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**The Application of Choice Modelling to Determine the  
Economic Values of Non-market Goods and Services:  
A National Park Case Study**

A thesis presented in partial fulfilment of the requirements for the degree of  
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## ABSTRACT

National parks and protected areas form the basis of global conservation initiatives and provide a raft of benefits in the form of various consumptive and non-consumptive uses. However, it is extremely difficult to express these economic benefits in monetary terms. The lack of economic values for these areas often results in sub-optimal conservation outcomes. Non-market valuation techniques can be used to estimate monetary values for these key environmental assets. These values are able to provide critical information which can be used to inform management decisions and ensure the implementation of effective conservation policy.

This research applied the choice modelling stated preference technique to estimate the value of non-market goods and services associated with national parks. The study focuses on the ecological and recreational attributes of Abel Tasman National Park, New Zealand. The park receives high levels of visitor usage and is well regarded for its unique intrinsic values.

A standard multinomial logit model was used to estimate the non-market values. The results indicate park users were willing to pay an actual cash value for the protection of native bird species, better onsite educational material and less congestion. Respondents also revealed a cash value associated with their preference for retaining the existing accommodation facilities which they felt suited their wilderness experience.

The monetary values revealed in this study can be used to guide future park development, inform resource allocation decisions and ensure adequate conservation financing. Accordingly, it is recommended choice experiments be adopted as standard management practice.

Keywords: choice modelling, choice experiments, non-market valuation, national park, Abel Tasman National Park.



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## LIST OF ABBREVIATIONS

ABMs	Attribute-Based Methods
ATNP	Abel Tasman National Park
CBA	Cost-Benefit Analysis
CIs	Confidence Intervals
CM	Choice Modelling
CT	Cheap Talk (script)
CVM	Contingent Valuation Method
DOC	Department of Conservation (New Zealand)
HPM	Hedonic Price Method
IIA	Independence of Irrelevant Alternatives
IID	Independently and Identically Distributed
IUCN	International Union for Conservation of Nature
IUFs	Indirect Utility Functions
MDGs	Millennium Development Goals
MLE	Maximum Likelihood Estimation
MNL	Multinomial Logit
ODA	Official Development Assistance
OMEPE	Orthogonal Main Effects Plan
RUSC	Random Utility Site Choice (model)
RUT	Random Utility Theory
TCM	Travel Cost Method
TEV	Total Economic Value
WTA	Willing to Accept
WTP	Willing to Pay





## **CHAPTER 1: INTRODUCTION**

National parks and protected area networks play an integral role in the conservation of biodiversity and the provision of other benefits associated with the maintenance of ecological integrity (Chape et al., 2008; Stolton & Dudley, 2010). However, the economic benefits associated with national parks and protected areas have always been difficult to quantify in monetary terms. As an economic good, the provision of protected areas by the private market is often subject to a number of market failures (Dixon & Sherman, 1990). These failures primarily stem from the fact that protected areas exhibit varying degrees of non-rivalry and non-excludability and generate positive consumption externalities in the form of ecosystem services.

One of the most pervasive market failures afflicting protected areas is their public good characteristics including non-rivalry and non-excludability. Non-rivalry ensures that consumption of a good by one individual does not detract from the ability of others to consume the same good. Non-excludability implies that it is not possible to exclude individuals from engaging in consumption via the price mechanism. While national parks are unlikely to be pure public goods, they are likely to satisfy this criteria to a certain degree. With regard to the presence of externalities, while some protected areas may yield private benefits, more often it is the case that the benefits are social in nature and are unable to be appropriated by private individuals. This results in a lack of private incentive to engage in the provision of protected areas (Balmford et al., 2002; Dixon & Sherman, 1990; Turner, 2002).

As a consequence of these market failures, the benefits associated with protected areas are typically not subject to economic valuation by the price mechanism often resulting in an implicit zero value. This leads to protected areas being undervalued and underfunded relative to other government fiscal and budgetary considerations (Dixon & Sherman, 1991). However, national parks and protected areas provide a range of benefits including education, recreation and tourism, ecosystem services and other consumptive and non-consumptive uses (Harmon & Putney, 2003; Stolton & Dudley, 2010). An expression of this value in dollar terms would help to ensure the efficient allocation of conservation resources. Specifically, monetisation of these benefits can be used to justify continued public investment in protected areas and provide an impetus for the continuation of conservation activities in the face of competing development interests (Dixon & Sherman, 1990).



The increasing importance of non-market valuation for protected areas must also be seen in the global context of a declining funding base for conservation and increasing calls for the adoption of a consumer-oriented approach to protected area management. Within this context, non-market valuation can play an increasingly important role by providing protected area managers with information regarding visitor preferences, the goods and services provided by these areas and how these benefits are able to be captured (WCPA-IUCN, 1998, 2000).

Currently, New Zealand's conservation estate faces a number of challenges in terms of declining budgetary allocations, calls for increasing commercialisation and renewed pressure from development interests (Haque, 2006; Office of the Parliamentary Commissioner for the Environment, 2010). Consequently, the application of non-market valuation techniques to protected areas in New Zealand is of particular relevance given the urgent need to ensure the efficient allocation of resources to enhance protected area management and conservation outcomes.

### **1.1 Problem Statement**

The understanding of the economics of national parks and protected areas has always been hindered by a lack of tangible economic values for these environmental assets. Many protected areas exhibit public good characteristics and generate significant externalities. The resulting market failure ensures the benefits associated with protected areas are not subject to formal market exchange mechanisms making them extremely hard to value (Dixon & Sherman, 1990, 1991; Turner, 2002).

Despite this, national parks and protected areas provide a range of economic benefits in terms of ecosystem services and various other use and non-use values (WCPA-IUCN, 1998). The quantification of these values in monetary terms is necessary to ensure that policy and management decisions maximise societal welfare through allocative efficiency. This has traditionally been achieved through the use of non-market valuation techniques such as the contingent and travel cost valuation methods. However, the relatively recent development and application of choice experiments to non-market environmental valuation studies shows considerable promise.

Recently New Zealand's national park and protected area network has come under increasing pressure from both development interests and fiscal sustainability issues. Consequently the non-market valuation of these natural assets is becoming increasingly important to ensure the implementation of effective conservation policy.

However, little research has been reported regarding the non-market valuation of national parks and protected areas in New Zealand.

## **1.2 Aim of Research**

The aim of this research is to use the choice modelling approach to determine the economic value of non-market goods and services associated with national parks.

## **1.3 Objectives**

1. To identify a suitable environmental good or service in which to undertake the non-market valuation assessment.
2. To design a choice experiment to value the non-market goods and services associated with national parks.
3. To apply the valuation model to the selected case study in order to estimate the non-market economic value.

## **1.4 Limitations of the Study**

The sampling strategy employed in the non-market valuation study imposes a number of limitations on the research. As a result of resource constraints, the stated preference survey was administered over the course of several weeks. Accordingly, the results presented in this research may be biased if there are significant differences between park visitors' preferences and demographics at differing times of the year. In terms of geographical coverage, several of the smaller entrances to the national park case study were not covered by a survey point. These factors may introduce a degree of coverage bias. This issue is further compounded by the lack of reference data which can be used to assess whether the sample of park visitors is representative of the wider target population.

A further limitation is that imposed by the model used. The standard multinomial logit (MNL) model is only able to account for respondent heterogeneity in a very simplistic fashion. Sources of observed heterogeneity (i.e. socioeconomic, attitudinal and demographic variables) will be incorporated into the MNL model through interactions with the constant terms or key design attributes.

Finally, in terms of policy application, while welfare estimates can be used to inform the allocation of conservation resources they should not be regarded as a panacea by park managers. Economic efficiency is only one criterion which can be used to assess policy and management decisions. Park managers and policy-makers will also need to base their decisions on a range of criteria including equity/fairness, social justice, various scientific criteria (biological and ecological), political acceptability, procedural justice and managerial considerations.

### **1.5 Contribution to Knowledge**

The primary contribution to knowledge stemming from this research is the expression of the economic benefits associated with national parks in monetary terms. These environmental assets are typically not subject to valuation by market mechanisms often resulting in the economic value of these areas being overlooked. Choice modelling is an emerging stated preference technique which holds considerable promise with regard to the estimation of environmental values. These monetary values can be used to justify additional conservation funding and guide the allocation of scarce conservation resources. In this manner, non-market environment valuation can provide important information which can be used to enhance conservation and management outcomes.

### **1.6 Thesis Outline**

Chapter 1: This chapter provides an introduction to the research accompanied by a problem statement, research aim and related objectives.

Chapter 2: This chapter provides an overview of the background to the research. The concept of a protected area is defined and their role and importance in the conservation of biodiversity is explored. This chapter also includes a review of applicable economic theory and current practice regarding the application of non-market valuation studies to national parks and protected areas.

Chapter 3: This chapter provides a comprehensive description of the selected national park case study.

Chapter 4: The research methods used in the study are presented. This includes a description of the research methodology, experimental design process, construction of the survey instrument and sampling procedures.

Chapter 5: The results of the non-market valuation study are presented.

Chapter 6: The results are discussed in relation to the background review and the wider implications will be inferred from these findings.

Chapter 7: This chapter reports the conclusions of the study.



## **CHAPTER 2: BACKGROUND TO THE RESEARCH**

The purpose of this chapter is to establish the wider conceptual and theoretical framework in which the current research is embedded. The first section will define the notion of a protected area and provide a brief historical overview of this continually evolving concept. The contemporary role and relevance of protected areas will also be explored. The second section focuses on the economics of protected areas and includes a discussion of why these environmental assets are not subject to valuation by market forces. The economic benefits and costs associated with protected areas will also be described and the concept of total economic value will be introduced. The third section will present a summary of the current state of conservation financing and how protected areas have adapted to fulfil their objectives in an environment of limited funding. The fourth section will provide a critical overview of existing non-market valuation techniques. This will be accompanied by a brief literature review detailing previous applications of these techniques to national parks and protected areas.

### **2.1 Protected Areas**

Currently, national parks and protected areas are at the forefront of global conservation efforts. A generally accepted definition of a protected area as developed by the International Union for Conservation of Nature (IUCN) is, “an area of land/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means” (Chape et al., 2008, p. 7).

Protected areas aim to ensure the continuation of ecological integrity by placing constraints on the degree of human interaction and exploitation. These areas fulfil a range of roles and functions including preserving areas of outstanding natural beauty and cultural heritage, maintaining genetic diversity and ecological processes, contributing towards sustainable livelihood strategies and allowing for recreational, educational and scientific opportunities (McNeely, 1994; Stolton & Dudley, 2010).

The concept of designating a specific land area to be set aside for conservation purposes is not a recent development. Initially, protected areas were established by royalty and wealthy landowners for hunting and recreational purposes. However, throughout the nineteenth and early twentieth century the primary impetus for the creation of protected areas was to preserve wilderness and restrict natural resource exploitation (Wright & Mattson, 1996). This occurred during a period of continued

expansionism and unrestrained exploitation, or what has been referred to as cowboy or frontier economics (Boulding, 1966; Wright & Mattson, 1996). Subsequent concern regarding the loss of wilderness and heritage values culminated in the founding of the first National Park at Yellowstone in the United States. Established in 1872, the park aimed to preserve in perpetuity its unique landscape and intrinsic beauty for the general public and prohibited any commercial development. The establishment of a number of other national parks followed including the Royal National Park in Australia (1879), Tongariro National Park in New Zealand (1894) and Banff National Park in Canada (1898) (Chape et al., 2008).

These early national parks were managed according to an exclusionary model which was based on the belief that conservation objectives could only be achieved in the absence of humans. Accordingly, activities such as forestry, mining and agriculture were excluded along with local communities and indigenous peoples. The only human activity which was actively encouraged was tourism which was often espoused as being the primary economic benefit associated with national parks. Protected area management agencies were generally public sector entities funded exclusively from government budgetary allocations. These entities operated a top-down highly centralised decision-making process with policy actions dictated by scientific and ecological criteria. National parks were also developed in isolation as there was usually no over-arching national conservation strategy (Chape et al., 2008; Lockwood & Kothari, 2006; Martin, 2003).

However, since their initial inception the role and functions of protected areas have undergone significant transformation. As contextual factors including societal expectations change, the conservation objectives and values these areas protect must also adapt. International agreements such as the World Conservation Strategy (1980) and the United Nations Conference on Environment and Development (1992) have had a profound impact on the way environmental issues are being framed. Increasingly, environmental and natural resource issues are now being perceived within a framework which encompasses sustainable development and biodiversity. Consequently, the primary goal of modern protected area networks is to ensure the conservation of a representative sample of the world's biodiversity (Chape et al., 2008).

In order to achieve this goal, the number of protected areas in existence has increased dramatically (Naughton-Treves, Holland, & Brandon, 2005). In 2005, there were 114,000 protected areas in existence covering 19 million km<sup>2</sup> or approximately 13% of the world's terrestrial surface (Chape et al., 2008). This has largely been in response to

the continued appropriation of the natural biosphere by the human economy. For example, in over half of the world's major terrestrial biomes, between 20-50% of the land area has already been converted to human use (Millennium Ecosystem Assessment, 2005). The expansion of the economic subsystem has been accompanied by a corresponding decrease in the biosphere's natural carrying capacity (Czech, 2000). This displacement has resulted in a human induced rate of extinction which is estimated to be 1,000 times greater than natural background levels. In addition, increasing pressure on environmental source and sink functions has the ability to compromise ecological integrity and adversely affect biological diversity (Naughton-Treves et al., 2005).

In an attempt to reconcile conservation objectives with human and economic realities, the traditional conceptualisation of a protected area has been replaced by a new paradigm. Protected areas are now tasked with fulfilling a range of economic, social, cultural and scientific objectives. In addition, the narrow focus on protection has been supplemented with an emphasis on the restoration and rehabilitation of previously degraded ecosystems. The exclusionary model has also been abandoned in favour of a more inclusive participatory approach. Local communities and indigenous peoples are now actively encouraged to participate in decision-making and manage certain aspects of protected areas. Visitor interaction and engagement is encouraged with the goal of promoting an ethic of stewardship, environmental responsibility and appreciation. This inclusionary model also extends to governance with the adoption of a highly decentralised decision-making structure involving public sector entities, non-governmental organisations and the private sector. In addition, funding sources have also been diversified with a multitude of stakeholders providing financial resources for protected area management. With regard to conservation planning, protected areas are now established and managed as part of a network guided by a national conservation strategy (Chape et al., 2008; Lockwood & Kothari, 2006).

In order to accurately reflect this new emerging paradigm, the IUCN has developed a number of protected area categories (see Table 2.1) (IUCN-WCMC, 1994). These categories provide a standardised framework which can be used to inform management objectives and determine which activities are compatible with overarching conservation values (Lockwood, 2006). For example, Category I protected areas are strictly managed for the preservation of biodiversity, ecological processes and scientific research purposes. Category VI protected areas allow for a range of human activities including tourism and recreation, sustainable exploitation and the preservation of cultural values. It is important to recognise that this hierarchy system utilised by the



IUCN does not imply that one protected area category is superior to another. Rather each category must be seen in the context of human-environment interactions which is one of the core notions of sustainable development (IUCN-WCMC, 1994).

Table 2.1 IUCN Protected Area Management Objectives

Protected Area Category	Management Objective (1=primary objective, 2=secondary objective, 3=potentially applicable objective)								
	<i>Scientific research</i>	<i>Wilderness protection</i>	<i>Biodiversity conservation</i>	<i>Maintenance of ecosystem services</i>	<i>Protection of natural/cultural features</i>	<i>Tourism/recreation</i>	<i>Education</i>	<i>Sustainable resource use</i>	<i>Maintaining cultural/traditional attributes</i>
<b>Ia</b> Strict nature reserve (science)	1	2	1	2	-	-	-	-	-
<b>Ib</b> Strict nature reserve (wilderness)	3	1	2	1	-	2	-	3	-
<b>II</b> National park	2	2	1	1	2	1	2	3	-
<b>III</b> National monument	2	3	1	-	1	1	2	-	-
<b>IV</b> Habitat/species management area	2	3	1	1	3	3	2	2	-
<b>V</b> Protected landscape/seascape	2	-	2	2	1	1	2	2	1
<b>VI</b> Managed resource protected area	3	2	1	1	3	3	3	1	2

Source: Adapted from IUCN-WCMC (1994, p. 8)

With regard to Category II protected areas, the primary management objectives for national parks include the maintenance of biodiversity and ecological processes while allowing for recreational and tourist activities. Secondary management objectives include wilderness protection, protection of natural and cultural resources and providing

opportunities for education and scientific research. Figure 2.1 provides a more comprehensive overview of the operational definition and the management objectives associated with modern day national parks.

Figure 2.1 National Park Management Category

<p><b>CATEGORY II</b></p> <p><b>National Park: protected area managed mainly for ecosystem protection and recreation</b></p> <p><i>Definition</i></p> <p>Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.</p> <p><i>Objectives of Management</i></p> <ul style="list-style-type: none"><li>• to protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes;</li><li>• to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity;</li><li>• to manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state;</li><li>• to eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation;</li><li>• to maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation; and</li><li>• to take account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.</li></ul> <p><i>Guidance for Selection</i></p> <ul style="list-style-type: none"><li>• The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special spiritual, scientific, educational, recreational and tourist significance.</li><li>• The area should be large enough to contain one or more entire ecosystems not materially altered by current human occupation or exploitation.</li></ul> <p><i>Organizational Responsibility</i></p> <p>Ownership and management should normally be by the highest competent authority of the nation having jurisdiction over it. However, they may also be vested in another level of government, council of indigenous people, foundation, or other legally established body which has dedicated the area to long-term conservation.</p>
--

Source: IUCN-WCMC (1994, p. 19)

## 2.2 Economics of Protected Areas

### 2.2.1 Protected Areas as Economic Goods

Conceptualising national parks and protected areas as an economic good allows for an understanding of why these areas are not subject to provision and valuation by the free market. These market failures are the primary reason why these critical elements of natural capital are often assigned an implicit zero economic value.

In general, economic goods can be classified according to whether they are public or private goods (see Figure 2.2). Private goods display two key characteristics: rivalry in consumption and excludability. Rivalry in consumption implies that if one person consumes a particular good, the benefits are no longer available to others. Private goods are also excludable which means that it is possible to prevent a person from obtaining the benefits of a particular good through the use of the price mechanism. As a result, private markets can be established to value and allocate resources to their most productive use (Dyke, 2008).

Figure 2.2 Categorisation of Economic Goods

	<b>Excludable</b>	<b>Non-excludable</b>
<b>Rivalrous</b>	Private goods	Common-pool resource
<b>Non-rivalrous</b>	Club goods	Public goods

Source: Vatn (2005, p. 263)

Public goods exhibit the opposite characteristics of private goods in the sense that they are both non-rival and non-excludable. Accordingly, consumption by one individual does not detract from the ability of other consumers to enjoy the same benefits. In addition, it is not possible to prevent individuals from consuming the good through the price mechanism. This also makes public goods prone to free riding behaviour. Free riding refers to the refusal by individuals to contribute to the cost of providing a good on the basis that once it is provided, no one can be excluded from using it. This ensures there is little or no incentive for private sector provision which ultimately results in market failure (Turner, 2002).

As to whether national parks and protected areas exhibit predominantly private or public good characteristics has been an issue of contention (Bennett, 1995, 2000; Damania & Hatch, 2005; Tisdell, 1972). Protected areas are likely to fall somewhere along the private/public good spectrum and may be more appropriately regarded as a mixed good (Turner, 2002). However, as Dixon and Sherman (1990) show, many of the goods and services provided by protected areas are non-rival in nature (see Figure 2.3). For goods with non-rival characteristics, marginal cost pricing results in an efficient price of zero. Furthermore, with the exceptions of recreation, tourism, scientific research and education, all of these benefits are non-excludable in nature. Accordingly, given that most of these benefits can be classified as pure public goods, there is no requirement for consumers to reveal their preferences in a market setting (Dixon & Sherman, 1990). This makes it highly unlikely that protected areas and national parks will be exposed to price signals which reflect their true economic value.

Figure 2.3 Characteristics of the Goods and Services Associated with Protected Areas

<b>Goods and Services</b>	<b>Non-rival</b>	<b>Non-excludable</b>	<b>Off-Site Effects</b>	<b>Estimation of Value</b>
Recreation/tourism	XC	P	-	S
Erosion control	X	X	X	S
Local flood reduction	X	X	X	E
Regulation of streamflows	X	X	X	E
Fixing and cycling nutrients	-	X	X	S
Soil formation	-	-	-	S
Cleansing air and water	X	X	X	S
Gene resources	X	P	X	E
Species protection	X	X	X	E
Evolutionary processes	X	X	X	E
Education	X	P	X	E
Research	X	P	X	E
Aesthetic	X	X	X	S
Spiritual	X	X	X	E
Cultural/historical	X	X	X	E
Option value	X	X	X	E
Quasi-option value	X	X	X	E
Existence value	X	X	X	E
Global life support	X	X	X	E

C=congestible, P=possible, S=somewhat difficult, E=extremely difficult, X=attribute is present

Source: Adapted from Dixon and Sherman (1990, p. 26)

The second consideration regarding protected areas as an economic good relates to the concept of externalities. Externalities refer to the unintended side effects resulting from the production or consumption of a good or service. It has been argued that protected areas give rise to a number of positive societal benefits (or off-site effects) in the form of education, scientific research and ecosystem services (see Figure 2.3) (Dixon & Sherman, 1990; Turner, 2002). In a market setting, individuals are assumed to be self-interested utility maximising agents who base decisions on private costs and benefits. As societal benefits are unable to be captured and appropriated by private individuals, they are often ignored in consumption decisions. This provides little incentive for private economic actors to engage in the supply of protected areas (Dixon & Sherman, 1991).

Monopoly elements and increasing returns to scale are another potential market failure which afflict national parks and protected areas. It has been theorised that these areas enjoy characteristics similar to natural monopolies in terms of declining marginal cost functions. This implies that a single entity would be able to supply the entire market at a lower cost than a competitive market structure. Left to the free market, this monopoly supply would ensure that protected areas would be underprovided relative to the socially optimal level (Turner, 2002).

As a result of the market failures discussed above, any attempt to supply protected areas through the private market would result in allocative inefficiency. It is for these reasons that in many countries, the government is responsible for the provision of protected areas and conservation initiatives (Dixon & Sherman, 1991). However, the institutional arrangements governing the allocation of public sector resources are usually not guided by price signals. The net result is often a perception that national parks and protected areas provide no significant economic benefits and are a drain on public funds (Dixon & Sherman, 1990).

### **2.2.2 Benefit and Costs of Protection**

Despite the benefits of protection often being undervalued or ignored completely, the conservation of biodiversity does provide a range of tangible benefits. A number of studies have attempted to quantify the benefits associated with maintenance of ecological integrity. One ambitious study undertaken by Costanza et al. (1998) valued the global biosphere's ecosystem services at US\$33 trillion per annum. Other studies support the notion that protected areas provide economic benefits which generally

exceed the opportunity cost of protection (Balmford et al., 2002). Specific examples of the benefits associated with protected areas are given below.

### **2.2.2.1 Benefits of Protection**

Recreation and tourism are one of the many benefits associated with national parks and protected areas. With the exception of areas managed for strict wilderness and nature protection, most protected areas allow for recreational and tourism activities. Some of these activities will yield direct returns while other activities will yield indirect returns in the form of increased regional economic activity (Chape et al., 2008).

Protected areas also provide a range of ecosystem services which act to support economic activity and human development. One of the key ecosystem services provided by protected areas is catchment/watershed protection. The presence of vegetative cover is able to regulate water flow, control erosion and reduce sediment loading (Dixon & Sherman, 1990). Protected areas also provide climate regulation services by maintaining microclimatic stability and sequestering atmospheric carbon dioxide (Chape et al., 2008).

