%	27%
Income	less than $499 per week	21%	17%	16%	17%	13%	19%	18%	20%	18%	24%	17%	19v
	$500 – $799 per week	16%	18%	21%	18%	14%	16%	16%	17%	22%	20%	19%	18%
	$800 – $1199 per week	20%	22%	22%	21%	22%	18%	19%	20%	22%	20%	24%	20%
	$1200 – $1999 per week	29%	25%	27%	24%	29%	22%	28%	22%	25%	21%	26%	23%
	$2000 or more per week	14%	18%	14%	21%	23%	26%	19%	21%	13%	14%	14%	21%

[1] Australian Bureau of Statistics 2006 Census data

Table 2a. Respondents' past and future use of the Great Barrier Reef

	Townsville (n=174)	Brisbane (n=503)	Sydney (n=315)	Melbourne (n=308)	Adelaide (n=298)	Perth (n=302)
Recreational fishing use						
Never	37%	78%	86%	90%	92%	90%
Once	15%	8%	4%	2%	6%	5%
More than once	48%	14%	10%	8%	2%	5%
Other recreational use						
Never	25%	34%	44%	51%	69%	67%
Once	16%	26%	27%	20%	18%	21%
More than once	59%	40%	29%	29%	13%	13%
Future recreational use						
Never	23%	21%	24%	24%	41%	40%
At least once in next 5 yrs	36%	55%	52%	50%	47%	49%
At least once next year	41%	24%	24%	26%	12%	10%

Table 3a. Mean importance scores for supporting the protection of the GBR

Scores ranged from 1= not important to 5= very important	Townsville (n=177)	Brisbane (n=506)	Sydney (n=315)	Melbourne (n=308)	Adelaide (n=298)	Perth (n=302)
a) I/my family use it for recreation	3.14	3.08	3.04	2.93	2.51	2.62
b) I/my family may want to use it for recreation in the future	3.62	3.67	3.53	3.56	3.09	3.26
c) For other people to enjoy and use	4.09	4.03	3.87	3.95	3.75	3.79
d) To preserve it for future generations	4.56	4.59	4.38	4.48	4.40	4.30
e) To keep the plants, birds and marine life in a healthy condition	4.66	4.69	4.51	4.51	4.59	4.49
f) We need to look after it now because we don't know what will happen in the future	4.49	4.52	4.27	4.37	4.43	4.32
g) We have an obligation to the international community to protect it	4.05	4.15	3.92	4.04	4.09	3.89

Table 4a. Influence of education levels on WTP for an improvement in GBR condition

	Townsville	Brisbane	Sydney	Melbourne	Adelaide	Perth
All respondents	$37.93***	$26.00***	$20.19***	$18.59***	$24.27***	$18.10***
No post school education	$59.28***	$32.05***	$6.32 ns	$20.43***	$17.77***	$9.82***
Post school education	$23.20***	$24.12***	$22.09***	$18.19***	$28.65***	$20.67***
No tertiary education	$38.76***	$28.61***	$14.27***	$26.03***	$22.18***	$15.78***
Tertiary education	$28.98**	$23.81***	$24.46***	$13.30***	$27.82***	$20.36***