As mentioned earlier, the preservation of biological diversity and ecological integrity is considered to be the primary objective of modern day protected areas. Protected ecosystems are able to ensure the continued existence of key biological and genetic resources. These resources provide the raw material inputs necessary for the development of pharmaceutical, agricultural and chemical products both in the developed and developing world (Dixon & Sherman, 1990).

Protected areas provide an opportunity for researchers and students to observe ecological processes in their natural context without human intervention (Dixon & Sherman, 1990). Managing protected areas as ecological baselines provides a reference point for assessing the impact of human activities on biodiversity and ecosystem integrity. The resulting research can be used to enhance scientific understanding with the ultimate goal of informing environmental management decisions (Arcese & Sinclair, 1997). This function is of particular importance given the current unprecedented levels of ecosystem modification (Chape et al., 2008).

Direct consumptive uses may also form part of the benefits associated with protected areas. Some protected area categories allow for the sustainable harvesting of natural resources including fuel wood, fibres, food collection, livestock grazing and the extraction of genetic resources. In some protected areas the extraction of non-

renewable resources such as hydrocarbons and minerals may occur (Chape et al., 2008).

Non-consumptive benefits fall into a number of sub-categories which do not involve the direct use of a protected area. These categories include aesthetic, cultural, spiritual, identity, historic, artistic, peace and therapeutic values (Putney, 2003).

#### **2.2.2.2 Costs of Protection**

While there are economic benefits associated with protection, there are also costs which accrue from the development and continued operation of any protected area. These costs fall into three categories including direct costs, indirect costs and opportunity costs.

Direct costs are the expenditures which are incurred from the establishment and ongoing operation of a protected area. Capital costs are the initial one-off costs incurred from establishing the required infrastructure. Direct costs include the ongoing operational costs associated with staffing and administration, infrastructure maintenance, public education programmes and conservation activities (Dixon & Sherman, 1990).

Indirect costs comprise of compensation paid to surrounding communities. This includes payment for any damage to crops, property or people caused by wildlife residing in the protected area. In addition, monetary compensation may also need to be provided to local communities for any property rights formal or otherwise which are forfeit as a result of protection (Dixon & Sherman, 1990).

Opportunity costs refer to the benefits which are foregone as a result of a particular area being set aside for conservation purposes. In many cases, the land occupied by a protected area could potentially be converted and utilised in an alternative manner (e.g. for agricultural/resource extraction purposes). The magnitude of the opportunity cost is dependent on possible alternative uses and the existence of land use restrictions (Dixon & Sherman, 1991).

As Dixon and Sherman (1991) note, although the benefits arising from protection are large, they are often difficult to quantify in monetary terms. In contrast, the total costs associated with protected areas are often sourced through public sector budgetary allocations and are hence relatively easy to measure. Accordingly, the use of conventional financial analysis would provide an erroneous perception of the economic

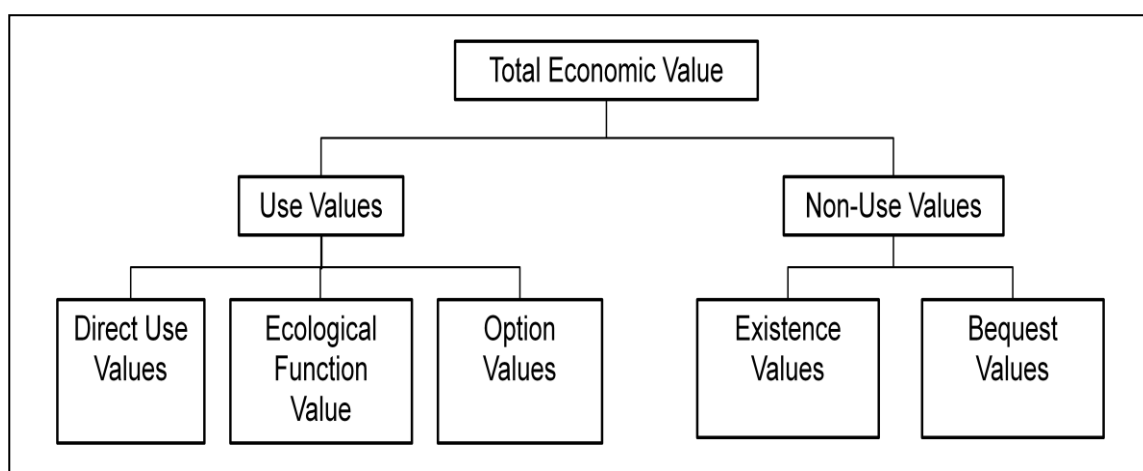
desirability of protected areas and a strong case for development as opposed to conservation.

### 2.2.3 Economic Value of Protected Areas

One framework commonly utilised in non-market valuation studies is the concept of total economic value (TEV). This framework presents a means of identifying the values associated with protected areas with the end goal of expressing them in monetary units (WCPA-IUCN, 1998).

The TEV of a protected area consists of the sum of use and non-use values (Figure 2.4). Use values comprise of direct use value, indirect use value/ecological function value and option value. Non-use values comprise of existence and bequest value.

Figure 2.4 Total Economic Value



Source: Young (1992, p. 23)

Protected areas can provide a range of direct use values in terms of recreation, tourism, scientific research and education. Other values stem from harvesting and extractive activities such as agriculture, grazing, collection of fuel wood and hunting (WCPA-IUCN, 1998).

Ecological function value refers to the benefits provided by protected areas in the form of ecosystem services. These services include but are not limited to: carbon sequestration, erosion and flood control, nutrient cycling and water purification (WCPA-IUCN, 1998).

Option value refers to the benefit associated with maintaining a protected area for use in some future period. Protected areas provide a stockpile of biological and genetic



resources which could potentially provide useful inputs in the development of pharmaceutical and agricultural products (WCPA-IUCN, 1998).

With regard to non-use values, existence value is the benefit received from the ongoing presence of the protected area independent of any actual use. Bequest value is the satisfaction received from knowing that future generations will benefit from the protected area (WCPA-IUCN, 1998). The motivation for non-use values originates from widely held notions of intergenerational equity, altruistic utility functions and acknowledgement of the intrinsic value of the environment (Bateman et al., 2002).

Whereas direct use values are relatively easy to quantify in monetary terms, the benefits associated with other sources of value are not subject to market transactions (for reasons already discussed). Accordingly, only non-market valuation techniques are able to provide an indication of the value of these benefits.

Although the TEV framework has gained acceptance among economists, it is not the only method of conceptualising the value of protected areas. One alternative method developed by the IUCN emphasises the importance of non-economic intangible values. These intangible values are defined as “that which enriches the intellectual, psychological, emotional, spiritual, cultural, and/or creative aspects of human existence and wellbeing” (Putney, 2003, p. 4). Other valuation frameworks adopt a more biocentric or deep ecology perspective by focusing on the intrinsic value of the environment (Putney, 2003). This is the value which species or ecosystems possess independent of human preferences and utility functions (Bateman et al., 2002).

It is important to recognise the existence of other values which are not necessarily structured in economic terms. This illustrates the diverse range of benefits which accrue from national parks and protected areas. However, the concept of economic value is based on the notion of instrumental value or that which satisfies human needs and wants. Accordingly, the environment is deemed to have value only to the extent to which it contributes towards human well-being (Bateman et al., 2002; WCPA-IUCN, 1998). Only the TEV framework is consistent with this anthropocentric utilitarian philosophy which forms the conceptual basis of welfare economics.

### **2.3 Conservation Financing**

In order for national parks and protected areas to fulfil their conservation objectives, it is imperative that adequate financial resources are available to cover both capital and ongoing costs (Lockwood & Quintela, 2006). The issue of conservation finance has

been given extra attention due to the current shortfall in protected area funding worldwide (Emerton, Bishop, & Thomas, 2006). This has resulted in the concept of financial sustainability being increasingly applied to protected area management. Financial sustainability is defined as:

...the ability to secure sufficient, stable and long-term financial resources, and to allocate them in a timely manner and in an appropriate form, to cover the full costs of protected areas and to ensure that they are managed effectively and efficiently with respect to conservation and other objectives. (Emerton et al., 2006, p. 15)

The emphasis on achieving financial sustainability has necessitated the development of a new model of protected area financing. This model incorporates a range of funding stakeholders and involves the adoption of a business oriented/commercial approach to protected area management.

### **2.3.1 Sources of Conservation Finance**

There are a range of sources which are able to provide conservation financing for protected area networks. Funding can be obtained from central government, development agencies, private sector entities, non-governmental organisations and private individuals.

Traditionally, central government has provided the bulk of funding for protected areas. Allocations are usually sourced from appropriations from a consolidated fund controlled by a national treasury. Public sector expenditure often falls into two categories including recurring administrative costs and capital outlays. The public good benefits associated with protected areas and the need to maintain intrinsic and non-use values provides a strong justification for government support (Lockwood & Quintela, 2006). However, government budgetary allocations are always subject to political pressure and competing priorities. Accordingly, in times of fiscal austerity, it is unrealistic to assume that public funding is able to meet the total costs incurred from a national protected area network (Spergel, 2001).

A supplementary source of conservation finance is the private sector. The involvement of the private sector in biodiversity conservation is largely driven by the production of biodiversity-linked goods and services. With regard to commercial products, there are increasing opportunities for the development of biodiversity-linked markets for products

such as organic agriculture, ecotourism and bio-prospecting. Businesses can purchase operating licences which grant them permission to carry out such activities (Rubino, 2000). Private sector entities may also pay for the provision of certain ecosystem services including carbon sequestration and water purification (Lockwood & Quintela, 2006). In addition, businesses may also provide donations as part of their social outreach and corporate responsibility programmes (Rubino, 2000).

International development assistance is an important source of conservation finance, particularly for developing countries. Multilateral agencies such as the United Nations, World Bank and the Global Environment Facility provide financial support for a range of sustainable development initiatives including biodiversity conservation. Bilateral aid agencies from developed nations also provide an additional source of funding. Both types of institutions administer a range of funding mechanisms including debt-for-nature swaps, conservation trust funds and payments for ecosystem services (Emerton et al., 2006).

Another source of conservation funding is through non-governmental organisations such as the World Wide Fund for Nature, IUCN and the Nature Conservancy. These organisations provide a range of assistance, including financial resources as well as technical expertise and institutional capacity building (Lockwood & Quintela, 2006).

The last major source of conservation finance is derived from private individuals. Site membership schemes are increasingly common and provide an additional source of funding through donations and membership fees. Private philanthropy in the form of donations and bequests also supplement conservation funds (Lockwood & Quintela, 2006).

### **2.3.2 Conservation Financing in Crisis**

Worldwide, the explosion in the number of protected areas in the latter half of the twentieth century has not been matched by a commensurate increase in conservation funding. In the mid-1990s, it was estimated that approximately US\$3 billion was spent annually on the world's protected area network. In 2005, aggregate spending on protected areas was estimated to be US\$6.5 billion with inflationary pressures being the main factor behind this increase. Over the same period, the global protected area network experienced a 50% increase in land area (Emerton et al., 2006).

Overall there appears to be a general consensus that conservation financing is currently in a state of crisis. For example, one estimate placed the total cost of

establishing and maintaining a global system of protected areas at US\$23 billion per annum (Bruner, Hanks, & Hannah, 2003). Other estimates indicated that the establishment of a protected area network which covers 15% of terrestrial and 30% of marine ecosystems would cost US\$45 billion per annum (Balmford et al., 2002). Based on these estimates it would appear that current levels of expenditure represent a gross underinvestment in biodiversity conservation.

Several broader contextual factors are responsible for the lack of conservation finance. First, despite the increasing number of non-government entities involved in the management of protected areas, government agencies are still largely responsible for the provision of managerial capacity and funding. However, the widespread adoption of economic liberalisation measures has resulted in declining levels of public sector expenditure. This has led to the rationalisation of protected area funding which is often perceived as less important relative to other budgetary considerations (Emerton et al., 2006).

Furthermore, the institutional arrangements responsible for protected area management have also been subject to significant changes. In many cases, these separate entities have been amalgamated with larger environmental protection agencies. Consequently, funding which had previously been earmarked for conservation is now usually directed into a consolidated fund. This often results in financial resources being diverted to other policy programmes resulting in a smaller share for protected areas (Emerton et al., 2006).

Secondly, flows of official development assistance (ODA) and foreign aid for conservation purposes have declined in real terms. The annual value of foreign aid for protected areas in developing nations has fallen from US\$700-770 million in the early 1990s to a present figure of US\$350-420 million. In addition, ODA has become increasingly oriented toward poverty alleviation in response to the Millennium Development Goals (MDGs). Most ODA is now conditional on the implementation of poverty reduction strategies and initiatives which are of direct relevance to the MDGs. This renewed interest in human development has come at the expense of biodiversity conservation (Emerton et al., 2006).

### **2.3.3 Business Planning and the Client Approach**

In order to address the financial crisis afflicting protected areas globally, management agencies have adopted a number of tools including the use of business and financial planning practices. Business planning is one method of identifying protected area

financing requirements and matching these with available funding sources. Plans are typically organised in a hierarchy which consists of a management plan, a business plan and a financial plan (WCPA-IUCN, 2000).

The primary function of the management plan is to provide the policy context within which the business and financial plans must operate. Management plans provide a comprehensive overview of the objectives of the protected area, important stakeholder groups and financial requirements. This ensures the emphasis on revenue generation does not become an end in itself, but remains a means of enhancing conservation outcomes. The business plan provides an in-depth analysis of the protected area customer base, the goods and services provided by the protected area and a description of the proposed marketing strategy. This information is then utilised to develop a financial plan. This includes information regarding potential funding sources, projected cash flows and break-even analysis (Lockwood et al., 2008; WCPA-IUCN, 2000).

Financial planning exhibits a number of key differences from standard budgeting practices. First, one of the primary tasks of planning involves forecasting the amount of funding necessary for immediate, medium and long-term requirements. Secondly, financial plans also include an assessment of the reliability, vulnerability and expected duration of potential funding sources. This allows protected area managers to develop a diversified portfolio which can provide effective and sustained finance (Lockwood & Quintela, 2006).

One implication of utilising quasi-commercial practices is the shift towards referring to protected area stakeholders as clients or customers. Accordingly, the challenge for protected area managers is to adopt an entrepreneurial outlook and identify the goods and services demanded by each group of consumers. In addition, managers also need to develop methods of capturing consumer values with the aim of generating additional revenue (WCPA-IUCN, 1998). The goods and services provided by a particular area are dependent on prevailing management objectives, the ecological character of the area and accessibility to consumers. Consideration should also be given as to whether these goods exhibit private good characteristics since they are easier to commercialise. In general, a protected area customer base typically consists of local communities, commercial customers, indirect/offsite consumers and the international community. Goods and services demanded may include subsistence resources (e.g. fuel wood, food), tourism services, genetic resources and various ecosystem services such as carbon sequestration and catchment protection (WCPA-IUCN, 2000).

Economic valuation is able to assist protected area managers with the formulation of business plans in several ways. First, the process of economic valuation provides information regarding the goods and services derived from protected areas and the resulting benefits which accrue to consumers. Secondly, valuation studies also provide an indication of which values are being captured and which are currently subject to free riding behaviour (WCPA-IUCN, 1998). In this manner, economic values are able to provide critical information which is necessary for the development of effective conservation business plans.

#### **2.4 Non-market Environmental Valuation**

Non-market environmental valuation refers to the process of assigning economic values to environmental goods and services. For reasons discussed earlier, the establishment of clearly defined and enforceable property rights for environmental goods is often impossible. This results in market failure and the inability of the price mechanism to provide an accurate indication of the value of these amenities.

However, economists generally agree that the environment encompasses at least three dimensions of value. The first dimension can be conceptualised in terms of environmental source and sink functions. Essentially, the environment provides the economy with a source of raw material inputs and a sink for assimilating waste outputs. The second source of value refers to the amenity services provided to households in the form of recreational, scenic and non-use values. The last dimension of value relates to the life supporting capacity of the ecosystem which supplies a range of services including climate regulation, biogeochemical cycling and water cycling (Hanley & Barbier, 2009).

As many of these benefits are not subject to market valuation, they cannot be included in any formal cost-benefit analysis (CBA) framework. Ultimately, CBA provides the fundamental rationale for any non-market environmental valuation study. By comparing the full costs and benefits of policy actions, scarce resources can be allocated in a manner which maximises societal benefits. In cases where these values do not exist, policy is formulated in an environment of imperfect information and may have a detrimental impact on societal welfare (Hanley & Barbier, 2009).

To address this, several valuation techniques can be used to estimate non-market values. These methods can be classified according to whether they are revealed preference or stated preference techniques.

### 2.4.1 Revealed Preference Techniques

Revealed preference techniques rely on the use of surrogate markets to derive value estimates. Although markets for environmental goods are often non-existent, statistical tools can be used to interpret consumer behaviour in private markets to provide a basis for valuation. Specifically, these techniques focus on the consumption of private goods that are derived from the demand for the environmental asset (Garrod & Willis, 1999). The travel cost and hedonic price methods will be considered below.

One revealed preference technique which has long been associated with the valuation of national parks is the travel cost method (TCM). First suggested by Harold Hotelling in 1947, the idea was more fully developed several decades later (Hanley & Barbier, 2009). The TCM is commonly utilised to value the recreational aspects of a particular area when there is a strong link between environmental quality and recreational use (Parsons, 2003). The TCM utilises a survey instrument to collect information regarding travel distance and total expenditure (e.g. entrance fees, travel costs, time cost). This information can be used to derive a demand curve which shows the functional relationship between travel costs and number of visits. The cost variable effectively acts as a proxy for market price and illustrates how the number of trips (quantity demanded) changes in response to an increase in travel costs. The area under the demand curve represents the total benefit or value of the environmental amenity (Hanley & Barbier, 2009; Parsons, 2003).

However, the original TCM has largely fallen out of favour with practitioners since it ignores the important role of substitutes and site attributes in consumption decisions (Mendelsohn & Olmstead, 2009). This has resulted in the development of the Random Utility Site Choice (RUSC) model which incorporates substitution possibilities among sites. In this model, a range of recreational site attributes including a travel cost attribute is presented to consumers. These attributes vary over several levels and consumers are required to state their preferred bundle and distance they are required to travel. This allows the calculation of a demand function and provides additional information regarding how consumer's trade-off between attributes (Hanley & Barbier, 2009; Mendelsohn & Olmstead, 2009).

In addition, the TCM does suffer from a number of conceptual and methodological limitations. First, the TCM has limited scope in the sense that valuation is restricted to amenities which possess recreational value (Hanley & Barbier, 2009). Secondly, the statistical models used by researchers can be prone to omitted variable bias which can

provide inaccurate value estimates (Mendelsohn & Olmstead, 2009). Thirdly, the treatment of time in travel cost studies has been a longstanding issue of contention. One way of addressing this is by using an hourly wage rate although this may overestimate the cost if the act of travelling is a source of utility (Garrod & Willis, 1999; Hanley & Barbier, 2009). Fourthly, attributing a portion of travel cost to a particular site poses a number of difficulties for multipurpose trips. This issue is often addressed by researchers excluding multipurpose trips or by using a subjective decision-making process to assign value (Mendelsohn & Olmstead, 2009).

The second revealed preference technique is the hedonic price method (HPM). This method was developed during the 1960's and has become a well-established non-market valuation technique. The theoretical basis of the HPM is derived from Lancasterian consumer theory (Lancaster, 1966) which assumes that consumption decisions are best explained by the attributes embodied within a particular good (Garrod & Willis, 1999). The HPM uses econometric analysis to derive a hedonic price function which statistically relates the value of a market good to its attributes. This allows the calculation of implicit prices for each attribute. These figures can be used to provide an indication of the marginal benefit associated with a one unit increase in environmental quality. Other welfare estimates can also be obtained for non-marginal changes in either one or several attributes. In some cases, a demand curve can be estimated for environmental quality (Hanley & Barbier, 2009).

The HPM is usually applied to the housing market where the value of a house is a function of attributes including physical characteristics, proximity to public transport and environmental factors (e.g. noise, air pollution) (Garrod & Willis, 1999). Previous HPM studies have provided an estimate of the economic value of wetlands, open space, water quality, hazardous waste sites and urban noise (Mendelsohn & Olmstead, 2009). Hedonic wage models utilise similar principles but instead use the labour market as a reference point. A worker's wage is assumed to be a function of several factors including human capital investment, prestige, working conditions, risk of injury/mortality and certain environmental factors (Mendelsohn & Olmstead, 2009).

The HPM does suffer from a number of well-documented limitations. First, the scope of the HPM is limited to valuing environmental amenities which have a direct relationship with a reference market. Secondly, the HPM assumes the reference market is efficient and consumers have well-behaved rational preferences. In order for these assumptions to hold, consumers must have access to perfect information regarding the attribute levels and substitution possibilities, buyers must exhibit utility maximising behaviour and



the reference market must be in a state of equilibrium. In addition, consumers must also have perfect geographical mobility in order for implicit prices to accurately reflect their preferences. However, the likelihood of these preconditions being satisfied, is small. Thirdly, any variables which are omitted from the hedonic price function and are correlated with other attributes can result in biased coefficient and value estimates (Hanley & Barbier, 2009; Mendelsohn & Olmstead, 2009). In addition, the issue of multicollinearity may also arise if attributes exhibit a high degree of correlation with each other (Garrod & Willis, 1999). The final criticism of the HPM relates to the disjunction which can occur between actual and perceived characteristic levels. Often consumer perceptions of the risk associated with environmental disamenities may be inaccurate relative to scientific probabilities. Accordingly, preferences formed on subjective perceptions can result in the HPM providing erroneous welfare estimates (Grafton et al., 2008).

#### **2.4.2 Stated Preference Techniques**

As their name suggests, stated preference techniques are based on consumers explicitly stating their preference for an environmental amenity. A survey instrument is used to create a hypothetical market which provides a description of the environmental amenity and includes preference revelation questions. One advantage of stated preference techniques is that they can be applied to hypothetical settings for which reference markets currently do not exist. In addition, these techniques are able to ascertain the non-use values which many environmental goods possess (Garrod & Willis, 1999). It is for these reasons that stated preference techniques are becoming increasingly popular in both academic and policy settings (Adamowicz, 2004). Despite this, there is still an inherent bias amongst many economists for valuation estimates which are based on observed market behaviour as opposed to hypothetical markets (Mendelsohn & Olmstead, 2009). The contingent valuation method (CVM) and various attribute-based methods (ABMs) will be considered.

First developed and applied in the 1960s, the CVM can be used in situations where reference markets do not exist or when estimates of non-use values are required (Boyle, 2003). The contingent valuation technique involves directly questioning consumers about their preferences for an environmental good. Contingent valuation studies can utilise one of two valuation formats to transform consumer preferences into Hicksian consistent welfare estimates. The first format involves asking consumers about how much they would be willing to pay (WTP) to secure an environmental improvement. The second format is phrased in terms of how much consumers would be

willing to accept (WTA) in compensation to forego this improvement (Garrod & Willis, 1999).

The first step in any CVM study involves establishing a hypothetical market which includes a description of the existing status quo scenario, the environmental change, the incidence of cost and a payment vehicle. This provides the study with a frame in which consumers are required to elicit their preferences (Hanley & Barbier, 2009). The hypothetical market is then presented to consumers. Econometric analysis is then used to derive average and aggregate value estimates (Bateman et al., 2002).

The CVM does however suffer from a number of limitations. One of the major criticisms of the CVM is its hypothetical nature. As hypothetical questions are inconsequential in nature (i.e. consumers are not required to reconcile stated valuations with their budgetary constraint) people have no incentive to reveal their true preferences (Hanley & Barbier, 2009). Accordingly, individuals may engage in strategic behaviour by overstating their values in order to increase the likelihood of a policy being implemented. Alternatively, individuals may underestimate their value if they believe the government will pass the resulting cost onto taxpayers (Grafton et al., 2008). In addition, some contingent valuation formats are particularly susceptible to yea saying arising from either strategic behaviour or social desirability bias. This can result in inflated WTP estimates (Bateman et al., 2002).

Secondly, consumers may be unfamiliar with environmental goods which can result in a lack of sensitivity to scope. This leads to consumers expressing WTP values which are unresponsive to changes in the quantity of the environmental amenity (Mendelsohn & Olmstead, 2009). One way of addressing this is to provide consumers with adequate levels of information during the valuation exercise. However, providing more than the optimal level is likely to result in respondents becoming "super-informed" which may result in inflated stated values (Rolfe & Bennett, 2001).

Finally, the choice of response mode has also been the subject of much controversy. An open-ended question asks the consumer for a single value which represents their maximum willingness to pay for the good in question. However, this question format has largely fallen out of favour with CVM practitioners due to consumers being unfamiliar with valuing goods and services in this manner (Bateman et al., 2002). An alternative response mode involves the use of a payment card which presents a range of values to consumers. This approach has been criticised for orientating preferences around a pre-specified range of values (Garrod & Willis, 1999). Another method involves the use of an iterative bidding process where consumers respond to several rounds of discrete

choice questions. However, this process can result in anchoring effects or starting point bias and yea saying which may provide inaccurate welfare estimates (Bateman et al., 2002). Current recommended practice is to utilise a single bounded dichotomous question response mode. This involves offering a single monetary value which the consumer either accepts or rejects. This value is then varied over the entire sample frame. Follow-up values based on the initial response may also be presented resulting in a double-bounded dichotomous choice response format. The main strength of the dichotomous choice question format is the “take it or leave it” approach which mimics consumption decisions in an actual market setting and is incentive compatible (Bateman et al., 2002; Boyle, 2003; Haab & McConnell, 2003).

The debate regarding the validity of the CVM came to a head during the Exxon Valdez oil spill and the subsequent use of this method to measure non-use values for litigation purposes. This resulted in a commission of enquiry (NOAA Blue Ribbon Panel) which aimed to investigate the validity of the CVM. The panel reported that despite the presence of a number of limitations, the CVM can be used to provide credible estimates of non-market environmental values (Boyle, 2003; Hanley & Barbier, 2009).

The relatively recent development of ABMs has diversified the number of stated preference techniques available to practitioners. ABMs refer to a number of different methods which have emerged from the combination of Lancasterian demand theory and traditional conjoint analysis (Holmes & Adamowicz, 2003). ABMs have typically been used in disciplines such as marketing, health care and transport economics and are increasingly being used to value environmental amenities (Alriksson & Öberg, 2008; Grafton et al., 2008). ABMs have been applied to a range of issues including pollution damage, ecosystem management, recreation, land management, risk analysis and agriculture and forestry (Alriksson & Öberg, 2008).

The fundamental premise of ABMs is that an environmental good can be decomposed into several attributes. These attributes vary over a range of levels and consumers are required to indicate their preferences over several tasks (Farber & Griner, 2000). The inclusion of a monetary attribute can be used to provide value estimates in the form of marginal willingness to pay (Grafton et al., 2008). Several types of ABMs exist including choice experiments, contingent rating, contingent ranking and paired comparisons. While all these methods encompass the basic principles outlined above, the response formats differ. Choice experiments require consumers to make discrete choices between competing alternatives while contingent rating involves the rating of alternatives according to some pre-specified scale. A contingent ranking format asks

respondents to rank alternatives from most to least preferred. The paired comparison approach involves a sequential process whereby respondents are initially required to choose their most preferred alternative and then rate the remaining alternative. Econometric analysis can then be used to derive part-worths which indicate the relative importance of each attribute in determining consumption decisions (Bateman et al., 2002; Hanley, Mourato, & Wright, 2001).

ABMs have several advantages over contingent valuation including the ability to elicit a greater amount of information regarding consumer preference structures. In addition, ABMs are able to provide welfare estimates for individual attributes as well as aggregate measures for a bundle of attributes (Hanley et al., 2001). The main limitations of ABMs are the complex nature of the experimental design process and the fact that not all response formats result in welfare consistent estimates. A number of the criticisms levelled at the CVM with regard to hypothetical bias are also applicable to ABMs (Bateman et al., 2002).

## **2.5 Choice Modelling**

One ABM which shows considerable merit in its application to non-market valuation is the choice modelling (CM) approach. The relatively recent development of CM has largely been in response to criticism directed towards the CVM and traditional conjoint analysis. While choice experiments are relatively well-established in both transport and health economics, this technique has only recently been applied to value environmental amenities (Bennett & Blamey, 2001a).

### **2.5.1 Choice Modelling Technique**

The conceptual microeconomic foundations for the CM approach are based on Lancasterian consumer theory. The *characteristics theory of value* states that consumers derive utility from the characteristics or attributes of a good as opposed to the actual good *per se* (Lancaster, 1966). Different goods represent different bundles of attributes and consumer decisions are best explained by this decompositional method (Hanley & Barbier, 2009). The process of implementing a CM valuation study involves several steps which are outlined below.

#### **2.5.1.1 Characterising the Decision Problem**

The first step in any CM study is to define the decision problem. This involves describing the change in environmental amenity, the resulting impacts and the type of

values under consideration (e.g. use, non-use or TEV). The definition of the decision problem must also be consistent with the CBA framework, specifically benefits should be described as marginal changes from the status quo (Bennett & Adamowicz, 2001).

### **2.5.1.2 Attribute and Level Selection**

Secondly, the attributes which characterise the decision problem need to be identified. The attributes describe both the status quo option as well as the outcomes associated with the policy intervention under consideration. These attributes must satisfy the criteria of being policy relevant, consumer/demand relevant and amenable to change by environmental managers. Attributes which fail to satisfy any of these criteria may compromise the validity of the study and its ability to inform policy-making (Bennett & Adamowicz, 2001; Hanley & Barbier, 2009). An appropriate monetary payment vehicle also needs to be identified. Payment vehicles which are not realistic may undermine the credibility of the scenario whereas payment vehicles which are unacceptable may engender a high level of protest responses (Bateman et al., 2002). The appropriate number of levels also needs to be identified and a decision made as to whether they are described in quantitative or qualitative terms. This second step relies heavily on consultation with policy-makers, focus groups and a comprehensive literature review (Amaya-Amaya, Gerard, & Ryan, 2008).

### **2.5.1.3 Experimental Design**

The third step involves using experimental design procedures to create the management alternatives characterised by different levels of attributes. In order to statistically relate individual choices to attribute levels, choice tasks need to exhibit a large number of attribute level combinations. Several methods can be used in the experimental design process including a full factorial design, a fractional factorial design and a blocking variable (Bennett & Adamowicz, 2001).

A full factorial design involves presenting respondents with a choice profile that consists of all possible combinations of attribute levels. This allows the effect of individual attributes (main effects) and combinations of attributes (interaction effects) to be estimated. However, full factorial designs are often impractical as the inclusion of even a small number of attributes and levels can result in a large number of combination profiles (Lancsar & Louviere, 2008).

One way of addressing this is to utilise a fractional factorial design which selects a subset of all possible combination profiles. Statistical software and design catalogues can be used to develop an orthogonal main effects plan (OMEPE). This ensures that

statistical independence between attributes is maintained and allows for unconfounded attribute parameter estimates. One limitation of the fractional factorial design is that it is unable to detect secondary effects and higher order interactions (Bateman et al., 2002).

Another strategy which can be used in conjunction with either a full factorial or fractional factorial design is the introduction of a blocking variable. A blocking variable separates the design into a number of segments ensuring that respondents are only confronted with the profiles relating to a particular block (Hensher, Rose, & Greene, 2005).

The next step involves pairing the alternatives derived from the experimental design with the status quo option. The resulting choice sets then need to be analysed to eliminate any implausible or dominated alternatives (Bennett & Adamowicz, 2001).

#### **2.5.1.4 Questionnaire Development**

The most important aspect of the questionnaire development stage is the framing of the decision problem (Bennett & Adamowicz, 2001). This involves embedding the environmental amenity within the appropriate context of substitute and complementary goods. In addition, respondents need to be made aware of their budgetary constraint through a “cheap talk” (CT) script (Rolfe & Bennett, 2001). The choice sets which consist of several resource management alternatives (inclusive of a status quo option) are then introduced. These alternatives can either have informative or generic labels (Bennett & Adamowicz, 2001). Respondents are then required to select their most preferred alternative in a choice set and this may be repeated for between 6-10 choice tasks (Blamey, Gordon, & Chapman, 1999). The exact number of choice tasks is dependent on respondent familiarity with the attributes and task complexity which is a function of the number of alternatives, attributes and levels (Bennett & Blamey, 2001b). Follow-up questions to better understand respondent motivations and decision strategies are also included (Bennett & Adamowicz, 2001).

#### **2.5.1.5 Valuation and Welfare Estimates**

Once respondents have completed the questionnaire, their choices can be statistically related to the levels of the attributes chosen. The statistical analysis is usually based on the MNL model which will be discussed in more detail in the following section. The CM approach can provide two forms of welfare estimates. First, implicit prices for individual attributes can be obtained by estimating the marginal rate of substitution between the non-monetary and monetary attribute. Secondly, willingness to pay for movements from the status quo alternative to some other bundle of attributes can also be measured through compensating surplus estimates (Hanley & Barbier, 2009). CM may also

provide additional information to policy-makers in the form of market shares or the relative support which each alternative has among members of the public (Bennett & Adamowicz, 2001).

## 2.5.2 Model Specification and Estimation

In order to explain consumer choices within a utility maximising framework, CM has integrated the Lancasterian model of consumer behaviour with random utility theory (RUT) developed by McFadden (1974). RUT presupposes that an individual's utility can be divided into an observable deterministic component ( $V_i$ ) and a random stochastic component ( $\varepsilon_i$ ) which is unobservable (Holmes & Adamowicz, 2003). Assuming these two components are additive, a generalised utility expression for each alternative  $i$  can be expressed by equation 2.1 (Boxall, Adamowicz, Swait, Williams, & Louviere, 1996):

$$U_i = V_i + \varepsilon_i \quad 2.1$$

The deterministic component of utility can be explained by the attributes included in the CM study. The random component is a result of the analyst having imperfect information regarding all the determinants of utility (Holmes & Adamowicz, 2003). This leads to the inclusion of an error term which is able to capture the effect of these unobserved influences (Louviere, 2001). The deterministic component of utility can be further decomposed and expressed as (Hensher et al., 2005):

$$V_i = B_{oi} + B_{1i}f(X_{1i}) + B_{2i}f(X_{2i}) + B_{3i}f(X_{3i}) + \dots + B_{Ki}f(X_{Ki}) \quad 2.2$$

Where there are  $K$  attributes and:

$B_{1i}$  represents the parameter coefficient relating to attribute  $X_1$  alternative  $i$

$B_{oi}$  represents the parameter coefficient which captures the average influence of all unobserved factors on utility.

This representative portion of utility is often assumed to be linear in attributes for computational ease but can also be represented in quadratic or logarithmic form. The coefficients show the relative importance of each attribute and their effect on utility (Hensher et al., 2005).

With regard to the error component, as the analyst has practically no information about the unobserved elements a number of maintained assumptions exist. Collectively, these assumptions are referred to as the independently and identically distributed (IID) condition. The IID condition assumes that all error terms are derived from the same

underlying distribution and are uncorrelated with other error terms (Hensher et al., 2005).

Applying RUT specifically to the choice model, each individual selects an alternative which maximises their utility. The inherent uncertainty caused by the random element ensures the analyst is restricted to modelling the probability of an individual choosing a particular alternative (Hensher et al., 2005). The probability of an individual selecting alternative  $i$  over alternative  $j$  can be expressed as (Hensher et al., 2005):

$$\text{Prob}_i = \text{Prob} [(V_i + \varepsilon_i) \geq (V_j + \varepsilon_j) \forall j \in J = 1, \dots, J; i \neq j] \quad 2.3$$

Where  $J$  represents the entire choice set.

The fact the error term cannot be measured, transforms a consumer's standard utility maximisation rule to a random utility maximisation rule (Hensher et al., 2005). Equation 2.3 can be re-arranged to express this as (Hensher et al., 2005):

$$\text{Prob}_i = \text{Prob}[(\varepsilon_j - \varepsilon_i) \leq (V_i - V_j) \forall j \in j = 1, \dots, J; i \neq j] \quad 2.4$$

Expression 2.4 states that the probability of an individual choosing alternative  $i$  is equal to the probability that the difference in the unobserved sources of utility is less than or equal to the difference in the observed sources of utility (Hensher et al., 2005).

Assuming the error term exhibits an extreme value type 1 or Gumbel distribution, a MNL model can be used for CM purposes (Hensher et al., 2005). The probability of a respondent selecting alternative  $i$  is given in equation 2.5 (Hensher et al., 2005):

$$\text{Prob}_i = \frac{\exp V_i}{\sum_{j=1}^J \exp V_j} ; j = 1, \dots, i, \dots, J \quad i \neq j \quad 2.5$$

The probability of an individual selecting an alternative is modelled as a function of the key design attributes and respondent socioeconomic, demographic and attitudinal variables. Alternatives with higher levels of desirable attributes have a higher probability of being selected (Bennett & Adamowicz, 2001). Assuming the existence of three alternatives with quantitative attributes exclusive of interactions, equation 2.6 represents the conditional indirect utility functions (IUFs) (Bennett & Adamowicz, 2001):



$$\begin{aligned}
\text{Status quo: } V_1 &= \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) \\
\text{Alternative 2: } V_2 &= ASC_2 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) \\
\text{Alternative 3: } V_3 &= ASC_3 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3)
\end{aligned}
\tag{2.6}$$

Where:

$\beta$  represents the parameter estimates associated with each attribute

$ASC$  is the alternative specific constant which captures the average influence of unobserved factors on utility

$X$  represents the levels of a particular attribute.

The MNL model estimates parameter coefficients through the use of maximum likelihood estimation (MLE). MLE regression uses an iterative procedure to fit a model that best explains the choices made by respondents. The final MNL model is derived when the parameter estimates maximise the log-likelihood function. The validity of these models can be tested through the use of statistical tools such as pseudo- $R^2$ , Wald-statistics and log-likelihood statistics (Hensher et al., 2005).

One restriction or assumption embodied in the MNL model is the behavioural condition known as the independence of irrelevant alternatives (IIA). This condition states that the probability of a respondent selecting an alternative is independent of the presence or absence of other alternatives in a choice set. A result of the IID assumption, the IIA condition implies that the unobserved attributes are identical for each alternative (Hensher et al., 2005).

The results of the choice model can be used to derive Hicksian consistent welfare estimates. The marginal willingness to pay for each attribute can be obtained by dividing the attribute coefficient by the monetary attribute coefficient as shown in equation 2.7 (Hanley & Barbier, 2009):

$$IP = - \left( \frac{\beta_k}{\beta_c} \right) \tag{2.7}$$

Where:

IP is the implicit price

$\beta_k$  is the parameter coefficient for the non-market attribute

$\beta_c$  is the parameter coefficient for the monetary payment vehicle.

Welfare estimates can also be obtained for situations involving changes to multiple attributes. Compensating surplus can be calculated by multiplying the difference in utility between two states of the world with the negative of the monetary coefficient (Bennett & Adamowicz, 2001). This is shown in expression 2.8 (Bennett & Adamowicz, 2001):

$$CS = -\frac{1}{\beta_c}(V_1 - V_0) \quad 2.8$$

Where:

CS is the compensating surplus

$V_1$  is the utility associated with an alternative management option

$V_0$  is the utility associated with the status quo option

$\beta_c$  is the parameter coefficient for monetary payment vehicle.

### **2.5.3 A Critical Appraisal of the Choice Modelling Approach**

The CM approach has a number of advantages which make it suitable for the purpose of this research. Some of these advantages can be generalised to all stated preference techniques while others are specific to discrete choice experiments.

One of the advantages of the CM technique is its ability to measure both use and non-use values. For certain environmental amenities, non-use values are likely to be several times the magnitude of direct use values. In such cases, only stated preference techniques will be able to provide an accurate indication of total non-market economic value (Bateman et al., 2002).

CM also has a number of advantages over other ABMs. First, choice experiments are able to provide welfare consistent value estimates. Other techniques such as contingent rating, contingent ranking and paired comparisons approach produce results which are inconsistent with consumer theory. This can create issues surrounding the interpretation of the resulting welfare estimates (Hanley et al., 2001). Secondly, these response formats can impose a significant cognitive burden on respondents (Holmes & Adamowicz, 2003). Choice experiments avoid this by requiring respondents to make a singular discrete choice amongst several alternatives.

One of the primary advantages of the CM technique is the range of information which can be provided in terms of welfare estimates. This approach allows for the calculation of implicit prices or marginal WTP figures for each individual attribute. Such measures are often more useful from a practical management perspective since policy is often formulated on a marginal basis (Hanley, Wright, & Adamowicz, 1998). The relative importance of each attribute can also be established based on these implied attribute rankings (Bennett & Blamey, 2001b). Furthermore, WTP figures can also be obtained for management alternatives which change several attribute levels simultaneously. This allows welfare measures to be derived for any management scenario within the range of the attribute levels. Combined, this information allows policy-makers to develop resource management options which constitute a Pareto improvement over the status quo option. This flexibility afforded by the CM approach is arguably one of the primary advantages of this method relative to other non-market valuation techniques (Bennett & Blamey, 2001b).

Choice experiments are also able to address a number of the methodological limitations that still plague applications of the CVM. First, it has been theorised that the CM approach may be able to overcome some of the problematic responses encountered in contingent valuation applications. By not eliciting a direct WTP value from respondents and de-emphasising the relative importance of the payment vehicle, CM may be less susceptible to yea saying, strategic behaviour and protest responses. In addition, the process of evaluating multiple alternatives may also increase the cognitive demands associated with behaving strategically. Accordingly, engaging in truthful preference revelation could be a respondent's dominant strategy in any CM study (Bennett & Blamey, 2001b; Hanley et al., 2001).

Another issue is whether the CM approach is less susceptible to hypothetical bias than the CVM. Carlsson and Martinsson (2001) find that the WTP estimates resulting from an experimental market are statistically equivalent to those derived from a hypothetical choice experiment. In addition, the study found that respondents exhibited well-behaved rational preferences in terms of stability and transitivity. However, several studies have indicated that choice experiments may not necessarily outperform contingent valuation in this regard. For example, Carlsson, Frykblom and Johan Lagerkvist (2005) find that the inclusion of a CT script results in lower WTP estimates. This suggests that a degree of hypothetical bias was present in the choice experiment. In another study conducted by Lusk and Schroeder (2004), hypothetical choices were found to result in higher WTP estimates vis-à-vis choices elicited in a non-hypothetical setting. While additional tests

of criterion validity are required to determine the full extent of hypothetical bias, Bateman et al. (2002) states that there is no reason to believe *a priori* that choice experiments are any less susceptible to hypothetical bias.

With regard to framing effects, the CVM has been criticised for being unable to effectively communicate an appropriate frame to respondents. CM can address this by including a range of possible outcomes which involve trade-offs between attributes as opposed to the simplistic monetary trade-off associated with the CVM. This can enhance the realism of the task and promote more discerning choice behaviour among respondents. In addition, a number of contingent valuation studies exhibit estimates which are insensitive to changes in the scope of the environmental amenity. CM studies contain an internal test for any evidence of perfect embedding. Attributes which are statistically insignificant indicate that respondent utility is unresponsive to changes in the level of the attributes (Bennett & Blamey, 2001b).

The decompositional method inherent in the CM approach ensures that this valuation technique is particularly suited for benefit transfer purposes. Contingent valuation studies are often tailored to a very specific set of circumstances which may be impossible to replicate at another site. However, implicit prices can be easily transferred between sites which share similar attributes. In addition, the transfer of CM functions can be used to account for differences in population and site characteristics (Bennett & Blamey, 2001b; Rolfe, 2006b).

Despite the considerable strengths of the CM approach, there are limitations which the analyst needs to be aware of. Perhaps the main disadvantage of the CM approach is the cognitive burden imposed on respondents due to task complexity. In any CM study, respondents need to understand the overall choice task and the attributes which constitute the environmental good. Respondents are then required to evaluate multiple alternatives over a number of choice sets. The complexity associated with these tasks has been reported to lead to increased parameter variance and random errors due to fatigue effects. In addition, respondents may also adopt heuristic techniques (such as lexicographic preferences and satisficing strategies) in order to simplify the decision-making process. These factors can result in inconsistent choice responses (Bennett & Blamey, 2001b).

The second problem associated with applications of CM is the subjective nature of the experimental design process. Key design issues such as which attributes to include,

how many levels to assign and the construction of the choice sets are often left to the subjective judgement of the practitioner. This situation has largely arisen due to a lack of consensus in the CM literature regarding which methods constitute best practice. This lack of standardised design procedures is confounded by the fact that welfare estimates can be extremely sensitive to the design of the hypothetical market (Hanley & Barbier, 2009).

Another criticism of the CM approach relates to whether the value of the amenity is equal to the sum of its parts. To estimate the value of the environmental good in its entirety, one has to assume the summation of the individual attributes equals the whole. This can create problems if important attributes are omitted or if individual attributes are somehow valued differently when embedded within an overall good. For studies which require estimates of aggregate value, the CVM is generally preferred (Bateman et al., 2002).

From this overview, it is apparent that the CM technique has a number of advantages and disadvantages. However, the decompositional nature of this approach is particularly suited to the valuation of protected areas given the increasingly multidimensional nature of national park management. In addition, the flexibility afforded by this technique with respect to the estimation of welfare measures ensures that the results will be highly informative for park managers and policy-makers. Accordingly, discrete choice experiments represent a suitable means of eliciting visitor preferences and non-market values for the selected case study.

## **2.6 Review of Non-market Valuations of National Parks and Protected Areas**

The CM approach is an extremely versatile stated preference technique which has been applied to a range of non-market assets. Recent applications of the CM technique have been used to analyse preferences and derive environmental values for wetland attributes (Birol, Karousakis, & Koundouri, 2006; Carlsson, Frykblom, & Liljenstolpe, 2003; Othman, Bennett, & Blamey, 2004), urban water supply options (Blamey et al., 1999), cultural heritage sites (Mazzanti, 2003), landscape planning (Rambonilaza & Dachary-Bernard, 2007), river/catchment management (Kragt & Bennett, 2011) and general ecosystem management (Blamey, Rolfe, Bennett, & Morrison, 2000; Xu et al., 2007). As this research is concerned with estimating economic values for protected areas, the relevant literature will be reviewed.

Traditionally, non-market values for national parks and protected areas have been estimated using the contingent valuation, travel cost and HPM. There is currently a

substantial body of literature which reports the results of numerous applications of these valuation techniques to protected areas around the world. This previous research has demonstrated that national parks and protected areas possess significant economic value.

Using the CVM, Carson, Wilks and Imber (1994) found that the value of preserving the Kakadu Conservation Zone in Australia is conservatively estimated at AU\$435 million. This figure is several times the magnitude of the estimated returns associated with the opportunity cost of mining development.

Lee and Han (2002) utilised the CVM to estimate both direct and passive use values for several national parks in South Korea. The results of their study indicate that the TEV of the parks was significant and greatly exceeded the cost of administration and maintenance. This study was of particular policy relevance due to the prospect of declining central government budgetary allocations and the resulting need to develop pricing policies to ensure continued financial sustainability.

Other studies have also utilised the CVM to elicit WTP estimates in order to inform the development of national park entrance fees. For example, Shultz, Pinazzo and Cifuentes (1998) investigated the strengths and weaknesses of using the CVM to estimate entrance fees for several national parks in Costa Rica. The study also commented on the feasibility of using the resulting WTP estimates to implement a differential pricing strategy.

Furthermore, the CVM has also been used to specifically estimate direct use values in terms of the recreational and cultural benefits associated with national parks and protected areas. Belkayali, Atan, Talay and Akpınar (2010) estimated the recreational value of Göreme National Park in Turkey which is well-regarded for its unique natural and cultural values.

The biodiversity values of national parks and associated ecosystem services have also been the subject of several contingent valuation studies. Martín-López, Montes and Benayas (2007) elicited consumer preferences for the provisioning, regulating, cultural and supporting ecosystem services provided by Doñana National Park in south-west Spain. In another study, Moran (1994) found that the consumer surplus resulting from the non-consumptive use of biodiversity in Kenya's national parks significantly exceeded the opportunity cost of alternative productive uses.

Other studies have used the CVM in conjunction with other stated preference techniques in order to derive a more complete understanding of visitor preferences. For

example, Ellingson and Seidl (2007) combined the CVM with a contingent behaviour scenario in order to estimate the non-market values for improved tourist infrastructure for Eduardo Avaroa Reserve in Bolivia. Turpie and Joubert (2001) combined the CVM with conjoint analysis to measure visitor preferences for changes in water quality for Kruger National Park, South Africa. The study estimated the proportion of the total recreational value that could be directly attributed to river quality.

Revealed preference techniques have also been widely applied to derive non-market values for national parks and protected areas. In Australia, Pearson, Tisdell and Lisle (2002) used the HPM to estimate the impact of Noosa National Park on surrounding property prices. The key findings of the study indicated that properties within the viewshed of the national park experienced a 6-7% increase in land value. In the United States, Neumann, Boyle and Bell (2009) found that residential properties in close proximity to a National Wildlife Refuge have a price premium of US\$623 per 100 m of proximity.

The TCM has also been used extensively to value the recreational amenities of national parks and protected areas. Beal (1995) estimated the recreational value of Carnarvon Gorge National Park in Australia at AU\$40 million.

The TCM has also been used in conjunction with stated preference techniques as a measure of convergent validity. For example, the recreational value of Mt Buffalo National Park in Australia has been assessed by Hearth and Kennedy (2004) using both the TCM and CVM. The results of the study indicate that the consumer surplus estimates derived from the TCM exceeded the estimates obtained using the CVM. The authors conclude there is significant potential for the extraction of consumer surplus from entrance fees and other user charges.

Other environmental assets in protected areas which have been subject to valuation include the recreational value of bird watching at Lake Manyas, Turkey (Gürlük & Rehber, 2008). The ecological condition of the lake is under threat from a number of activities including pollution and visitor-induced pressures. The results of the study indicate the recreational values greatly exceed ongoing operational costs.

Two TCM applications have been utilised within the New Zealand context. The TCM has been used to estimate non-market values for Mt Cook National Park and the Milford Track in Fiordland National Park. Gough (1987) found that the economic surplus associated with the direct use of Mt Cook National Park was NZ\$2.2 million for New Zealand visitors. Woodfield and Cowie (1977) estimated the annual value of the Milford

track at NZ\$860,323. The study also comments on the feasibility of various pricing strategies including peak-load pricing as a demand rationing tool.

In contrast, only a handful of studies have attempted to derive economic values for the various attributes which characterise national parks and protected areas. For example, Han, Lee, Mjedle and Kim (2010) utilised a choice experiment to estimate WTP values for the reintroduction of the mountain goral in Woraksan National Park, South Korea. The study found that respondents held positive WTP values for an increase in the population of mountain gorals, the establishment of special conservation areas and the provision of education and information to the local population. The results of the study suggested that endangered species are a significant source of economic value for park visitors.

The CM approach has also been utilised to derive economic values for the recreational attributes of natural areas. For example, Christie, Hanley and Hynes (2007) used choice experiments to elicit user preferences for recreational infrastructure in woodland and forested areas in the United Kingdom. The authors noted that their results could be used to ensure future investment in recreational facilities is allocatively efficient.

Another study conducted by Jacobsen and Thorsen (2010) aimed to investigate public preferences *a priori* for the establishment of Denmark's first national park. Using a labelled choice experiment, a range of potential locations along with various environmental functions was presented to respondents. The research was unique in the sense that the study aimed to determine the extent to which respondent choice was influenced by generic environmental improvements or the inherent values associated with a particular site.

Several studies have also been carried out in protected areas to investigate various methodological aspects of discrete choice experiments. For example, Barkmann et al. (2008) investigated the application of the CM approach to protected area ecosystems in Indonesia when respondents were unfamiliar with ecosystem functions. The findings of the study indicated that complex ecosystem functions should be framed in terms of demand relevant ecosystem services. This ensures that respondents are able to express informed preferences which can meaningfully be translated into WTP estimates. In another study, Czajkowski and Hanley (2009) tested the effect of labels in the form of national park designations on the scale sensitivity of the resulting welfare estimates. They hypothesised that respondent choice and willingness to pay is dependent on both the attributes of an amenity and the labels. The findings indicated



that controlling for the effect of policy labels results in welfare measures which are more sensitive to the scope of the environmental amenity.

Other CM applications have analysed user preferences for ecotourism development. Hearne and Salinas (2002) elicited tourist preferences for the provision of recreational infrastructure in Braulio Carrillo National Park in Costa Rica. While the park was in a relatively undeveloped state, there was significant potential for future visitor induced development pressures. In general, visitors had a preference for the provision of additional onsite information, observation aids in the form of aerial trams and towers and upgraded recreational infrastructure (i.e. semi-rustic and modern facilities). In a similar context, Hearne and Santos (2005) analysed tourist preferences for the development of the Maya Biosphere Reserve in Guatemala. In general, both domestic and foreign visitors had preferences for more stringent management regimes (provision of more conservation measures and ecological services) and the presence of guides. Foreign tourists had a preference for unpaved roads and the provision of ecolodge type accommodation. In contrast, domestic visitors preferred paved roads and held no significant preferences for the provision of any accommodation facilities. Both visitor types held a strong preference for the introduction of entrance fees. The authors attribute this to the widespread recognition of the benefits (in terms of enhanced management outcomes) associated with the user fees. Chaminuka, Groeneveld, Selomane and van Ierland (2012) elicited tourist preferences for ecotourism development in communities surrounding Kruger National Park, South Africa. Tourists were found to hold positive values for the provision of a craft market and cultural tours. In contrast, the presence of accommodation facilities outside of the national park contributed negatively to utility. Naidoo and Adamowicz (2005) assessed the benefits associated with biodiversity conservation in Uganda's protected areas. The results of the study indicated that high levels of biodiversity contributed positively to utility and increased the probability of tourists visiting a protected area. In another nature-based recreation study Lee, Lee, Kim and Mjelde (2010) found that avian biodiversity had a positive impact on the utility of birdwatchers. Respondents also expressed a positive preference for additional interpretive services.

Within the developed country context, Juutinen et al. (2011) elicited visitor preferences for the management and development of Oulanka National Park in Finland. The study combined both ecological and recreational attributes including biodiversity, rest areas, frequency of interpretive signs and the expected number of visitor encounters. An entrance fee was included as the monetary payment vehicle. Park users were found to prefer high levels of biodiversity, fewer visitor encounters and only modest

enhancements to the rest areas and interpretive panels. This study most closely resembles the type of choice model which this research intends to apply within the New Zealand setting.

This overview of previous non-market valuation studies involving protected areas is by no means intended to be an exhaustive review of what is a large body of literature. Rather the review is intended to provide an indication of the general trends and topics being addressed by recent applications. This will assist in establishing the general research context in which the current study is embedded.

## **2.7 Summary**

Overall, protected areas and national parks play an extremely important role in the conservation of biodiversity. The continuing encroachment of the human economy and conversion of the natural biosphere has resulted in the irreversible loss of biodiversity. In response, the global protected area network has expanded considerably. These areas provide a raft of benefits by ensuring the preservation of key biological and genetic resources.

However, the lack of monetary values for national parks and protected areas has always been a major impediment to demonstrating the economic benefits which these areas provide. The provision of protected areas by the free market is subject to several market imperfections, arising from public good characteristics and positive externalities. This ensures that the price mechanism is unable to provide an accurate indication of the value of these areas.

The inability of the market to demonstrate this economic value often leads to protected areas being subject to pressure from competing development interests and limited public sector funding. The net result is the sub-optimal allocation of resources towards protected area networks and a loss of societal welfare.

This situation is evident from current trends in conservation financing which reveal that protected areas are grossly underfunded. One response from protected area management agencies has been to commercialise their operations in an attempt to capture additional sources of value.

Non-market valuation is an economic tool which can be used to address these issues. A number of different valuation methods exist which can broadly be classified as either revealed preference or stated preference techniques. For the purposes of this research, the CM approach appears to be the most suitable technique. This technique has

successfully been applied to a range of protected areas in order to gain an understanding of visitor preferences and non-market values.

The need to monetise the benefits from protected areas is becoming increasingly important. Monetary values can be used to justify additional investment in protected areas and the continuation of biodiversity conservation measures. These values can also be used to determine whether conservation policy is allocatively efficient. By integrating economic analysis with conservation management, non-market valuation is able to supplement the existing ecological arguments with the economic rationale for protected areas and national parks. In addition, the valuation process is able to assist managers in commercialising their operations with the aim of achieving financial sustainability. Accordingly, non-market valuation is able to make a significant contribution towards enhancing conservation outcomes and protected area management.

## **CHAPTER 3: CASE STUDY DESCRIPTION**

The previous chapter highlighted the range of economic benefits associated with protected areas and the increasing need to express these benefits in monetary terms. Non-market valuation is able to provide crucial information which can be used to ensure the continued financial and ecological sustainability of protected areas. To demonstrate this importance within the New Zealand context, the CM technique will be applied to a case study. The justification for selecting the CM approach and its advantages and disadvantages relative to other methods has already been discussed at length in Chapter 2. Accordingly, the purpose of this chapter is to provide a detailed description of the selected national park. The first section will present basic background information and an overview of the relevant policy framework and governing institutional arrangements. Subsequent sections will address the various natural, cultural and recreational values associated with the case study.

### **3.1 Case Study: Abel Tasman National Park**

Abel Tasman National Park (ATNP) is the smallest national park in New Zealand and is located in the Tasman region of the South Island (see Figure 3.1). The park covers approximately 230 km<sup>2</sup> and is a designated IUCN category II protected area. The coastal boundary of the park is delineated by the mean high water mark (Department of Conservation, 2008).

ATNP was established in 1942 as a result of concerns regarding the loss of native flora and fauna in this area. Prior to this, the area had been subject to a range of land use activities including agriculture, quarrying, mining and timber milling. Pre-European Maori also used the area for settlement and subsistence agriculture. The park was named after the Dutch explorer Abel Tasman who first visited the area in 1642 (Department of Conservation, 1997).

Currently, the park is experiencing a period of ecological recovery and rehabilitation as a result of the cessation of previous land use activities. This is evident from the rapid changes in the structural composition of the park's ecosystem, with regenerating bush giving way to more dominant forms of native vegetation. This has resulted in the development of well-established communities of native plant and animal species. However, these biological communities face ongoing threats from both the presence of invasive alien species and visitor induced pressures (Department of Conservation, 2008).

ATNP is highly regarded for its scenic values and recreational opportunities. The coastal track and adjacent beaches are popular attractions and this is reflected in the high levels of visitor usage (Department of Conservation, 2008). Accordingly, the management challenge for the Department of Conservation (DOC) is to strike an appropriate balance between ecological preservation and park development.

Figure 3.1 Location of Abel Tasman National Park



Source: Department of Conservation (2008)

### 3.1.1 Legislative Context and Institutional Arrangements

The legislative policy context in which ATNP operates is governed by the National Parks Act 1980. Section 4 of the National Parks Act (1980) states that:

- (1) It is hereby declared that the provisions of this Act shall have effect for the purpose of preserving in perpetuity as national parks, for their intrinsic worth and for the benefit, use and enjoyment of the public, areas of New Zealand that contain scenery of such distinctive quality, ecological systems, or natural features so beautiful, unique, or scientifically important that their preservation is in the national interest*
- (2) It is hereby further declared that, having regard to the general purposes specified in subsection (1), national parks shall be administered and maintained under the provisions of this Act that-*
  - (a) they shall be preserved as far as possible in their natural state:*
  - (b) except where the authority otherwise determines, the native plants and animals of the parks shall as far as possible be preserved and the introduced plants and animals shall as far as possible be exterminated:*
  - (c) sites and objects of archaeological and historical interest shall as far as possible be preserved:*
  - (d) their value as soil, water and forest conservation areas shall be maintained:*
  - (e) subject to the provisions of this Act and to the imposition of such conditions and restrictions as may be necessary for the preservation of the native plants and animals or for the welfare in general of the parks, the public shall have freedom of entry and access to the parks, so that they may receive in full measure the inspiration, enjoyment, recreation, and other benefits that may be derived from mountains, forests, sounds, seacoasts, lakes, rivers and other natural features.*

The provisions of the Act specifically recognise the important role of these areas in safeguarding New Zealand's natural, historical and cultural heritage for both current and future generations. Furthermore, the Act acknowledges the diverse range of benefits which protected areas provide including spiritual, aesthetic, educational, recreational and non-use values.

With regard to the governing institutional arrangements, there is provision in the Act for the development of general policy statements by the New Zealand Conservation Authority. These policy statements provide the guiding framework for national park managers in the form of regional conservation management strategies and national park management plans. DOC is responsible for the administration and management of these areas in accordance with the principles and objectives outlined in these documents (Department of Conservation, 2005).

### **3.1.2 National Park Context**

Within the context of New Zealand's protected area network, ATNP has a unique status. The park is recognised internationally for its scenic and aesthetic values and has been used to promote New Zealand as a premier tourist destination.

The key characteristics of the park include a rugged, forested interior with golden beaches and a pristine marine environment. The coastal track is considered to be one of New Zealand's finest walking tracks and is part of the Great Walks programme administered by DOC (Department of Conservation, 2008). These factors provide a strong justification for the continued protection of the intrinsic values of ATNP.

Within the context of the Nelson/Tasman conservancy, there are several other national parks including Kahurangi National Park and Nelson Lakes National Park. Compared to Abel Tasman, these parks are primarily managed for their biodiversity, scientific and wilderness values. ATNP is different in the sense that the park occupies a unique coastal environment, is relatively accessible and receives high levels of visitor usage (Department of Conservation, 2008). This provides DOC with a unique set of management challenges.

### **3.1.3 Landforms**

With regard to physical geography, ATNP encompasses a diverse range of natural landforms resulting in exceptional aesthetic and scenic values. These unique landforms include estuarine areas and wetlands, various coastal landforms, offshore islands,

karst landscapes and forested areas (Department of Conservation, 2008). For management purposes, DOC divides the park into two distinct areas, the coastal region and the interior region as shown in Figure 3.2. This figure also shows some of the major geographical features of the park.

Figure 3.2 Management Zones and Geographical Features



Source: Department of Conservation (2008)



The interior of the park owes its ruggedness to the Pikikiruna range which extends from Takaka Hill in the south to Separation Point in the north. The highest point of elevation is Mt Evans which is 1,156 m above sea level. The range is also the source of several major rivers including the Wainui and Awapoto (Department of Conservation, 2008).

Landforms commonly found within the interior of the park include gullies, hills and ranges which are generally covered in native vegetation. A number of wetland areas and freshwater ecosystems are present in the catchment areas. The park also has a number of both regionally and nationally significant geological landforms including cave systems and associated features including crystal facets and stalactites (Department of Conservation, 2008).

With regard to the coast, dominant landforms include drowned river valleys, forming estuaries and rocky headlands. The beaches along the coast are renowned internationally for their scenic and aesthetic values (Department of Conservation, 2008).

#### **3.1.4 Geology**

The underlying geology of ATNP is mainly comprised of granite rock which provides the source material for streambeds, coastal formations and beaches. The granite is also responsible for poorly conditioned soils which exhibit low levels of inherent fertility. Other geological features within the park include coal seams and deposits of limestone and quartz sandstone (Department of Conservation, 2008).

#### **3.1.5 Climate**

The prevailing climatic conditions within ATNP vary according to geographical location. The interior of the park is characterised by sub-alpine conditions with snow in winter, high rainfall levels and low average temperatures. Climatic conditions for the coastal region are milder and characterised by sea breezes, summer droughts and winter frosts (Department of Conservation, 2008).

#### **3.1.6 Flora and Fauna**

ATNP exhibits a high degree of species richness due to the diverse range of habitats which are present. A number of the plant and animal species within the park are both endemic and considered to be either threatened or at risk. The most recent biological survey of ATNP recorded the presence of 60 native animal species in the park and

surrounding area. The park plays an extremely important role in both regional and national conservation efforts and is consequently well-regarded for its scientific and biodiversity values (Department of Conservation, 2008).

The vegetation in the interior of the park is predominantly mixed lowland forest comprising of podocarp, beech and broadleaved species. The vegetation is heavily stratified according to altitude and soil composition. Lower altitudes with more fertile soils provide an ideal habitat for mixed lowland forests and large leafed shrub species. Kahikatea forests can also be found in close proximity to wetlands. In contrast, higher altitudes with less fertile soils are characterised by mountain beech, southern rata and southern cedar. There are 21 native plant species found in the interior of the park which are currently classified as either threatened or at risk by DOC (Department of Conservation, 2008).

The interior of the park provides a large tract of continuous forest which is an ideal habitat for common native bird species such as tui, bellbird, fantail and kereru. Other animal species present include several native land snails, numerous gecko species and a number of freshwater fish communities (Department of Conservation, 2008).

The coastal region has historically been the site of significant ecosystem modification due to agricultural and timber milling activities (Dennis, 1985). The rate of ecological succession and rehabilitation is slow due to poor inherent soil fertility. Native vegetation commonly found along the coastline includes kanuka forests, manuka scrub, nikau and pukatea. There is also a well-established tract of mature podocarp/broadleaved forest along the coast. Of the native plant species present along the coast, 12 are classified as either threatened or at risk. Just over one third of the parks threatened and at risk native species are found exclusively in the coastal region (Department of Conservation, 2008).

With regard to native fauna, the coast provides a habitat for a number of marine and land-based species including the variable oyster-catcher, banded dotterel, blue penguin and pied shag. The estuarine and coastal wetland ecosystems provide a habitat for pukeko, various duck species, fernbirds and reef herons (Dennis, 1985; Department of Conservation, 2008).

### **3.1.7 Threats to Ecosystem Integrity**

The main threats to the ecological integrity of ATNP are the presence of animal and plant pest species. These species can have both direct and indirect impacts on native

species in the form of competition, predation and browsing. Pressure from visitors and associated infrastructure will be addressed in subsequent sections.

One of the most pressing threats to the ecological integrity of ATNP is the proliferation of invasive plant species. The historical clearing of native vegetation through burning and logging created conditions which favoured the establishment of exotic species (Dennis, 1985). Pest species commonly found along the coast line include banana passion fruit, gorse, Japanese honeysuckle and marram grass. Pest species located in the interior of the park include German ivy, yellow jasmine and Himalayan honeysuckle. These communities typically become established from neighbouring populations in areas adjacent to the park. In some cases, regenerating native bush is able to dislodge invasive species from their existing niches (Department of Conservation, 2008). In other cases, particularly in the dynamic coastal environment, DOC may be required to actively manage these threats through the use of chemical control and/or physical removal (C. Golding, personal communication, April 5, 2012).

With regard to animal pests, the main threats to ecological integrity arise from possums, mustelids, wasps and feral goats and pigs. Possums and mustelids are considered to be the primary threat as they consume vast quantities of native vegetation and prey on native birds and their eggs. Wasps can compete with native species for limited resources and in some cases can swarm smaller birds. Feral pigs and deer can also consume native plants and disturb invertebrate communities (Department of Conservation, 2008). DOC currently manages these threats through a mixture of trapping, ground baiting and professional and recreational hunting (C. Golding, personal communication, April 5, 2012).

### **3.1.8 Culture and Heritage**

The cultural and heritage values associated with ATNP are linked to Maori and early European habitation of the area. It is estimated that Maori have had been visiting the coastal areas of the Tasman region for approximately 700 years. Historically, the marine life provided a plentiful supply of food for local Maori and archaeological investigations indicate the coastal region was the site of several fortified settlements. The coast also has a number of wahi tapu and urupara burial sites which have been officially recorded by the New Zealand Archaeological Association. The cave systems in the interior of the park are considered sacred due to their connections with Maori mythology (Department of Conservation, 2008).

European settlers were initially drawn to the Abel Tasman region due to the vast array of natural resources which were readily available. Areas of lowland forest were cleared to provide land for agriculture and the raw material inputs necessary for shipbuilding. Other activities included bark-stripping for tanning purposes and granite quarrying at Tonga Bay. Several farming estates were established at Awaroa, Bark Bay and Whariwharangi (Department of Conservation, 1997). However, due to poor soil fertility and the limited supply of native timber, the duration of European settlement was relatively short (Dennis, 1985). A number of farming structures still stand and are considered to be a source of significant heritage value. DOC is responsible for the management of sites deemed to be of major historical and cultural importance. DOC activity is guided by conservation plans which outline appropriate protection and threat mitigation measures (Department of Conservation, 2008).

### **3.1.9 Visitor Use and Recreational Activities**

Despite being the smallest national park in New Zealand, ATNP experiences high levels of visitor usage. The coastal track is the most popular walking track in New Zealand with approximately 151,000 visitors annually. Visitor activity is heavily concentrated in the coastal region with 95% of visitor use being within 500 m of the coastline. Visitor numbers typically peak between December and January with over 2,000 people per day entering the southern entrance of the park (Department of Conservation, 2008).

The facilities along the coastal track include four huts and 19 campsites which have a total capacity of 654 people. Totaranui campground is able to accommodate approximately 850 people and is a popular destination for New Zealand holidaymakers (Department of Conservation, 2011a). The campground also acts as an informal transport hub and receives approximately 1,200 visitors per day during the peak season (Department of Conservation, 2008).

Access to the coastal areas of the park is usually either by vehicle or boat. The main recreational activities in this region include tramping/hiking, mountain biking on designated tracks and various water-based activities such as kayaking and swimming. The scenic and aesthetic values of the coastal environment provide a unique setting for such activities (Department of Conservation, 2008).

A number of tramping tracks are also located within the interior of the park. The interior is less developed and is primarily oriented towards more experienced trampers. The interior has three huts which can accommodate a total of 24 individuals (Department of

Conservation, 2011b). Recreational opportunities offered in the interior of the park include tramping/hiking, recreational hunting, mountain biking and caving (Department of Conservation, 2008).

For several decades, there has been a perception among visitors that ATNP suffers from overcrowding, particularly along the coast during peak months (Department of Conservation, 2008). Perceptions of overcrowding can have a detrimental impact on visitor experiences and have the potential to compromise the core values embodied in the park. In addition, conflicts have arisen between recreational users due to the perceived incompatibility of some activities (Hawke, 2000).

In response, DOC has implemented a number of measures in an attempt to manage visitor numbers and user conflicts. These measures include the use of a hut booking system and conditions imposed on commercial operators regarding maximum group size and frequency of trips. DOC has also segmented the park into several recreational use zones which are reserved for particular recreational activities. Information-based management approaches are also utilised to minimise perceptions of overcrowding (Department of Conservation, 2008). In addition, DOC is actively working with the Tasman District Council to develop an integrated management plan which covers coastal areas adjacent to the park (D. Parr, personal communication, August 26, 2011). It should be noted, however, that the range of policy interventions available to DOC is limited due to provisions in the National Parks Act 1980 which guarantees freedom of access (Department of Conservation, 2008).

A major constraint on DOC's ability to develop ATNP is whether additional development would compromise the values which the national park is intended to protect. Further development has the potential to negatively impact on wilderness values and ecologically sensitive areas. For the most part, DOC considers the current level of facility provision to be both adequate and compatible with the scenic, heritage and natural values of the park (Department of Conservation, 2008).

### **3.1.10 Economic Benefits of ATNP**

ATNP provides a range of both onsite and offsite economic benefits. Given that the park is managed for high levels of visitor use, the recreational and tourism value of ATNP is likely to be significant. Other economic benefits are likely to include ecosystem services such as carbon sequestration, water purification, soil conservation and landscape stability (Department of Conservation, 2008).

Despite the extensive range of economic benefits provided by ATNP, most of these benefits have never been defined in monetary terms. However, one study undertaken by Butcher Partners Ltd (2005) assessed the impact of the park on the Nelson/Tasman economy. This study utilised a simple money generation method to evaluate the economic impact of the park which was expressed in terms of local output, value added, household income and employment.

The study canvassed visitors to establish their total onsite and offsite expenditure. This was combined with a contingent behaviour scenario which aimed to determine the impact of the park on visitor travel plans. Levels of DOC expenditure were also analysed and businesses holding concessions provided information regarding employment and income. These direct impacts were then combined with multipliers for the Nelson/Tasman economy to obtain the total economic impact. The results of the study indicated that ATNP generated NZ\$45 million in economic output per annum. Park-related tourism was also responsible for the creation of 370 jobs (full-time equivalent) and generated NZ\$11 million per year in additional household income. In contrast, DOC was spending approximately NZ\$1.2 million per year on management and administration (Butcher Partners Limited, 2005).

The Butchers Partners Ltd (2005) report acknowledged that this particular methodology did not capture other benefits which are a source of consumer and producer surplus. Accordingly, non-market valuation could be utilised to provide a more complete and accurate picture of the total economic benefits of ATNP.

### **3.2 Summary**

ATNP is New Zealand's smallest national park and is located in the Tasman District at the top of the South Island. The geographical coverage of the park includes a diverse array of physical landforms which provide a habitat for a range of threatened and at risk native flora and fauna. ATNP is widely regarded for its recreational opportunities and role in biodiversity conservation. The park is also a significant economic asset and makes a substantial contribution to regional economic output.

ATNP plays a unique role in New Zealand's protected area network due to its coastal location and associated scenic and aesthetic values. In terms of recreational value, the park receives extremely high visitation rates and is regarded as one of New Zealand's premier national parks. The park is also a significant source of ecological value due to the ongoing recovery and rehabilitation of native ecosystems.

However, these values also create a number of management issues including perceptions of overcrowding the need to accommodate potentially conflicting recreational uses. In addition, the high levels of visitor usage require DOC to develop adequate facilities and supporting infrastructure. Consequently, management of the park is largely dictated by the need to reconcile resulting development pressures with the intrinsic values enshrined in ATNP. This provides a unique context in which to undertake a non-market valuation study.

## **CHAPTER 4: RESEARCH METHODOLOGY**

The purpose of this chapter is to describe the research methodology that will be used to elicit consumer preferences and derive monetary values for ATNP. The structure of this chapter corresponds with the major design stages associated with undertaking a discrete choice experiment. Accordingly, the first section provides an overview of the decision problem in order to establish the context of the hypothetical market. The second section defines the attributes and associated levels which constitute the environmental good. This is followed by a discussion of appropriate experimental design methods and techniques. The remainder of the chapter will cover questionnaire development and sample design.

### **4.1 Choice Modelling Methodology**

The method and general design framework used in the development of the choice model follows that of Bennett and Adamowicz (2001), with supplementary insights from Lancsar and Louviere (2008) and Bateman et al. (2002). The following sections will provide a detailed account of the process used in the design and implementation of the model.

#### **4.1.1 Characterising the Decision Problem**

The first step in designing a choice experiment is to define the decision problem under consideration. The key decision problem addressed by this study is the lack of information regarding user preferences to inform the future development of ATNP.

The decision problem reflects the challenges which many protected area management agencies currently experience. As mentioned in previous chapters, protected areas are now tasked with a number of functions ranging from biodiversity conservation to the promotion of nature-based recreation (McNeely, 1994; Naughton-Treves et al., 2005). In addition, management agencies are under increasing pressure to adopt quasi-commercial practices in order to achieve financial self-sufficiency (WCPA-IUCN, 1998). Traditional survey methods which have been used to gauge visitor preferences often provide no information on the relative value of attributes and how consumers are willing to substitute between them (Juutinen et al., 2011).

Accordingly, the value which visitors place on various attributes can be used to enhance management outcomes in several ways. First, expressing benefits in



monetary terms can be used to justify continued public sector funding. Secondly, the valuation process is able to identify sources of consumer surplus which could potentially be captured and transformed into economic rent. Thirdly, economic values provide a basis to assess whether the allocation of conservation resources is efficient (IUCN, The Nature Conservancy, & The World Bank, 2005; WCPA-IUCN, 1998).

In order to measure the welfare effect of an alternative allocation of resources, a status quo or constant base option needs to be included in the model. This allows the resulting welfare estimates to be expressed as the additional costs and benefits of alternative park management options. This format is consistent with the marginal valuation framework which forms the conceptual basis of any CBA exercise (Bennett & Adamowicz, 2001).

#### **4.1.2 Attribute Definition and Level Selection**

The second major design stage in the construction of the choice model involves defining the attributes and levels which describe the alternative park management options. According to Cleland and McCartney (2010) and Bennett and Adamowicz (2001), the attribute definition process involves three steps. The first step involves identifying the important attributes which characterise the environmental good. The second step establishes an appropriate frame for the attributes. The final step involves assigning levels to each attribute.

A combination of primary data collection and secondary research methods were utilised to select attributes which were consistent with the decision problem. A comprehensive literature review was carried out in order to compile an initial list of potential attributes. Previous applications of the CM technique to protected areas were reviewed along with general literature relating to the management and operation of protected areas. In addition, documents and other publications relating specifically to ATNP were analysed to gain an understanding of current management issues. This list was then presented to a focus group with previous recreational experience in New Zealand's conservation estate. Participants were then asked to indicate which attributes played an important role in determining consumer choice and were given an opportunity to add additional attributes. A refined list of attributes was then provided to DOC staff for comment and final approval. All the attributes identified in the focus group were considered to be relevant by park managers ensuring there was little divergence between public and policy perspectives. This is important as Cleland and McCartney

(2010) state that divergent perspectives can lead to results which either do not reflect public values or are of little use to decision-makers.

In selecting the final attributes to be included in the choice experiment, three key design issues were considered. First, attributes which could be perceived by respondents to be causally related were screened and eliminated. A causal relationship exists when the level of one attribute is deemed to be a product of another (Blamey, Rolfe, Bennett, & Morrison, 1997). The inclusion of attributes at different stages of the cause-effect relationship can lead to respondents placing a greater emphasis on the casual attribute. This use of causal heuristics has been shown to result in the distortion of implicit price estimates (Blamey, Bennett, Louviere, Morrison, & Rolfe, 2002).

Secondly, attributes which referred to complex ecosystem functions were excluded due to a lack of appropriate biophysical data and respondent unfamiliarity. Barkmann et al. (2008) note that respondent unfamiliarity with an environmental amenity can result in stated values which are not based on fully informed preferences. This is likely to result in welfare estimates being subject to a range of biases including information and methodological misspecification bias.

The third issue revolves around the consideration of task complexity and associated cognitive burden. Several studies have indicated that increased task complexity (as defined by various design dimensions including the number of attributes) can lead to reduced choice consistency (Caussade, Ortúzar, Rizzi, & Hensher, 2005; DeShazo & Fermo, 2002). Mazzotta and Opaluch (1995) find that utilising more than five attributes can adversely affect the quality of respondent choice. There is also evidence that task complexity can result in participants adopting simplifying heuristics in favour of optimising decision strategies (Boxall, Adamowicz, & Moon, 2009; Hensher, 2007).

Currently, most CM applications utilise between 4-6 attributes with no reports of respondent fatigue or excessive cognitive burden. Accordingly, for this study a decision was made to restrict the number of attributes to five. Throughout this process care was taken to avoid the exclusion of salient attributes which could potentially introduce problems surrounding omitted variable bias.

The final list of attributes included number of native bird species present, onsite information, accommodation facilities, number of visitors and an entrance fee as the payment vehicle. The attributes are designed to capture the unique recreational and ecological benefits which ATNP is well-regarded for.

With the attributes defined, the levels which describe the potential future management options were developed. The status quo attribute levels were primarily obtained from the Abel Tasman National Park Management Plan (Department of Conservation, 2008). Consultation with DOC staff confirmed that these levels were still representative of the current situation at ATNP (M. Townsend, personal communication, October 21, 2011).

The plan provided a substantial amount of information regarding existing accommodation facilities and the availability of onsite information. The plan also cited data from a number of biological surveys and track visitor counters which proved useful in developing the two other attributes. It is important that the attributes are framed in a manner which is consistent with how respondents relate to the environmental amenity (Bennett & Adamowicz, 2001). For example, the visitor numbers attribute was framed in terms of the average number of people encountered over a 1 km walk. With regard to this attribute, special care was taken to avoid the use of loaded terms such as “crowding” in order to avoid influencing respondent preferences.

The non-status quo attribute levels were developed in consultation with DOC staff to ensure realistic management outcomes. The range of the attribute levels must also be sufficient to ensure respondents are not indifferent between the various management options (Bennett & Adamowicz, 2001).

In terms of the monetary attribute, ideally the chosen payment vehicle should be coercive, credible and acceptable to respondents (Bateman et al., 2002). There is a general belief that voluntary payment vehicles should be avoided since they can promote free riding behaviour (Hanley & Barbier, 2009). In addition, the payment vehicle needs to be realistic and have an obvious link with the consumption of the environmental amenity. With regard to acceptability, the payment vehicle should not result in a high level of protest responses (Bateman et al., 2002; Thang Nam & Bennett, 2009).

Within a national park/protected area context, an entrance fee appears to satisfy this criteria. Entrance fees are both a credible and coercive means of raising additional funds. With regard to acceptability, the concept of paying for access to a national park would be foreign to many New Zealanders. Conservation funding is sourced from general tax revenues and legislation prohibits the use of financial mechanisms which restrict access. This may result in a high level of protest responses from New Zealanders. However, alternative payment mechanisms such as taxation instruments and utility payments do suffer from a number of disadvantages including the lack of

credibility and poor coverage. For example, taxation instruments are not applicable to overseas tourists and could act to exacerbate hypothetical bias. Accordingly, an entrance fee was chosen as the monetary payment vehicle.

Special consideration was also given to the range of the entrance fee which should encompass the extreme points of the linear part-worth without being unrealistic (Johnson, Kanninen, Bingham, & Özdemir, 2007). The final list of attributes and associated levels are given in Table 4.1. The status quo attribute levels are those presented as Level 1.

Table 4.1 Attributes and Levels

<b>Attribute</b>	<b>Definition</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>
<i>Native Bird Species (NBS)</i>	Number of native bird species present	50 species	60 species	70 species
<i>Onsite Information (ONI)</i>	Onsite information available to visitors	Interpretive signs	Interpretive signs, brochures	Interpretive signs, brochures and visitor centre
<i>Accommodation Facilities (ACF)</i>	Type of accommodation available to visitors	Campgrounds and huts	Cabins	Lodges
<i>Number of Visitors (NMV)</i>	Expected number of visitor interactions	50 people over a 1 km walk	40 people over a 1 km walk	30 people over a 1 km walk
<i>Entrance Fee (ENF)</i>	Entrance fee (\$ NZ)	\$10	\$20	\$30

### 4.1.3 Experimental Design

Experimental design procedures are utilised in CM to formulate the various attribute profiles and choice sets that will be presented to respondents. One method which can be used to derive attribute profiles is through the use of a full factorial design. A full factorial consists of all possible attribute level combinations and has the advantage of being able to estimate both main and interaction effects (Hoyos, 2010). However, the combination of five attributes each with three levels, results in 243 unique treatment combinations. As it is simply not practical for respondents to simultaneously evaluate such a large number of alternatives, a fractional factorial design was used.

A fractional factorial design utilises a sample of the full factorial in order to estimate the effects of interest (Lancsar & Louviere, 2008). An OMEP for six variables each with three levels was obtained from a design catalogue (Hahn & Shapiro, 1966) and is shown in Table 4.2. As suggested by Hensher, Rose and Greene (2005) an additional attribute was included as orthogonal blocking variable in order to reduce the number of choice sets presented to each respondent. The design consists of 18 treatment combinations which have been blocked into three different segments. By using a fractional factorial design, there is an implicit assumption that all attribute interactions are negligible (Hensher et al., 2005). According to Louviere, Hensher and Swait (2000) main effects typically account for between 70-90% of explained variance, indicating that this assumption may not be too unreasonable.

Table 4.2 Experimental Design – Experimental Plan Code Number 19a

Attribute Profile	OMEP – Attributes					Block Variable
	<i>NBS</i>	<i>ONI</i>	<i>ACF</i>	<i>NMV</i>	<i>ENF</i>	
1	0	0	0	0	0	0
2	0	1	1	2	1	1
3	0	2	2	1	2	2
4	1	0	1	1	1	2
5	1	1	2	0	2	0
6	1	2	0	2	0	1
7	2	0	2	2	1	0
8	2	1	0	1	2	1
9	2	2	1	0	0	2
10	0	0	2	1	0	1
11	0	1	0	0	1	2
12	0	2	1	2	2	0
13	1	0	0	2	2	2
14	1	1	1	1	0	0
15	1	2	2	0	1	1
16	2	0	1	0	2	1
17	2	1	2	2	0	2
18	2	2	0	1	1	0

Source: Adapted from Hahn and Shapiro (1966)

There are currently a wide range of design strategies which can be used to assign attribute profiles to choice sets (Louviere et al., 2000; Street & Burgess, 2007; Street, Burgess, & Louviere, 2005). Experimental Plan 19a from Hahn and Shapiro (1966) provided a starting design with the attribute profiles comprising the first alternative in each choice set. The second alternative was generated using a strategy known as the mix and match method as described by Johnson, Kanninen, Bingham and Ozdemir (2007). First, a rotation or fold-over of Plan 19a was generated to create a set of rotated alternatives. An additional shuffling step was then introduced to avoid each choice set being characterised by the same incremental difference between attribute

levels. Both the original and rotated profiles were shuffled and one alternative from each array was randomly paired to create a choice set (see Appendix 1 for the full design).

Ideally, the resulting experimental design should maximise the statistical information obtained about the estimated parameters. Huber and Zwerina (1996) have developed a set of criteria to evaluate the statistical efficiency of an experimental design for a non-linear choice model. This criteria includes orthogonality, level balance, minimal overlap and utility balance. A design which is orthogonal ensures the resulting parameter estimates are uncorrelated or statistically independent (Hensher et al., 2005). Attribute level balance occurs when each attribute level is replicated an equal number of times in the design matrix (Rose & Bliemer, 2009). As Johnson et al. (2007) state, any imbalance may distort parameter estimates since the amount of information gained about each level will be asymmetric. Attribute level overlap occurs when attribute levels are invariant across choice sets providing no information about how respondents trade between alternatives (Johnson et al., 2007). Finally, utility balance requires the utility associated with each alternative to be approximately equal (Carlsson & Martinsson, 2003). However, Louviere and Lancsar (2009) note that the concept of utility balance is flawed in the sense that no meaningful information about attribute trade-offs is obtained if respondents are technically indifferent between the alternatives. With the exception of utility balance, the three remaining criteria will be used as a benchmark to assess the statistical efficiency of the experimental design.

One of the management profiles (attribute profile number 1 – see Table 4.2) was excluded from the final design since it combined the status quo attribute levels with a non-zero entrance fee. This alternative would be strongly dominated in every choice set and could be perceived by respondents as implausible. The deletion of this alternative will ensure the experimental design does not exhibit perfect orthogonality and introduces a degree of attribute level imbalance.

The resulting choice sets were screened for dominated alternatives and overlapping attribute levels. Several choice sets were re-ordered in order to minimise these occurrences. The presence of these features ensures that the choice data provides no information about the willingness of respondents to trade between certain attributes (Johnson et al., 2007). Accordingly, from an efficiency perspective, the incidence of attribute level overlap should be minimised and dominated alternatives excluded.

With regard to format, each choice set contains three alternatives inclusive of a status quo option which remains constant. The decision regarding the number of alternatives

to include in the choice sets is largely left to the discretion of the analyst. While the use of pair-wise comparisons such as those described by Breffle and Rowe (2002) may reduce task complexity, this format may not necessarily be optimal. Rolfe and Bennett (2009) find that a dichotomous choice format results in respondents systematically ignoring differences in attribute levels by utilising a fixed choice decision strategy. This is not ideal given that welfare estimates are dependent on the marginal rate of substitution between the attributes. The inclusion of a third alternative was found to reduce the likelihood of fixed choice behaviour and serial non-participation (Rolfe & Bennett, 2009). Consequently, a decision was made to adopt a multiple choice format which utilised three alternatives. In total, the number of choice tasks presented to respondents will be restricted to five or six depending on the survey block to which they are assigned.

#### **4.1.4 Questionnaire Design**

The questionnaire development stage involves designing a survey instrument which will be used to elicit visitor preferences. In general, the design principles used in the construction of a CM survey are based on those used in contingent valuation.

Throughout the questionnaire design, particular attention was given to the overall structure of the survey and presentation. Bateman et al. (2002) suggests that the typical question order consists of an introductory section with attitudinal and lifestyle questions, a valuation section inclusive of choice sets and a final section which elicits respondent characteristics. For presentation purposes, the survey instrument needs to be user friendly and visually appealing. This can be achieved through the use of neutral colours, large font and uncluttered layout in order to give a professional appearance (Bateman et al., 2002).

The following sections will provide a detailed overview of both the development and content of the questionnaire. The final version of the survey is provided in Appendix 2.

- Introduction

The first section of the survey informed respondents of the topic under investigation and the importance of the study. Details regarding the confidentiality of survey responses and participants rights were also provided. These details were included in order to establish the credibility of the survey and gain the trust of respondents.

Respondents were then presented with a series of general questions about their current visit to the park and an attitudinal rating question. These 'warm-up' questions are intended to facilitate participant engagement with the survey and force respondents to investigate their preferences about the amenity (Krupnick & Adamowicz, 2007).

Throughout the introductory section, participants were advised that ATNP was being used as case study in order to mitigate the potential for importance bias. Importance bias occurs when the act of administering a questionnaire conveys a sense of significance or value about the environmental amenity to the respondent. This bias effectively acts as an implied value cue which can result in inflated WTP estimates (Bateman et al., 2002). The introduction also emphasised the fact the survey was being undertaken primarily for academic purposes in order to mitigate the potential for strategic behaviour.

- Statement of the Issue

The next questionnaire design stage involves introducing the decision problem. Participants were told that in order to cope with high levels of visitor usage and continuing pressure on existing facilities, additional park development would be necessary. To inform future development, managers require information about visitor preferences.

A supplementary information sheet provided additional background information about the park and an overview of park management issues. The current situation in terms of the status quo attribute levels was also explained. A colour map of the park was included to assist respondents in contextualising the information and break up the text.

- Statement of Potential Solution

The potential solution presented to respondents included the provision of upgraded facilities and more stringent management actions that would lead to fewer visitor interactions and more native birds. Examples of potential actions which could result in these outcomes were given to enhance the plausibility of the choice scenarios. The final outcomes were defined in terms of the non-



status quo attribute levels. Respondents were then asked to make a number of choices between competing management options for ATNP.

A basic level of information about the proposed development programme was provided to respondents. According to Mathews, Freeman and Desvousges (2007), the optimal amount of information to include in a stated choice study is a function of task complexity and respondent familiarity. The provision of additional information was deemed unnecessary given that respondents will have experience<sup>1</sup> with the national park. Furthermore, the selected attributes are primarily recreational in nature and do not relate to complex ecosystem functions and processes.

With regard to presentation, a bullet point layout was utilised in order to minimise the amount of text. To reduce the potential for amenity misspecification bias and implied value cues, the information was screened for factual accuracy and presented using neutral wording (Mathews et al., 2007).

With regard to the monetary payment vehicle, participants were told that park managers did not have sufficient financial resources to fund these outcomes. Accordingly, one source of funding could come from a park entrance fee which would apply to visitors over 18 years of age and be in addition to any existing charges. Participants were informed that the fee would be charged for every visit but would not restrict the length of the visit.

Boyle (2003) and Bateman et al. (2002) also stressed the importance of establishing a time frame over which the potential solution will materialise. It would be unrealistic for the proposed management outcomes to be realised within the space of several years. While DOC currently develop their management plans on a 10-year basis, respondents may view this time period as too long. Accordingly, respondents were told that managers required information regarding visitor preferences for their five-year plans.

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<sup>1</sup> Respondents will be surveyed as they exit ATNP.

- Framing

The next step involved establishing the wider context in which the environmental amenity is embedded. This was achieved through the use of a CT script which reminded respondents of the limitations imposed by their budget constraint and the presence of substitute goods. The purpose of a CT script was to reduce the impact of hypothetical bias and make respondents aware of alternative consumption options (Cummings & Taylor, 1999).

There is still considerable debate about the optimal design and effectiveness of CT scripts in the stated preference literature (Aadland & Caplan, 2006; Cummings & Taylor, 1999; Rolfe, Bennett, & Louviere, 2002). For practical reasons a shortened version of the CT script was included in the questionnaire. Specifically, participants were reminded that there are other national parks in the Nelson/Tasman conservancy including Kahurangi and Nelson Lakes National Parks. Participants were also asked to consider their household budget and whether they could afford the proposed entrance fee.

In addition, a framing statement was included to address any perceptions regarding implausible management options. The statement told respondents that “the choice scenarios represent hypothetical outcomes and some management options may seem strange – but they are all possible”. This statement was designed to enhance the credibility of the choice scenarios and reduce the incidence of simplifying decision strategies (Blamey et al., 2002).

Another important consideration was whether the established frame was incentive compatible. In order for a stated preference survey to be incentive compatible, participants must believe that their choice will somehow influence policy decisions regarding provision of the amenity. In addition, participants must also care about the final outcome with respect to their utility (Carson & Groves, 2007). A survey which satisfies this criterion is referred to as being consequential and provides respondents with a dominant strategy to reveal their true preferences (Harrison, 2007).

Ultimately, the biggest threat to incentive compatibility is hypothetical bias. If participants view the valuation exercise as inherently hypothetical then the resulting welfare estimates can be biased (Harrison, 2007). In order to address

this, a statement of consequence as suggested by McCartney and Cleland (2010) was included. Respondents were told that their answers were important and may be used to inform future management decisions. This provides the survey with an element of consequentiality which is a necessary pre-requisite for incentive compatibility.

- Choice Sets

With the decision problem and potential solution defined and the appropriate frame established, respondents are prepared to be introduced to the choice scenarios. With regard to the presentation of the choice sets, one key design consideration is whether to present the alternatives in a labelled or unlabelled format. Labelled alternatives provide respondents with informative titles about each management option. Labels are often utilised when information about the policy context is a relevant determinant of choice. Alternative-specific labels may also reduce the cognitive burden associated with the choice tasks. In contrast, unlabelled/generic alternatives have titles which provide no information to respondents (e.g. "Option A"). This may lead to better informed judgements as respondents are required to evaluate each alternative solely on the basis of attribute levels. This suggests that the generic format may be more appropriate when choice models are being used to derive non-market values (Blamey, Bennett, Louviere, Morrison, & Rolfe, 2000).

Accordingly, the choice sets were presented to respondents in a generic format (e.g. Option A,B,C,D,E,F,G,H,I,J,K,L and M). The choice sets were printed on separate pages to dissuade respondents from referring back to previous sets in order to inform their current decision. For each choice set, participants were asked to consider the three management options present and select the one they preferred the most. Figure 4.1 provides an example of a choice set.

Figure 4.1 Example Choice Set

	<b>Option A Current Situation</b>	<b>Option B</b>	<b>Option C</b>
<b>Presence of native birds</b>	50 species	70 species	60 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs, brochures, visitor centre	Interpretive signs
<b>Type of accommodation</b>	Campgrounds and huts	Campgrounds and huts	Lodge type accommodation
<b>Number of visitors</b>	50 people over a 1 km walk	40 people over a 1 km walk	50 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$20	\$10
<b>Your most preferred option (tick ONE box)</b>			

- Follow-up Questions

A set of debriefing questions are usually included in most CM questionnaires in order to gain greater insight into the decision strategies employed by respondents. These decision strategies can then be screened to determine whether the resulting choices are valid (Krupnick & Adamowicz, 2007). Participants who select the status quo alternative in every choice set will be asked to state their reason for doing so. This is intended to allow the identification of payment vehicle protests and respondents who are either uncertain or confused by the choice task.

- Socioeconomic and Attitudinal Data Collection

The last section of the questionnaire is concerned with the collection of socio-economic, demographic and attitudinal data. According to Dillman (2000), personal questions relating to income and age should be introduced last as this reduces the likelihood of respondents abandoning the survey.

The theory of reasoned action developed by Fishbein and Ajzen (1975) suggests that participant behaviour (e.g. respondent choice and willingness to pay) is ultimately a function of individual attitudes, demographic variables and socioeconomic factors. Accordingly, this data can be incorporated into the choice model as covariates which can be used to predict respondent choice. This information can also be used as a test of construct validity and for respondent classification purposes (Krupnick & Adamowicz, 2007). Information that will be collected from respondents includes gender, age, education level, whether participants have children, residency status, annual household income and if participants belong to an organisation concerned with environmental conservation.

Finally, respondents were given an opportunity to provide a written comment relating to any aspect of the questionnaire. Such comments could provide useful feedback regarding the design of the survey instrument or greater insight into visitor preferences and decision strategies. A final statement of appreciation was included.

## **4.2 Sample Design**

Prior to the administration of the survey to participants, the techniques and procedures that will be used to obtain the sample must be detailed. This includes the identification of the sample population and frame, consideration of adequate sample size and selection of the survey mode.

### **4.2.1 Study Population**

Definition of the appropriate study population is largely dictated by the decision problem under investigation. According to Champ and Welsh (2007) the issue of whose values have standing in any non-market valuation exercise is context specific and may be difficult to identify. Champ (2003) suggests that the appropriate study population consists of those individuals who benefit from the proposed policy intervention and are willing to pay to secure provision.

The inclusion of non-use values which have pure public good characteristics does complicate the process of identifying the relevant study population. Individuals may receive the benefits from an amenity without engaging in direct consumption. For some

amenities with large non-use values (such as protected areas), only a small proportion of the total benefit is likely to be captured onsite (Champ & Welsh, 2007).

This study is primarily interested in understanding user preferences for different ways that ATNP can be managed. Accordingly, the study population will consist of visitors to ATNP. With regard to non-use values, many of the selected attributes focus on the recreational benefits which accrue to individuals within the boundary of the national park. Consequently, this study does not have a large passive value component and most of the measured benefits will be captured in terms of direct use value.

#### **4.2.2 Sample Frame**

The sample frame refers to the entire list of eligible units from which a sample could be selected. For this research, a sample frame for the study population is largely non-existent as a complete list of park visitors is unavailable. This will necessitate the use of in-person onsite surveys which do not require a well-defined sample frame (Bateman et al., 2002).

#### **4.2.3 Sample Size**

Determination of the appropriate sample size in any non-market valuation study is largely a case of constrained optimisation. The sample size needs to be large enough in order to obtain reliable model estimates subject to the projects budgetary constraints (Hoyos, 2010).

Calculation of the optimal sample size is rarely achieved in CM applications since this requires information about the value of the parameter estimates *a priori* (Lancsar & Louviere, 2008). This has led to the development of a number of *ad hoc* rules regarding selection of sample sizes for choice models. For example, Bennett and Adamowicz (2001) suggest a minimum sample size of 50 respondents per survey block. Using this guideline, the target sample size for this study is 150 respondents.

#### **4.2.4 Survey Mode**

For this survey, selection of an appropriate administration mode is largely dictated by the absence of a sampling frame. This will require the use of an onsite intercept survey where respondents are approached and invited to participate. Individuals who accept the invitation will be presented with a self-administered questionnaire.

As the aim of the survey is to investigate visitor preferences for different ways of managing ATNP, the questionnaire will be administered at the park. After careful consideration of potential surveying sites, the southern (Marahau) entrance of the park was selected. This site is one of the main entrance points to the park and experiences high levels of foot traffic. There is also a visitor shelter with seating facilities which can be utilised for the comfort of participants. Visitors will be approached as they exit the park to ensure they have a reasonable degree of familiarity with the environmental good. Visitors aged 18 years and older will be invited to participate.

The primary advantage associated with this mode is that the administrator is always on hand to clarify any issues which may arise during the course of the survey. This is of particular importance given the complexity of the task and associated cognitive burden imposed on respondents (Champ, 2003). In addition, this method has been shown to produce consistently high response rates and can avoid some of the biases associated with interviewer administered questionnaires (e.g. social desirability bias and refusal to answer sensitive questions). The main disadvantages of this method include relatively high administration costs, lack of control over how respondents answer the survey and samples which are generally not representative (Champ & Welsh, 2007).

### **4.3 Pilot Testing and Implementation**

The questionnaire was tested on a convenience sample of postgraduate students in the Environmental Management Programme at Massey University. A basic set of guidelines was provided to respondents to assist their evaluation of the survey instrument. Respondents were also asked to comment on the credibility of the general scenario and hypothetical market with particular regard to the payment vehicle.

Based on respondent feedback, several changes were made to improve the structure, clarity of instructions and general readability of the survey. No changes were made to the description of the hypothetical market. The final version of the questionnaire was administered onsite at the Southern (Marahau) entrance of the park between 14 November 2011 and 23 November 2011.

### **4.4 Summary**

This chapter has provided a comprehensive overview of the methodology which has been used to construct the choice model for this research. The major design stages include establishing the decision problem, defining the attributes and levels, generating an experimental design, questionnaire design, sample design and pilot testing. At each

stage, the relevant theoretical and conceptual underpinnings were explored in order to assist the development of the model and its application. This is to ensure that the estimated non-market values are both valid and accurate and can be used to guide future management and policy decisions.

The next chapter will analyse and report the results of the choice model. This will include an overview of the survey results and presentation of the welfare estimates.





## **CHAPTER 5: DATA ANALYSIS AND RESULTS**

The previous chapter highlighted the key design stages used in the development and implementation of the choice model. In this chapter, the results of the CM application will be presented and analysed. First, a description of the survey responses will be provided including an analysis of respondent characteristics and response rates. The second section will describe the choice model used for the analysis and will detail aspects such as model specification and data coding. This will be followed by the results of the model and an interpretation of the model output. Finally, welfare measures in the form of implicit prices and compensating surplus estimates will be derived.

### **5.1 Survey Results**

In total, 183 questionnaires were collected over the survey administration period. Nine survey responses were subsequently discarded due to either payment vehicle protests or respondents being uncertain of their answers. In these surveys, respondents always selected the constant base alternative but revealed through debriefing questions that they had not utilised an optimising decision strategy. The relatively low level of protest responses indicates that respondents generally accepted the valuation scenario. The researcher also observed a number of respondents exhibiting lexicographic preferences, particularly in relation to the accommodation attribute. While traditionally viewed as a departure from optimising behaviour, recent evidence from Lancsar and Louviere (2006) show lexicographic preferences are not irrational. Accordingly, while lexicographic choices may not provide much information regarding attribute trade-offs, there appears to be no valid justification for their exclusion.

With regard to non-response rates, 24 individuals declined the invitation to participate in the survey which corresponds to a response rate of 88.4%. The presence of language barriers and time constraints were the primary reasons given for non-participation. In any stated preference survey, a degree of unit non-response is both inevitable and to a certain extent desirable. In order to elicit accurate welfare estimates, it is preferable for respondents to engage in non-participation rather than provide a response which is either ill-considered or not based on fully informed preferences (Mitchell & Carson, 1989). The relatively high response rate encountered in this survey is most likely a result of both the relevance and salience of the topic to park users.

Four surveys were handed back to the researcher only partially completed. Despite the missing socioeconomic and demographic information, the individual choice observations were retained for the analysis. Overall, 174 valid responses were received which provided 986 choice observations. A full breakdown of respondent demographic and socioeconomic characteristics is provided in Table 5.1.

Table 5.1 Respondent Characteristics

	<b>Number of Respondents</b>	<b>Percentage of Respondents (%)</b>
<b>Gender</b>		
Male	78	44.8
Female	96	55.2
<b>Age</b>		
18-24	51	29.3
25-34	73	42.0
35-44	13	7.5
45-54	13	7.5
55-64	17	9.8
65-74	6	3.4
75+	1	0.6
<b>Educational Attainment</b>		
Primary school	0	0
Secondary school	27	15.5
Tertiary diploma/certificate	25	14.4
University degree	120	69.0
<i>Not specified</i>	2	1.1
<b>Child Status</b>		
Children	39	22.4
No children	135	77.6
<b>Residency Status</b>		
NZ Permanent Resident	41	23.6
Visitor to New Zealand	133	76.4
<b>Annual Household Income (\$ NZ)</b>		
<\$30,000	72	41.4
\$30,001-60,000	24	13.8
\$60,001-90,000	31	17.8
\$90,001-120,000	17	9.8
\$120,001-150,000	7	4.0
\$150,001-180,000	10	5.7
\$180,001+	11	6.3
<i>Not specified</i>	2	1.1
<b>Environmental Organisation Membership</b>		
Member	42	24.1
Non-member	132	75.9
<b>Previous Visit to ATNP</b>		
Yes	36	20.7
No	138	79.3
<b>Intended Future Visit to ATNP</b>		
Yes	94	54.0
No	80	46.0
<b>Length of Current Visit</b>		
Day trip	40	23.0
Overnight trip	134	77.0

The survey achieved a reasonable balance in terms of gender with males and females comprising 44.8% and 55.2% of the sample population respectively. The distribution of respondent age is skewed towards younger individuals with 71.3% of respondents being younger than 35 years of age. In general, respondents had a high level of educational attainment with 83.4% having some form of tertiary qualification (tertiary diploma/certificate or university degree). In terms of family situation, 22.4% of the sample population have children. A substantial majority of respondents were visitors to New Zealand with only 23.6% of those surveyed permanently residing in New Zealand. In relation to income, 41.4% of respondents recorded an annual household income which was less than NZ\$30,000. Only 24.1% of the sample population were members of an environmental organisation. Respondents were also asked several questions about their use of the national park. Approximately 20.7% of the sample population had previously visited ATNP and just over half of those surveyed indicated they would visit the park within the next five years. With regard to the length of the current visit, 77.0% of respondents were on an overnight trip.

One of the main disadvantages of onsite intercept surveys is that it is unlikely to result in a representative sample of park users (Bateman et al., 2002; Champ & Welsh, 2007). This particular survey method has the potential to introduce several sources of sampling bias in the form of temporal and geographical bias. Temporal bias can occur when there is a significant difference in park visitor characteristics between different periods of the year (Bateman et al., 2002). For example, the questionnaire was administered in November prior to the summer break which may explain the relatively low proportion of New Zealanders surveyed. A degree of geographical sampling bias may also be present given several of the smaller park entrances were not covered by a survey point (Bateman et al., 2002). Currently, DOC does not collect detailed statistical information about park visitors. As a result, it is impossible to gauge the extent to which the sample of park visitors is representative of the wider visitor population.

Prior to the introduction of the choice scenarios, respondents were presented with an attitudinal rating task. Using the four pre-existing park attributes, respondents were asked to indicate the extent to which these factors were important to their experience of ATNP. A five-point Likert scale was utilised and the results are presented in Table 5.2.

Table 5.2 Respondent Attribute Preference Rating

Attributes	Attribute Preference Rating (1=Very important, 3= Moderately important, 5= Not important)				
	1	2	3	4	5
<i>Native birds</i>	51 (29.3%)	46 (26.4%)	43 (24.7%)	26 (14.9%)	8 (4.6%)
<i>Onsite information</i>	53 (30.5%)	59 (33.9%)	36 (20.7%)	21 (12.1%)	5 (2.9%)
<i>Accommodation facilities</i>	43 (24.7%)	46 (26.4%)	50 (28.7%)	21 (12.1%)	14 (8.0%)
<i>Number of visitors</i>	37 (21.3%)	67 (38.5%)	44 (25.3%)	19 (10.9%)	7 (4.0%)

The results in Table 5.2 indicate that a vast majority of respondents believed the attributes played an important role in their national park experience. Approximately 80% of respondents regarded the presence of native bird species as moderately to very important. In addition, 85% of respondents indicated that visitor numbers were a significant factor which influenced their recreational experience. The same percentage of survey participants reported that the provision of onsite information made an important contribution to their visit. In terms of accommodation facilities, slightly fewer than 80% of respondents believed this attribute constituted an important part of their national park experience. This is encouraging as it confirms the attributes are relevant from a demand perspective and are therefore likely to be significant determinants of respondent choice. In general, the attribute preference ratings should exhibit a degree of correlation with respondent choice and willingness to pay (Krupnick & Adamowicz, 2007). The information presented in Table 5.2 can also be used by park managers in conjunction with the final valuation estimates.

## 5.2 Choice Modelling

The following sections provide a detailed overview of the choice model utilised in this study. This includes a description of the model specification, data coding, model results and an evaluation of the model output.

### 5.2.1 Model Specification

The IUFs which were used to estimate the discrete choice model are provided below. Table 5.3 provides a description of the variables used in the model specification.

$$U(A) = \beta_1 NBS + \beta_2 MED + \beta_3 FUL + \beta_4 CAB + \beta_5 LOD + \beta_6 NMV + \beta_7 ENF$$

$$U(B) = ASC + \beta_1 NBS + \beta_2 MED + \beta_3 FUL + \beta_4 CAB + \beta_5 LOD + \beta_6 NMV + \beta_7 ENF + ASC * GEN + ASC * AGE + ASC * EDU + ASC * BEQ + ASC * VIS + ASC * INC + ASC * ENV + ASC * OPT$$

$$U(C) = ASC + \beta_1 NBS + \beta_2 MED + \beta_3 FUL + \beta_4 CAB + \beta_5 LOD + \beta_6 NMV + \beta_7 ENF + ASC * GEN + ASC * AGE + ASC * EDU + ASC * BEQ + ASC * VIS + ASC * INC + ASC * ENV + ASC * OPT$$

Table 5.3 Choice Model Variables

Variable	Definition
ASC	Alternative specific constant (1 if option B or C selected, 0 if otherwise)
NBS	Native bird species
MED	Medium onsite information (interpretive signs and brochures)
FUL	Full onsite information (interpretive signs, brochures and visitor centre)
CAB	Cabin type accommodation
LOD	Lodge type accommodation
NMV	Number of visitors
ENF	Entrance fee
ASC_GEN	Respondent gender (1=male, 0=female)
ASC_AGE	Respondent age bracket (coded 1-7, youngest to oldest)
ASC_EDU	Respondent education level (1= university degree, 0 if otherwise)
ASC_BEQ	Respondent child status (1= child, 0 if otherwise)
ASC_VIS	Respondent visitor status (1= visitor to New Zealand, 0 if otherwise)
ASC_INC	Respondent income bracket (coded 1-7, lowest to highest)
ASC_ENV	Respondent environmental organisation membership (1=member, 0 if otherwise)
ASC_OPT	Respondent future visit within 5 years (1=yes, 0 if otherwise)

The first utility specification (Option A) represents the constant base option or status quo situation. The two remaining specifications (Option B and C) represent the two alternative management options. For the purpose of computational ease, the IUFs are specified as linear in parameters. With regard to the socioeconomic and demographic characteristics, a set of dummy variables was created to allow these factors to be

included in the model through interactions with the alternative specific constant (see Table 5.3).

The use of the standard MNL model needs to be seen within the context of the model's assumptions and limitations. First, respondents are assumed to have homogenous preferences for an environmental amenity. Accordingly, the MNL model will derive a single attribute parameter coefficient for the entire sample of park users. Secondly, the IIA behavioural condition allows for only limited substitution patterns between alternatives. Thirdly, all errors terms are assumed to have the same scale parameter (Holmes & Adamowicz, 2003).

### **5.2.2 Data Coding**

With regard to the coding of the dataset, a number of different coding formats can potentially be utilised. For the attributes expressed in quantitative terms (i.e. native bird species, visitor interactions, entrance fee) the attribute-level labels can be used. The qualitative attributes (i.e. accommodation facilities, onsite information) can either be coded using design codes or one of the non-linear coding structures. Hensher, Rose and Greene (2005) caution against the use of design codes since this format assumes that each attribute level has a uniform effect on marginal utility. In order to capture any non-linear effects and more accurately represent the utility part-worth, dummy or effects coding is required.

These two coding formats create a set of new variables equal to the number of attribute levels minus one. This allows utility part-worths to be estimated for each individual attribute level. Effects coding is generally regarded as the superior format since dummy coding results in the base level of the attribute being perfectly correlated with the alternative specific constant (Hensher et al., 2005). This can cause identification problems within the model since it becomes impossible to isolate the effect of the base level from other unobserved factors which influence utility (Bech & Gyrd-Hansen, 2005). Accordingly, the accommodation and onsite information attributes were effects coded resulting in the creation of two additional variables respectively. In both cases, the status quo attribute levels were utilised as the designated reference points and hence are not directly estimated in the resulting model. The full coding structure that will be used in the regression analysis is shown in Table 5.4.

Table 5.4 Attribute Coding Structure

Attribute	Levels	Coding Structure
Native bird species (NBS)	50 native bird species 60 native bird species 70 native bird species	50 60 70
Onsite information (MED, FUL)	Interpretive signs Interpretive signs and brochures Interpretive signs, brochures and visitor centre	MED=-1; FUL=-1 MED=1; FUL=0 MED=0; FUL=1
Accommodation facilities (CAB, LOD)	Campgrounds and huts Cabin type accommodation Lodge type accommodation	CAB=-1; LOD=-1 CAB=1; LOD=0 CAB=0; LOD=1
Number of visitors (NMV)	50 people over a 1 km walk 40 people over a 1 km walk 30 people over a 1 km walk	50 40 30
Entrance fee (ENF)	\$10 \$20 \$30	10 20 30

### 5.2.3 Model Results

The results of the CM application are presented in Table 5.5 which includes the parameter estimates for two separate MNL models. The first model (Model 1) uses a basic specification to demonstrate the effect of the key design attributes on respondent choice. The second model (Model 2) utilises a more comprehensive specification which includes the design attributes and various socioeconomic, demographic and attitudinal variables. A full description of the model specification and associated variables is provided in section 5.2.1.

The MNL model calculates the probability of a respondent selecting an alternative based on the utility derived from the different park management outcomes. Accordingly, alternatives with higher levels of desirable attributes have a higher probability of being selected (Bennett & Adamowicz, 2001). The parameter coefficients represent the marginal utility associated with each attribute (Hanley & Barbier, 2009).



Table 5.5 Model Results

Variables	Model 1		Model 2	
	Coefficient	Standard error	Coefficient	Standard error
ASC	0.07306	0.23721	-0.83403**	0.35777
Native bird species	0.04734***	0.00688	0.04871***	0.00706
Basic information	-0.20258**	0.08092	-0.22436***	0.08357
Medium information	0.06915	0.07228	0.06579	0.07394
Full information	0.13343*	0.07207	0.15857**	0.07392
Campgrounds and huts	0.43320***	0.07599	0.43321***	0.07841
Cabin accommodation	-0.04318	0.08302	-0.06082	0.08604
Lodge accommodation	-0.39003***	0.08179	-0.37239***	0.08381
Number of visitors	-0.04532***	0.00726	-0.04799***	0.00754
Entrance fee	-0.07282***	0.00734	-0.07757***	0.00769
ASC_GEN			0.13438	0.15001
ASC_AGE			0.23754***	0.07890
ASC_EDU			0.14215	0.16952
ASC_BEQ			-0.78562***	0.26701
ASC_VIS			-0.47366**	0.19154
ASC_INC			0.19906***	0.04853
ASC_ENV			0.13790	0.17168
ASC_OPT			0.38220**	0.15971
<b>Summary Statistics</b>				
LL (at convergence)	-919.336		-863.911	
Pseudo-R <sup>2</sup>	0.13		0.18	

Note: \*\*\*significant at 1% level, \*\*significant at 5% level, \*significant at 10% level

From the results in Table 5.5, the basic model shows that all of the key design attributes are statistically significant. The signs on the coefficients for the three quantitative attributes conform with *a priori* expectations. Namely, the presence of native bird species contributes positively to utility while the number of visitors and the proposed entrance fee have a negative impact. The two effects coded attributes can be regarded as an important determinant of choice provided at least one attribute level is statistically significant. Whilst effects coding does not directly measure the impact of the status quo attribute level, the coefficient is equal to the negative sum of the two estimated parameters (Bech & Gyrd-Hansen, 2005). The expected signs for the information and accommodation coefficients are somewhat ambiguous. For example,

some park visitors may have a preference for greater park development in terms of more onsite information and upgraded accommodation facilities. Other park users may prefer lower levels of development and a more basic experience. The coefficients for the information attribute show that additional information is preferred with the status quo level having a negative impact on utility. In contrast, the provision of upgraded accommodation facilities such as cabins and lodges had a detrimental impact on respondent well-being.

In order to account for observed respondent heterogeneity, Model 2 incorporates a range of socioeconomic, demographic and attitudinal variables through interactions with the constant term. According to Hensher et al. (2005), while these variables are not sources of utility in themselves, they can act as proxy measures for other unobserved attributes. All of the key design attributes are statistically significant and have their expected signs. The alternative specific constant is both statistically significant and negative which suggests that moving away from the status quo option was a source of disutility for respondents.

With regard to the socioeconomic and demographic variables, several attributes including gender, education and membership of an environmental organisation were found to be statistically insignificant. The interaction term for respondent age was positive indicating that older respondents were more likely to choose one of the alternative park management options. Furthermore, the interaction terms for respondent income and future visit were positive indicating that these factors increased the probability of respondents selecting an alternative management option. However, visitors to New Zealand and park users with children were more likely to choose the status quo management option.

Economic theory can provide some guidance with respect to the expected signs of the socioeconomic and demographic coefficients. For example, one would expect the income coefficient to be positive as respondents with higher household incomes have a greater ability to pay to secure provision. With regard to future visits to ATNP, option value motivations dictate that the expected sign should be positive. In terms of child status, the expected sign is somewhat ambiguous. Whereas bequest motivations may increase the probability of respondents selecting a new management option, the presence of children can decrease disposable household income (Morrison, Bennett, & Blamey, 1999). The results from Model 2 indicate that the coefficient signs conform with the expectations derived from economic theory.

In addition, all of the estimated attribute parameters were statistically significant indicating that respondents were sensitive to the scope of the environmental amenity. Accordingly, respondents were more likely to select options which provided desirable attributes and were WTP higher amounts for greater levels of the amenity (Bennett, 2011). Any insensitivity to scope would provide evidence of perfect embedding and raise doubts over the internal validity of the WTP estimates (Bennett & Blamey, 2001b).

As a number of the socioeconomic and demographic variables are statistically insignificant in Model 2, the MNL model was re-estimated (Model 3) excluding these variables. The results are presented in Table 5.6.

Table 5.6 Model Results

Variables	Model 3	
	Coefficient	Standard error
ASC	-0.75179**	0.33562
Native bird species	0.04931***	0.00702
Basic information	-0.21079**	0.08280
Medium information	0.06204	0.07355
Full information	0.14874**	0.07345
Campgrounds and huts	0.42922***	0.07787
Cabin accommodation	-0.05169	0.08546
Lodge accommodation	-0.37753***	0.08325
Number of visitors	-0.04773***	0.00748
Entrance fee	-0.07686***	0.00762
ASC_AGE	0.24886***	0.07568
ASC_BEQ	-0.84591***	0.26033
ASC_VIS	-0.47668**	0.18639
ASC_INC	0.21776***	0.04436
ASC_OPT	0.46757***	0.15129
<b>Summary Statistics</b>		
LL (at convergence)	-875.5934	
Pseudo-R <sup>2</sup>	0.17	

Note: \*\*\*significant at 1% level, \*\*significant at 5% level, \*significant at 10% level

## 5.2.4 Evaluation of Models

With the results presented, the validity of the estimated models can be assessed. Bennett and Adamowicz (2001) suggested that several measures can be used to evaluate the model. First, tests of theoretical construct validity should be used to establish whether the relationships between the estimated variables conform with theoretical and other *a priori* expectations (Brown, 2003). Secondly, the model can be evaluated through various statistical measures including log-likelihood statistics and McFadden's pseudo-R<sup>2</sup> (Lancsar & Louviere, 2008). Whereas construct validity has largely been assessed in previous sections, the following sections will evaluate the statistical robustness of the estimated models.

### 5.2.4.1 LL Ratio-Test

To determine whether the models are statistically significant overall, a LL ratio-test can be performed. The test involves the comparison of the log-likelihood (LL) function of the estimated model at convergence with the LL function of a reference model with constant terms only (Amaya-Amaya et al., 2008). The resulting value, referred to as the (-2LL) statistic is then compared to a critical chi-square value with degrees of freedom (dof) equal to the number of new parameters estimated. If the results of the test indicate that the LL function of the estimated model is statistically closer to zero than that of the reference model, then the model can be considered statistically significant (Hensher et al., 2005). The test formula is provided in equation 5.1.

$$-2(LL_{base} - LL_{estimated}) \sim \chi^2_{(\text{number of new parameters in the estimated model})} \quad 5.1$$

The LL ratio-test was carried out for Model 1 (basic specification) to determine whether the inclusion of the key design attributes enhances the explanatory power of the model. The relevant test statistics are shown in Table 5.7 and in equation 5.2.

Table 5.7 LL Ratio-test

Model	LL Function	DOF	DOF Differential	-2LL	Critical Chi-square Statistic
Constants Only Model	-1051.215	1	-	-	-
Estimated Model (Model 1)	-919.336	8	7	263.758	14.067*

\*95% confidence level

$$-2(-1051.215 - -919.336) \sim \chi^2_{(7)} \quad 5.2$$

From Table 5.7 it is evident that the -2LL value was greater than the critical chi-square statistic. Accordingly, the null hypothesis that the LL functions of both models are similar can be rejected and the estimated model can be considered statistically significant overall.

The LL ratio-test can also be used to compare two different model specifications using a slightly modified Equation 5.1 (Hensher et al., 2005). This allows LL function of the more comprehensive model specification (Model 3) to be compared against the LL function of the basic model (Model 1). The modified LL ratio test is shown in equation 5.3 below along with the relevant test statistics in Table 5.8 and equation 5.4.

$$-2(LL_{largest} - LL_{smallest}) \sim \chi^2_{(\text{number of new parameters in the estimated model})} \quad 5.3$$

Table 5.8 LL Ratio-test

Model	LL Function	DOF	DOF Differential	-2LL	Critical Chi-square Statistic
Model 1	-919.336	8	-	-	-
Model 3	-875.5934	13	5	87.485	11.070*

\*95% confidence level

$$-2(-875.5934 - -919.336) \sim \chi^2_{(5)} \quad 5.4$$

Table 5.8 shows the -2LL value exceeded the critical chi-square statistic of 11.07 indicating the inclusion of socioeconomic and demographic variables improved the overall model fit. The null hypothesis was therefore rejected as the LL function of Model 3 was statistically closer to zero.

#### 5.2.4.2 Pseudo-R<sup>2</sup>

With regard to the goodness of fit, one commonly estimated measure is McFadden's pseudo-R<sup>2</sup>. It is important to note that the psuedo-R<sup>2</sup> statistic cannot be interpreted in exactly the same manner as the R<sup>2</sup> typically used in conventional linear regression (Amaya-Amaya et al., 2008). For example, according to Bennett and Adamowicz (2001) and Hoyos (2010) pseudo-R<sup>2</sup> values between 0.2 and 0.4 constitute an adequate model fit. Equation 5.5 can be used to calculate the psuedo-R<sup>2</sup> values.

$$R^2 = 1 - \frac{LL_{Estimated\ model}}{LL_{Base\ model}} \quad 5.5$$

The pseudo-R<sup>2</sup> values for Model 1 and Model 3 were 0.13 and 0.17 respectively. These statistics indicate the more comprehensive model specification was superior in terms of parametric fit and explained a higher proportion of respondent choice. While the values for both models were below the recommended minimum value of 0.2, the values are of similar magnitude to other CM applications which utilise a simple MNL model (Juutinen et al., 2011; Rolfe, Bennett, & Louviere, 2000; Thang Nam & Bennett, 2009).

### 5.2.4.3 Hausman Test

The use of the MNL model is only valid if the underlying IIA behavioural condition is satisfied. The IIA condition states that the ratio of the choice probabilities of any two alternatives is independent of the presence of other alternatives (Alberini, Longo, & Veronesi, 2007). If this behavioural condition is violated then the resulting parameter estimates and welfare measures will be biased (Birol et al., 2006).

The Hausman test developed by Hausman and McFadden (1984) is commonly used in CM applications to determine whether the IIA condition holds. The test involves comparing the parameter estimates between an unrestricted model (with all alternatives present) and a restricted model (with one alternative excluded). If the parameter estimates from the two models are statistically similar, then the IIA condition is valid (Amaya-Amaya et al., 2008). The results of the Hausman test for Model 1 are presented in Table 5.9.

Table 5.9 Hausman Test for IIA

	Option Excluded	DOF	Critical Chi-square Statistic	Calculated Chi-square Statistic	Probability
<b>Model 1</b>	Option B	8	15.507*	12.2056	0.142264
	Option C	8	15.507*	12.0473	0.149106

\*95% confidence level

In both cases, the calculated chi-square statistic was less than the critical value indicating that any difference in the parameters estimates was not statistically significant. Any violation of the IIA condition suggests respondents were framing the alternatives as substitutes in the decision-making process (Rolfe & Bennett, 2001; Rolfe et al., 2002). This would necessitate the use of more advanced models which are specifically designed to relax the IIA condition and account for substitution effects.

### 5.3 Welfare Measures

With the coefficients estimated and the validity of the resulting models evaluated, the primary output of the research can be presented. While the coefficients demonstrate the impact of each attribute on utility, it is useful to quantify this impact in monetary terms. These figures can then be included in decision-making or policy analysis via CBA or other quantitative tools.

#### 5.3.1 Implicit Prices

The implicit price for a particular attribute can be calculated as the marginal rate of substitution between the non-monetary and monetary attribute as shown in equation 5.6 (Hanley & Barbier, 2009).

$$IP = - \left( \frac{\beta_k}{\beta_c} \right) \quad 5.6$$

Where:

IP is the implicit price

$\beta_k$  is the parameter coefficient for the non-market attribute

$\beta_c$  is the parameter coefficient for the monetary payment vehicle.

It is important to note that the implicit prices should be interpreted as the marginal willingness to pay for an attribute, *ceteris paribus*. The confidence intervals (CIs) for the implicit prices were estimated using the delta method. One of the underlying assumptions of this method is that willingness to pay is normally distributed around the mean value. This condition is likely to be satisfied provided a large enough sample size is obtained and the parameter coefficient for the payment vehicle is accurate (Hole, 2007). However, Hole (2007) notes that the delta method does perform reasonably well under a range of different circumstances. In order to derive the CIs, the variance of the WTP estimates was calculated using expression 5.7 (Hole, 2007).

$$\text{Var}\left(\frac{\beta_k}{\beta_c}\right) \cong \frac{1}{\beta_c^2} \left[ \text{Var}(\beta_k) - \frac{2\beta_k}{\beta_c} \cdot \text{Cov}(\beta_k, \beta_c) + \left(\frac{\beta_k}{\beta_c}\right)^2 \text{Var}(\beta_c) \right] \quad 5.7$$

Where:

$\beta_k$  is the parameter coefficient for the non-market attribute

$\beta_c$  is the parameter coefficient for the monetary payment vehicle.

The resulting values were then substituted into equation 5.8 which is shown below (Hole, 2007).

$$CIs = \left(\frac{\beta_k}{\beta_c}\right) \pm 1.96 \sqrt{\text{var}\left(\frac{\beta_k}{\beta_c}\right)} \quad 5.8$$

The implicit prices and associated CIs are presented in Table 5.10 and are derived from Model 3.

Table 5.10 Implicit Price Estimates

Attribute	Implicit Price (\$ NZ)
Native bird species	0.64 (0.30 ~ 0.98)*
Basic information	-2.74 (-4.96 ~ -0.52)*
Medium information	0.81 (-2.78 ~ 4.39)*
Full information	1.94 (-1.49 ~ 5.36)*
Campgrounds and huts	5.58 (3.41 ~ 7.75)*
Cabin accommodation	-0.67 (-4.08 ~ 2.73)*
Lodge accommodation	-4.91 (-8.99 ~ -0.84)*
Number of visitors	-0.62 (-0.98 ~ -0.27)*

\*95% confidence level

Based on the results of the survey sample, park visitors were on average WTP \$0.64 for the presence of an additional native bird species. Visitors were also WTP \$0.81 for the provision of medium levels of onsite information consisting of interpretive signs and brochures. In addition, park visitors would be WTP \$1.94 for a comprehensive level of information which includes interpretive signs, brochures and a visitor centre. In contrast, the current level of information resulted in a negative willingness to pay, indicating visitors would require \$2.74 in compensation for the provision of interpretive signs only. With regard to accommodation, visitors were WTP \$5.58 for campgrounds and huts but would require compensation for the development of cabin and lodge



accommodation facilities. In terms of visitor interactions, park users would require \$0.62 in compensation for each additional visitor encountered over a 1 km walk.

### 5.3.2 Compensating Surplus

The implicit prices presented in Table 5.10 provide an indication of the value of a marginal change in a particular attribute. However, implicit prices alone cannot be used to provide an estimate of the average willingness to pay for a particular management option. In order for welfare measures to be consistent with the underlying RUT framework, the probability of an alternative being selected needs to be accounted for. This requires welfare estimates to include the impact of both the attributes and other unobserved factors incorporated in the intercept term (Morrison et al., 1999). As measures of compensating surplus (equation 5.9) include the relevant alternative specific constant, these estimates can be used to provide an indication of overall willingness to pay.

$$CS = -\frac{1}{\beta_c}(V_1 - V_0) \quad 5.9$$

Where:

CS is the compensating surplus

$V_1$  is the utility associated with an alternative management option

$V_0$  is the utility associated with the status quo option

$\beta_c$  is the parameter coefficient for monetary payment vehicle.

Equation 5.9 shows the average willingness to pay for an alternative management option is equal to the utility differential between the two different states of the world expressed in monetary terms. While other welfare measures are available, estimates of compensating surplus are appropriate when the consumption of an environmental amenity occurs in discrete quantities (Devine, 1987). In this case, park users are unable to freely adjust their consumption bundle on a continuous scale (i.e. they cannot choose how much national park development to consume) (Hanley & Barbier, 2009). Rather, they are forced to make a decision between the provision of the status quo and some other management option.

Table 5.11 presents WTP estimates for a range of hypothetical future management options for ATNP. These estimates are derived from the parameter coefficients from Model 3, using sample means for the socioeconomic and demographic variables.

Table 5.11 WTP for Alternative Management Options

Scenario	Attributes				WTP (\$ NZ)
	<i>Native Bird Species</i>	<i>Onsite Information</i>	<i>Accommodation Facilities</i>	<i>Number of Visitors</i>	
Current situation	50	Basic	Campgrounds and huts	50 people over a 1 km walk	-
Low development impact	60	Basic	Campgrounds and huts	40 people over a 1 km walk	\$14.18
Moderate development impact	60	Medium	Cabin type accommodation	40 people over a 1 km walk	\$11.47
High development impact	70	Full	Lodge type accommodation	30 people over a 1 km walk	\$20.99
Optimal development scenario	70	Full	Campgrounds and huts	30 people over a 1 km walk	\$31.48

The results in Table 5.11 can be interpreted as the amount respondents would be WTP in order to secure the welfare gains resulting from an environmental improvement (Hanley & Barbier, 2009). In general, respondents were WTP for management options which improved the recreational and ecological attributes of ATNP. Specifically respondents were on average WTP \$14.18 for a low development scenario which consists of modest enhancements to the number of native bird species and visitor interactions. For moderate levels of development, respondents were WTP \$11.47. In contrast, respondents were WTP \$20.99 for high levels of park development consisting of 70 native bird species, comprehensive information, lodge accommodation and few visitor interactions. The decompositional approach inherent in the CM technique can also be used to develop management alternatives which are Pareto optimal. Management options which maximise the net benefits to respondents can be created using the implied attribute rankings from the implicit price estimates (Bennett & Blamey, 2001b). The optimal development scenario for ATNP was constructed using the marginal WTP values reported in Section 5.3.1. In this case, respondents preferred the

presence of 70 native bird species, comprehensive information, campgrounds and huts and fewer visitor interactions. On average, respondents were WTP \$31.48 for this bundle of attributes. It is important to note that all WTP estimates are calculated on a per entry basis and therefore include both overnight and day trip visits.

#### **5.4 Summary**

Overall, this chapter has detailed the procedures used in the analysis of the choice data and presented the results of the choice model. With regard to the data analysis, an overview of the survey responses and the characteristics of the sample population were provided. This was followed by the results of the attribute preference ratings and a detailed account of the model specification and data coding formats used.

The second section of the chapter presented the results of the study in terms of the model output and welfare estimates. The key findings indicate the presence of native bird species, additional onsite information and the provision of basic accommodation facilities contributed positively to utility. Specifically, respondents were WTP \$0.64 for the presence of an additional native bird species and \$1.94 for the provision of a comprehensive level of onsite information. In terms of accommodation facilities, respondents would be WTP \$5.58 for the development of campgrounds and hut accommodation. In contrast, factors such as the development of upgraded accommodation facilities, provision of basic levels of information and visitor interactions contributed negatively to utility. Expressed in monetary terms, respondents would require \$0.67 and \$4.91 in compensation for the development of cabin and lodge type accommodation respectively. Respondents would also require \$2.75 in compensation for the existing level of onsite information. With regard to visitor interactions, respondents would accept \$0.62 in compensation for each additional visitor encountered over 1 km walk.

Estimates of compensating surplus were also derived for a range of potential future management options. The results indicate that respondents were WTP \$14.18 for low levels of park development, \$11.47 for moderate levels of development and \$20.99 for a high development impact scenario. At most, respondents would pay \$31.48 for a management scenario which resulted in high levels of native bird species, comprehensive information, basic accommodation facilities and few visitor interactions.

The next chapter will critically discuss these key findings within the context of the background to the research. The implications of the results for the future development of ATNP will also be discussed.

## CHAPTER 6: DISCUSSION

The preceding chapter presented the primary output of this research in the form of marginal WTP values and compensating surplus estimates. The purpose of this chapter is to discuss the key findings of the research. The first section will detail the importance of the estimated economic values for ATNP. The second section will explore the implications of the results for future park management decisions. This will be followed by an interpretation of the negative intercept term reported in the previous chapter. The last section of this chapter will comment on whether the results of this CM application can be generalised to other national parks and protected areas in New Zealand.

### 6.1 Economic Value of ATNP

Despite the lack of appropriate markets and relevant price signals, national parks and protected areas are a significant source of economic value. This application of the CM approach has demonstrated that park users hold tangible economic values for the recreational and ecological attributes of ATNP.

The expression of these benefits in monetary terms can provide valuable information which can be used to enhance management and conservation outcomes. First, these monetary values can be used to justify continued public sector funding for ATNP. The often ambiguous link between additional investment in protected areas and the resulting economic returns can act as a barrier towards the sourcing of conservation funding (Dixon & Sherman, 1990). However, by demonstrating these returns in dollar figures, this information can be used by policy-makers to argue for continued conservation financing.

From a park management perspective, the estimation of implicit prices for individual park attributes is arguably more informative than a single overall value. Many protected area management agencies lack a formalised decision-making framework which can be used to guide resource allocation decisions. This often leads to resources being allocated in an *ad hoc* manner resulting in the inefficient use of existing conservation funding (Wu & Boggess, 1999). The marginal WTP estimates can be used by park managers to determine how scarce resources should be allocated amongst competing management priorities. This can allow park managers to develop and implement management plans which constitute a Pareto improvement over the current management regime. Accordingly, these results can be used to ensure that

conservation resources are allocated in a manner which maximises the net benefits to park visitors. The implications of these findings for the future management of ATNP will be discussed in the following section.

In terms of business and financial planning, the estimated values can be used to provide park managers with an indication of the goods and services demanded by visitors to ATNP (WCPA-IUCN, 2000). This can be used to identify sources of consumer surplus which could potentially be appropriated by park managers and transformed into economic rent. The welfare estimates presented here could be used as guidelines by park managers to develop suitable pricing policies. For example, park users were on average WTP \$14.18 per visit for a low development scenario, \$11.47 for a moderate development scenario and \$20.99 for a high development scenario. Park users would be WTP at most \$31.48 per visit for the optimal management scenario.

It has been suggested that visitation rates to protected areas are relatively unresponsive to changes in price. As many tourists would have already incurred substantial travel costs, any user charges are likely to constitute only a small proportion of that cost. Accordingly, any increase in price will be accompanied by a less than proportionate decrease in visitor numbers (Lindberg, 1991; Naidoo & Adamowicz, 2005). Accordingly, there may be significant potential for park managers to capture additional revenue from visitor usage.

While there may be some issues regarding the political acceptability and feasibility of site charges, these mechanisms could potentially be used as an additional source of conservation finance. The adoption of a user pays approach is increasingly being seen by park management authorities as both an efficient and equitable means of generating additional revenue. With regard to the consumption of benefits with private good characteristics (e.g. recreation), economic efficiency requires that users contribute to the cost of provision (Lockwood & Quintela, 2006). In this manner, the results of the choice model could be used to enhance the financial sustainability of ATNP.

## **6.2 National Park Management**

The aim of the choice experiment was to analyse visitor preferences to inform future management decisions for ATNP. The results of the choice model can be used to determine which forms of development in terms of park infrastructure and amenities are welfare enhancing. In addition, choice experiments are able to model the trade-offs inherent in park management decisions. This information can be used to establish

whether a proposed development programme is perceived to be compatible with the intrinsic values of ATNP. Accordingly, choice experiments are able to assist park managers in reconciling the somewhat conflicting goals of facilitating recreational use while ensuring the preservation of natural values. The results of this research indicate there is significant demand among park visitors for additional development.

### **6.2.1 Native Bird Species**

Visitors had a positive preference for the number of native bird species present in the park. On a wider scale, the diversity of native bird species can also be used as a surrogate measure to elicit visitor preferences for the overall biodiversity of the park.

As a result of New Zealand's unique evolutionary history, native bird species have evolved to fill an important ecological niche in many terrestrial ecosystems. Many of these species also exhibit high levels of endemism and have had a direct influence on the development of New Zealand's fauna (Craig et al., 2000). Furthermore, ATNP encompasses a wide variety of different habitats including coastal, wetland/estuary and inland areas with large tracts of unfragmented mature forest. This habitat diversity allows the park to support a range of birdlife (Department of Conservation, 2008). Native bird species are therefore likely to be the most prominent example of native flora and fauna encountered by park users. Accordingly, measures of avian species richness are an appropriate means of estimating the biodiversity values associated with the park. This interpretation is similar to that used by Naidoo and Adamowicz (2005) and Lee et al. (2010).

The positive WTP figure elicited for this attribute suggest that park visitors are concerned with the biodiversity of ATNP. This is consistent with the findings of a number of CM studies which evaluate user preferences for nature-based recreation and protected area development (Han et al., 2010; Juutinen et al., 2011; Lee et al., 2010; Naidoo & Adamowicz, 2005). These studies suggest that biodiversity is a significant source of economic value and that appropriate conservation measures can provide tangible economic returns.

In terms of the implications for park management, the investment of additional resources in conservation activities would have a positive impact on visitor welfare. There is significant scope for park managers to maintain and improve the existing levels of biodiversity within ATNP. The control and removal (where practicable) of invasive alien species which compete with and in some cases predate on native species should be given priority. Furthermore, active pest management can also

facilitate the regeneration and restoration of native habitat which in turn can support additional populations of native fauna. The enhancement of existing populations of native flora and fauna can be used to supplement biodiversity levels. Park managers should also investigate the potential for the reintroduction of locally extinct native flora and fauna (Lockwood et al., 2008).

Visitor induced pressures and the location of recreational infrastructure can also pose a risk to the continued ecological integrity and biodiversity of the park. Visitor activities can potentially lead to the disturbance of wildlife, soil erosion and the trampling of vegetation (Worboys, Lockwood, & De Lacy, 2000). Park managers need to ensure that recreational structures including tracks and buildings do not have an adverse impact on the surrounding natural environment. Land use planning can be used to impose spatial constraints on the development of recreational infrastructure and associated activities (Worboys, Winkler, & Lockwood, 2006).

A combination of these management actions are currently utilised by DOC to preserve the natural values associated with ATNP. The results of this study provide an economic justification for the continuation of these measures which are aimed at preserving ecosystem integrity.

### **6.2.2 Onsite Information**

Visitors to ATNP generally regarded the current level of onsite information as inadequate. Respondents expressed a positive preference for additional information in the form of detailed information packages and a visitor centre with interactive displays and audiovisual presentations. This result is consistent with the findings of several other studies including Hearne and Santos (2005), Hearne and Salinas (2002), Juutinen et al. (2011) and Lee et al. (2010). In these studies, a positive WTP value was reported for various forms of additional onsite information. This result indicated that park visitors valued the onsite educational experience provided by interpretive services and structures.

With regard to the management of ATNP, park managers should supply more comprehensive levels of information to park visitors. The provision of additional information can enhance the experience of park users by interpreting the park's recreational, natural, cultural and historical values. Additional opportunities for interpretation can also assist park management in several ways. For example, the provision of information can be used to garner support for conservation objectives and

promote an ethic of stewardship, appreciation and environmental responsibility among park users (De Lacy & Whitmore, 2006).

A range of interpretive techniques could potentially be utilised by park managers at ATNP. The strengths and weaknesses of each method need to be evaluated to determine the appropriate combination of interpretive services and structures. With respect to the current level of information provision, interpretive signs and panels are relatively inexpensive to establish and allow visitors to be selective in terms of the information they read. Detailed brochures and maps are a portable means of conveying information and are unobtrusive. Visitor centres which are usually located at major entrance points are easily recognised and can provide in-depth information in a range of formats (e.g. audiovisual, written etc) (De Lacy & Whitmore, 2006).

However, the development of additional interpretive structures must be implemented in a manner which is consistent with the natural values of the park. For example, Juutinen et al. (2011) find that while visitors prefer a modest increase in the number of interpretive signs along walking trails, a significant increase has a negative impact on visitor utility.

### **6.2.3 Accommodation Facilities**

Visitors to ATNP were satisfied with the current level of park accommodation facilities (campgrounds and huts). The provision of cabin and lodge type accommodation with additional amenities had a detrimental impact on visitor welfare. A number of comments made by respondents indicated they did not believe such development was compatible with the natural and wilderness values of the park.

Only two other CM applications have elicited visitor preferences for the development of accommodation facilities. Hearne and Santos (2005) utilise a lodging attribute which consists of three levels: no accommodation facilities, cabins in rural communities, and ecolodge type accommodation. Whereas domestic visitors did not record a significant preference for any accommodation level, foreign visitors preferred the development of ecolodges. Naidoo and Adamowicz (2005) evaluate user preferences for tent, cabin and luxury lodge accommodation. While tents had a negative impact on visitor utility, the development of cabins and lodges was preferred relative to the current situation of no accommodation facilities. The results of the ATNP study appear to contradict these findings. However, it must be noted that the sample population consisted mainly of younger individuals who may enjoy a more basic and rustic recreational experience. In addition, the studies conducted by Hearne and Santos (2005) and Naidoo and



Adamowicz (2005) both occurred in the context of a relatively undeveloped protected area with limited recreational infrastructure. With regard to the management of ATNP, the results suggest that development of upgraded accommodation facilities is unnecessary. Accordingly, the continued provision of campgrounds and huts by park managers is the optimal development strategy.

#### **6.2.4 Visitor Numbers**

One management issue of particular relevance to ATNP is the high level of visitor use during certain times of the year. The results show that park users preferred fewer interactions as defined by the expected number of people encountered over a 1 km walk. This implies that the appreciation of natural wilderness and the desire to experience solitude are an integral part of the recreational experience at ATNP. This creates a particularly challenging management issue given DOC's dual mandate of ensuring the protection of both wilderness and natural values while facilitating recreational use.

This preference for fewer visitor interactions is supported by other CM applications conducted in protected areas. For example, Juutinen et al. (2011) find that a significant increase in the number of visitor encounters had a detrimental impact on visitor welfare. Hearne and Salinas (2002) analysed visitor preferences for the implementation of use restrictions to reduce congestion on certain trails in Braulio Carrillo National Park, Costa Rica. The results show that while domestic visitors held no significant preferences for use restrictions, foreign visitors held positive preferences for the implementation of use restrictions.

The findings indicate that management strategies aimed at reducing the level of crowding and visitor interactions would have a positive impact on visitor welfare. Park managers need to determine the appropriate carrying capacity of the park with priority given to high use areas such as the coastal zone. Carrying capacity refers to the level of visitor use which a protected area can sustainably support in terms of the ecological impact and quality of the recreational experience. With regard to recreational management, the concept of carrying capacity encompasses a significant experiential component (Manning, 2007). Accordingly, the preferences of visitors need to be taken into account in determining the appropriate level of recreational use.

The issue of congestion and perceived over-crowding during certain times of the year at ATNP is currently being addressed by DOC through a number of management tools. Land use planning in the form of recreational zoning is one of the primary mechanisms

which DOC currently use. Recreational zoning is able to reduce the potential for conflict between recreational users by ensuring that visitor usage is appropriately distributed throughout the park. This is currently achieved through limits on commercial activities (e.g. guiding, transportation) within ATNP and use restrictions which segregate the various recreational activities. Direct rationing mechanisms such as hut and campsite booking systems are also used to regulate recreational demand (Department of Conservation, 2008). The results of this study suggest that implementation of additional visitor management tools would be desirable from a visitor perspective. Supply side options such as the provision of new walking tracks and recreational opportunities could be used. Other measures such as the provision of information can lead to both the spatial and temporal redistribution of recreational demand. By providing information regarding current use-patterns, this can allow visitors to plan their trips during off-peak periods or utilise less crowded walking tracks. Peak load pricing is another management tool which could be used by park managers to redistribute recreational demand. Peak load pricing refers to the practice of charging differential entrance fees during certain times of the year or at different park locations (Manning, 2007). However, it is important to note that the use of the price mechanism as a rationing tool is currently prohibited by legislation.

### **6.3 Status Quo Bias and the Endowment Effect**

One particularly interesting feature of the choice model is that although there is significant demand for additional development, the alternative specific constant is both negative and statistically significant. This indicates that the act of moving away from the status quo was a source of disutility for respondents, *ceteris paribus*.

Adamowicz, Boxall, Williams and Louviere (1998) attribute such a phenomenon to the existence of a status quo bias or endowment effect. The concept of loss aversion is the underlying driver of such behaviour and suggests that individuals value gains and losses asymmetrically. Specifically, the disutility associated with the loss of an amenity exceeds the utility resulting from its initial acquisition. The net result is often a strong preference for the maintenance of the status quo situation (Kahneman, Knetsch, & Thaler, 1991).

While this is one possible interpretation of the negative constant term, another explanation is that respondents either did not view the hypothetical market as credible or were recording payment vehicle protests. Alternatively, the preference for the status quo could be a result of task complexity and the subsequent use of simplifying

heuristics (Adamowicz et al., 1998). However, all of these factors were taken into account during the appropriate design stages of the choice model and pilot testing of the survey instrument. In the case of protest responses, the use of follow-up questions was designed to provide greater insight into respondent motivations and decision strategies. Nine surveys were discarded due to either payment vehicle protests or respondents being uncertain of their choices.

#### **6.4 Benefit Transfer**

Within the non-market valuation context, the generalisation of findings from one site (i.e. the source site) to another (i.e. the target site) is referred to as benefit transfer (Rolfe, 2006a). Whether welfare estimates derived from this study can be generalised to another setting is dependent on the equivalence of both the user populations and site characteristics (Morrison & Bergland, 2006).

In order for benefit transfer to result in valid welfare estimates, the reference populations need to be statistically similar. Respondent characteristics such as socioeconomic and demographic factors are often key determinants of individual attitudes and ultimately behaviour (i.e. respondent choice and willingness to pay). Consequently, any discrepancy between the characteristics of the two populations is likely to result in a different set of welfare measures (Rolfe, 2006a). An additional caveat which should be noted is that onsite intercept surveys typically do not result in a truly representative sample of the target population (Bateman et al., 2002). Accordingly, the extent to which the reference population is representative of the wider population will also need to be taken into account for benefit transfer purposes.

In terms of site characteristics, both the study and policy site need to have similar baseline conditions with regard to the attributes and associated levels (Rolfe, 2006a). One complicating factor however is that ATNP occupies a relatively unique position within New Zealand's conservation estate. The park is located in a coastal environment and is well-regarded for its unique scenery and recreational values. This lack of any close substitutes may result in elevated WTP estimates.

Furthermore, framing differences between the source and target site need to be taken into consideration. Potential framing issues include the scope and scale of the environmental amenity, the appropriateness of the payment vehicle and the use of WTP or WTA elicitation formats (Rolfe, 2006a). Accordingly, factors such as the scope of the proposed development programme at ATNP and the extent of the changes in the park attributes will need to be assessed. In addition, consideration will also need to be

given as to whether the entrance fee constitutes an acceptable payment vehicle for the target site. Ultimately, the welfare measures elicited in any non-market valuation study are dependent on a specific set of contextual factors. However, several methods can be used in the benefit transfer process to account for differences in site characteristics, population demographics and framing effects. Regardless, practitioners should exercise the appropriate care and judgement when extrapolating these welfare estimates to other national parks in New Zealand.



## **CHAPTER 7: CONCLUSION AND RECOMMENDATIONS**

The aim of this research was to use the CM approach to determine the economic value of non-market goods and services associated with national parks. National parks and protected areas play an integral role in the conservation of biodiversity and the pursuit of nature-based recreation. In addition, these areas provide a raft of other benefits in the form of various use and non-use values. However, the provision of national parks and protected areas by the free market is subject to a range of imperfections resulting from the presence of externalities and public good characteristics. This prevents market mechanisms from developing price signals which accurately reflect the true economic value of these natural assets. By expressing these benefits in monetary terms, policy-makers can use these values to enhance conservation outcomes and protected area management. In this research, the CM approach was used to estimate the economic value of recreational and ecological attributes associated with ATNP.

The purpose of this chapter is two-fold. The first section will present the research conclusions and recommendations. The second section of this chapter will make suggestions regarding future research.

### **7.1 Research Conclusions and Recommendations**

The research has demonstrated that the CM approach is a suitable means of identifying visitor preferences and deriving non-market values for national parks and protected areas. Park users were found to hold significant non-market values for recreational and ecological attributes associated with ATNP. Park users were on average WTP \$0.64 for the presence of an additional native bird species. Visitors were also WTP \$0.81 for medium levels of onsite information (i.e. interpretive signs and brochures) and \$1.94 for comprehensive levels of onsite information (i.e. interpretive signs, brochures and a visitor centre). In contrast, visitors would require \$2.74 in compensation for the provision of interpretive signs only. In terms of accommodation facilities, park users were WTP \$5.58 for the provision of campgrounds and huts. However, visitors would require \$0.67 and \$4.91 in compensation for the development of cabin and lodge type accommodation respectively. With regard to visitor interactions, park users would require \$0.62 in compensation for each additional visitor encountered over a 1 km walk.

Park users were also WTP for alternative management options which improved the attribute levels relative to the status quo. For example, park users were on average

WTP \$14.18 per visit for a basic development scenario, \$11.47 for moderate levels of development and \$20.99 for high levels of development. At most, park users were on average WTP \$31.48 per visit for the optimal management scenario.

The findings of the study indicate the CM approach can be used to inform various aspects of park management and operational planning. Accordingly, the primary recommendation arising from this research is that DOC actively conduct discrete choice experiments as a matter of national policy. Such measures could be incorporated into the standard review process which DOC currently utilises to gauge visitor satisfaction, impacts and attitudes towards different management options. Table 7.1 provides a more in-depth summary of these key research findings and associated recommendations.

Table 7.1 Research Conclusions and Recommendations

Category	Current Situation	Findings	Recommendations
<b><i>Application of CM</i></b>			
<i>Technical Component</i>	Non-market valuation is a complex process and is currently not undertaken on a regular basis due to limited expertise and the often technical nature of its application.	The CM approach represents a robust method of eliciting visitor preferences and deriving non-market environmental values.	The CM approach is recommended for other studies where information regarding consumer preferences and environmental values can be used to inform decision-making.
<i>Data Requirements</i>	The provision of comprehensive, up to date information is crucial for the development of a choice model and the estimation of accurate welfare measures.	There is currently a lack of recent published data regarding the ecological and recreational attributes associated with ATNP.	It is recommended DOC engage in more frequent data collection and reporting of information relating to park attributes and current management activities. Such measures could help to facilitate additional non-market valuation studies.
<b><i>National Park Development</i></b>	Park managers need to ensure any future development does not compromise the quality of the visitor experience and natural values enshrined in the national park.	Choice experiments are able to model the trade-offs inherent in park management decisions. This can provide information regarding the forms of development perceived to be compatible with the natural character of the park.	It is recommended park managers use the CM technique to inform future development and reconcile any conflict between development and the preservation of natural values.



Category	Current Situation	Findings	Recommendations
<b>Management of ATNP</b>			
<i>Native Bird Species</i>	50 native bird species currently present.	Park users preferred higher numbers of native bird species suggesting that visitors regarded the biodiversity of ATNP as important to their experience.	It is recommended park managers consider the implementation of additional biodiversity conservation measures.
<i>Onsite Information</i>	Basic interpretive structures provided in the form of information signage.	Park users preferred additional onsite information in the form of information packages and a visitor centre.	It is recommended DOC investigate the possibility of providing additional onsite information to visitors.
<i>Accommodation Facilities</i>	Basic accommodation facilities provided (i.e. campgrounds and huts).	Visitors preferred the continued provision of basic accommodation facilities.	No management intervention necessary.
<i>Number of Visitors</i>	High level of visitor interactions with over 50 people encountered over a 1 km walk.	Visitors expressed a preference for fewer visitor interactions.	It is recommended DOC consider additional visitor management tools in order to regulate recreational demand.
<i>Entrance Fee/User Charges</i>	No entrance fee and limited use of site-level charges.	There is a considerable amount of consumer surplus which could potentially be captured and appropriated by park managers	It is recommended DOC consider the feasibility of utilising revenue gathering mechanisms to collect economic rent.

Category	Current Situation	Findings	Recommendations
<b>Conservation Financing</b>	Conservation funding almost exclusively sourced from central government budgetary allocations. Park managers are under increasing pressure to diversify funding sources and adopt a business-oriented approach to protected area management.	The findings provide an indication of the goods and services demanded by visitors to ATNP. In addition, the non-market values which users place on these goods and services can also be estimated.	It is recommended DOC adopt non-market valuation, specifically the CM approach to provide information regarding the value of protected area goods and services. This information can be used to inform the development of business plans to ensure the financial sustainability of New Zealand's conservation estate.
<b>Resource Allocation Decisions</b>			
<i>Macro Level</i>	The lack of economic values for national parks often leads to the sub-optimal allocation of resources towards these areas. This results in national parks and protected areas being underfunded relative to other government budgetary considerations.	Nature-based recreation and biodiversity conservation at ATNP provide significant economic benefits.	It is recommended that DOC frequently report the non-market values associated with protected areas. This can provide the economic rationale for continued protection and ensure adequate conservation financing.
<i>Micro Level</i>	Decisions regarding the allocation of resources within specific conservations units are often carried out in an informal, <i>ad hoc</i> manner. Currently, there is a lack of formal criteria which can be used by management agencies to guide resource allocation decisions.	The marginal WTP estimates are able to be used by park managers to determine how conservation resources should be allocated amongst competing management priorities. This can allow park managers to develop and implement management plans which maximise the net benefits to park visitors.	It is recommended that DOC utilises the CM approach to guide the allocation of resources for specific conservation units. In this manner, the monetary values can be used to not only provide additional resources, but ensure that existing resources are being utilised efficiently.

## **7.2 Further Research**

Based on the findings of this study, several suggestions can be made with regard to future research. These suggestions relate to data collection procedures and the use of additional CM applications.

Future research could utilise a more comprehensive sampling strategy in terms of temporal and geographical coverage. Sampling throughout different periods of the year would be able to account for differences in visitor composition. A larger sample size could also be obtained in order to derive more robust choice models. Accordingly, these measures could be utilised to elicit more accurate welfare estimates.

Further research to inform TEV should be conducted using choice experiments with a different set of design attributes and associated levels. In addition, choice experiments could also be applied to different national parks and protected areas to verify that the results of this research are not just specific to ATNP but can be applied elsewhere.

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## Appendix 1: Experimental Design

Starting OMEP- Experimental Plan Code Number 19a (Hahn & Shapiro, 1966)

Attribute Profile	OMEP – Attributes				
	<i>NBS</i>	<i>ONI</i>	<i>ACF</i>	<i>NMV</i>	<i>ENF</i>
1	0	0	0	0	0
2	0	1	1	2	1
3	0	2	2	1	2
4	1	0	1	1	1
5	1	1	2	0	2
6	1	2	0	2	0
7	2	0	2	2	1
8	2	1	0	1	2
9	2	2	1	0	0
10	0	0	2	1	0
11	0	1	0	0	1
12	0	2	1	2	2
13	1	0	0	2	2
14	1	1	1	1	0
15	1	2	2	0	1
16	2	0	1	0	2
17	2	1	2	2	0
18	2	2	0	1	1

## Foldover Design

Foldover Profile	Foldover – Attributes				
	<i>NBS</i>	<i>ONI</i>	<i>ACF</i>	<i>NMV</i>	<i>ENF</i>
A	1	1	1	1	1
B	1	2	2	0	2
C	1	0	0	2	0
D	2	1	2	2	2
E	2	2	0	1	0
F	2	0	1	0	1
G	0	1	0	0	2
H	0	2	1	2	0
I	0	0	2	1	1
J	1	1	0	2	1
K	1	2	1	1	2
L	1	0	2	0	0
M	2	1	1	0	0
N	2	2	2	2	1
O	2	0	0	1	2
P	0	1	2	1	0
Q	0	2	0	0	1
R	0	0	1	2	2



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# Abel Tasman National Park Visitor Survey 2011

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We are conducting this survey in order to understand visitor attitudes towards different ways that national parks can be managed. We are using Abel Tasman as a case study. This survey will take approximately 15 minutes of your time.

**Thank you for your participation**

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Block 1

## Abel Tasman National Park Visitor Survey

### What is this study about?

Assessing visitor preferences for different ways of managing national parks. I am using Abel Tasman National Park as a case study. The information could help with future park management decisions.

### Who is the researcher?

I am a Massey student doing my Master's degree. This survey has not been commissioned by the Department of Conservation (DOC) and there is no proposal to introduce a park entrance fee. Permission to interview visitors has been given by DOC.

### Confidentiality

This survey is completely anonymous and all survey forms will be destroyed on completion of the study.

### Participant Rights

You have the right to:

- Decline to answer any question
- Ask any questions about the study at anytime during participation

### Contacts

If you have any questions please feel free to contact either myself or my supervisor.

#### Researcher

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*This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*

*If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neil, Director (Research Ethics), telephone 06 350 5249, email [humanethics@massey.ac.nz](mailto:humanethics@massey.ac.nz).*

**Section 1:** General Questions

General questions about your visit to this national park and information about hypothetical future management options.

1. Have you visited **this** national park before?  
 Yes  No
2. Do you intend to visit **this** national park again within the next five years?  
 Yes  No
3. Which category best describes the length of your *current* visit to **this** national park?  
 Day trip  
 Overnight trip
4. To what extent are the following factors important to your experience of **this** national park? (*circle number*)

	<u>Very important – Moderately Important – Not Important</u>				
Native birds	1	2	3	4	5
Number of visitors	1	2	3	4	5
Onsite information	1	2	3	4	5
Accommodation facilities	1	2	3	4	5

## A Study of Potential Future Management Options for Abel Tasman National Park

### Native Bird Species

**Current Situation:** 50 native bird species present including a number of endangered and vulnerable species such as the Weka, Kea and Kaka

#### **Potential Management Actions**

- Re-introductions
- Predator and pest control

#### **Potential Outcomes:**

- 50 native bird species (no change from current situation)
- 60 native bird species
- 70 native bird species

### Background

- Abel Tasman National Park covers 225km<sup>2</sup>
- High visitor use - 160,000 visitors annually
- IUCN category II protected area
- Park management issues; native bird species, information provision, number of visitors, accommodation facilities



### Accommodation Facilities

**Current Situation:** Campgrounds and huts with basic facilities

#### **Potential Management Actions**

- Provision of upgraded facilities

#### **Potential Outcomes:**

- Campgrounds and huts (no change from current situation)
- Cabin accommodation with private sleeping areas and communal cooking and ablution facilities
- Lodge type accommodation with full facilities (e.g. power)

### Onsite Information

**Current Situation:** Interpretive signs on tracks (basic information)

#### **Potential Management Actions**

- Provision of additional information

#### **Potential Outcomes:**

- Basic information (no change from current situation)
- Medium information (basic information + information package with detailed maps and brochures)
- Full information (medium information + visitor centre with interactive displays and audiovisual presentations)

### Number of Visitors

**Current Situation:** During the busiest months, visitors can expect to meet up to 50 people over a 1 km walk (frequent visitor interactions)

#### **Potential Management Actions**

- Information based management
- Booking systems

#### **Potential Outcomes:**

- 50 people over a 1 km walk (no change from current situation)
- 40 people over a 1 km walk (regular visitor interactions)
- 30 people over a 1 km walk (few visitor interactions)

## **Section 2:** Management Options

*Abel Tasman National Park experiences high visitor levels and significant development pressures. To inform park development, managers require information regarding visitor preferences for their five-year plans.*

The following questions ask you to make a number of choices between future management options for Abel Tasman National Park. The previous page gives additional information to assist you in making your choices.

- Option A is to retain the **current situation** and remains the same across all questions.
- Options B to M represent management options with different outcomes.
- Outcomes are described by:
  - Native bird species present in the park
  - Number of visitors
  - Onsite information provided
  - Type of accommodation provided
- Park managers do not have the money to pay for these outcomes. Funding could come from a park entrance fee for visitors over 18 years of age and be in *addition* to any existing charges. The fee could be charged for every visit but would not restrict the length of the visit.

When making your decisions, please consider:

- There are other national parks within the Nelson/Tasman conservancy (e.g. Kahurangi and Nelson Lakes National Park).
- Your household budget and whether you can afford the entrance fee.
- The choice scenarios represent **hypothetical** outcomes and some management options may seem strange – but they are all possible.
- Each choice scenario should be treated **separately**.
- Your answers are important and may be used to inform future management decisions.

### Choice Scenario 1

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option B</b>	<b>Option C</b>
<b>Presence of native birds</b>	50 species	60 species	70 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs, brochures, visitor centre	Interpretive signs, brochures
<b>Type of accommodation</b>	Campgrounds and huts	Lodge type accommodation	Cabin type accommodation
<b>Number of visitors</b>	50 people over a 1 km walk	50 people over a 1 km walk	50 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$20	\$10
<b>Your most preferred option (tick ONE box)</b>			

### Choice Scenario 2

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option D</b>	<b>Option E</b>
<b>Presence of native birds</b>	50 species	50 species	60 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs	Interpretive signs, brochures
<b>Type of accommodation</b>	Campgrounds and huts	Lodge type accommodation	Campgrounds and huts
<b>Number of visitors</b>	50 people over a 1 km walk	40 people over a 1 km walk	30 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$10	\$20
<b>Your most preferred option (tick ONE box)</b>			



### Choice Scenario 3

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option F</b>	<b>Option G</b>
<b>Presence of native birds</b>	50 species	50 species	60 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs, brochures	Interpretive signs, brochures, visitor centre
<b>Type of accommodation</b>	Campgrounds and huts	Cabin type accommodation	Cabin type accommodation
<b>Number of visitors</b>	50 people over a 1 km walk	30 people over a 1 km walk	40 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$20	\$30
<b>Your most preferred option (tick ONE box)</b>			

### Choice Scenario 4

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option H</b>	<b>Option I</b>
<b>Presence of native birds</b>	50 species	70 species	60 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs, brochures	Interpretive signs, brochures, visitor centre
<b>Type of accommodation</b>	Campgrounds and huts	Campgrounds and huts	Lodge type accommodation
<b>Number of visitors</b>	50 people over a 1 km walk	40 people over a 1 km walk	50 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$30	\$30
<b>Your most preferred option (tick ONE box)</b>			

### Choice Scenario 5

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option J</b>	<b>Option K</b>
<b>Presence of native birds</b>	50 species	70 species	50 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs	Interpretive signs, brochures, visitor centre
<b>Type of accommodation</b>	Campgrounds and huts	Cabin type accommodation	Campgrounds and huts
<b>Number of visitors</b>	50 people over a 1 km walk	50 people over a 1 km walk	50 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$30	\$20
<b>Your most preferred option (tick ONE box)</b>			

### Choice Scenario 6

Please consider **ONLY** the three management options below and choose the **one** you prefer the most.

*You may wish to refer to the previous information sheet*

	<b>Option A Current Situation</b>	<b>Option L</b>	<b>Option M</b>
<b>Presence of native birds</b>	50 species	60 species	70 species
<b>Onsite Information</b>	Interpretive signs	Interpretive signs, brochures, visitor centre	Interpretive signs, brochures
<b>Type of accommodation</b>	Campgrounds and huts	Campgrounds and huts	Lodge type accommodation
<b>Number of visitors</b>	50 people over a 1 km walk	30 people over a 1 km walk	30 people over a 1 km walk
<b>Entrance fee (\$ NZ)</b>	\$0	\$10	\$30
<b>Your most preferred option (tick ONE box)</b>			

From the choices available, did you always select option A (current situation)?

Yes     No    → Go to Section 3

IF YES, which of the following statements best describes your reason for doing so?  
(Tick **ONE** box only)

- I support the current park management option
- I am unable to pay the entrance fee
- I object to paying an entrance fee
- I am uncertain as to which management option is the best
- Other reason, please specify:

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**Section 3:** Background Questions

1. Gender

- Male       Female

2. Age

- 18-24     25-34     35-44     45-54     55-64     65-74     75+

3. What is your highest level of formal education?

- Primary school     Secondary school     Tertiary diploma/certificate  
 University degree

4. Do you have children?

- Yes     No

5. Are you a:

- New Zealand permanent resident  
 Visitor to New Zealand

6. What category best describes your **annual household** income before taxation?

- <\$30,000  
 \$30,001-60,000  
 \$60,001-90,000  
 \$90,001-120,000  
 \$120,001-150,000  
 \$150,001-180,000  
 \$180,001+

7. Are you a member of an organisation concerned with environmental conservation?

- Yes     No

If you have any comments regarding any aspect of this survey, please use the space below.

**Thank you for your participation**

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