WILLINGNESS TO PAY FOR MARINE BASED TOURISM WITHIN THE PONTA DO OURO PARTIAL MARINE RESERVE, MOZAMBIQUE

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Abstract

Marine and coastal ecosystems face widespread degradation largely because market failure hides the economic value of the goods and services provided by them. Marine protected areas (MPAs) can serve as a structure that ensures the continuing function of marine and coastal ecosystem goods and services. Yet, to be effective and sustainable, MPAs must be able to prove their economic worth and generate revenue. User-fees are a common system used to partially finance multi-use MPAs. This study applies contingent valuation as a method of economic valuation within an MPA in southern Mozambique. The objectives of this study are to determine the willingness to pay of combined user groups and of individual user groups for use of the Ponta do Ouro Partial Marine Reserve and to investigate the potential for the reserve to increase revenues for conservation through the implementation of a user-fee for marine based activities. The payment card contingent valuation method was employed to determine willingness to pay of dolphin swim tourists, scuba divers and fishermen. Data was collected by face-to-face interviews of 120 respondents within two popular tourist locations in the PPMR. Results show that visitors within the PPMR are mainly South Africans, loyal to the area. Probit and OLS regressions were used to determine the effects of various independent variables on willingness to pay. Results from the Probit model indicate that African residency, activity and environmental awareness were significant factors that influenced visitors being WTP more than R20 per person per day as a user fee within the PPMR. The OLS model examined independent variables that influenced visitors being willing to pay as well as the impact of the variables on the amount visitors were willing to pay. The OLS model found income, African residency and environmental awareness to be significant factors influencing visitors being willing to pay. The mean

WTP was R43.75 per person per day. Using data supplied by the PPMR, conservative estimated annual revenues based on the implementation of this fee amount would range between R1.46m – R 3.3m.

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Dedication

For my grandmother,

Marguerite Dewey Carroll

(1919-1998)

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List of Abbreviations & Acronyms

AIM:	News Agency of Mozambique
	Portuguese: Agência de Informação de Moçambique
BG:	Bidding game
CBD:	Convention on Biological Diversity
CEPF:	Critical Ecosystem Partnership Fund
CV:	Contingent valuation
DBDC:	Double-bound dichotomous choice
DC:	Dichotomous choice
DNAC:	National Directorate for Conservation Areas
	Portuguese: Direcção Nacional de Áreas de Conservaçáo
EAME:	Eastern African Marine Ecoregion
FC:	Forced choice
FRELIMO:	Liberation Front of Mozambique
	Portuguese: Frente de Liberação de Moçambique
GDP:	Gross Domestic Product
HDI:	Human Development Index
HP:	Hedonic pricing
IFC:	International Finance Corporation
IUCN:	International Union for the Conservation of Nature
IWP:	iSimangaliso Wetland Park
MCA:	Marine Conservation Agreement
MITUR:	Ministry of Tourism
	Portuguese: Ministério do Tourismo
MPA:	Marine protected area
NOAA:	National Oceanic and Atmospheric Administration
OE:	Open-ended
PADI:	Professional Association of Diving Instructors
PC:	Payment card
PPMR:	Ponta do Ouro Partial Marine Reserve
RENAMO:	Mozambique National Resistance
	Portuguese: Resistência Nacional Moçambicana
SASSI:	Southern African Sustainable Seafood Initiative
SBDC:	Single-bound dichotomous choice
SCUBA:	Self contained underwater breathing apparatus
TCM:	Travel cost method
TEV:	Total economic value
TFCA:	Transfrontier Conservation Area
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
UNICEF:	United Nations Children's Fund
WTA:	Willingness to accept
WTP:	Willingness to pay
WWF:	World Wildlife Fund

Introduction **1**

Economic activity and the natural world interlace in a complex relationship on which every person relies. The environment provides benefits through biological resources that are fundamental to society as a whole (ten Brink *et al.*, 2009), and to human well-being (Frey *et al.*, 2009). Despite this, failures within the market mechanism of the economy largely hide (Schiller, 2003) and undervalue the demand (Balmford *et al.*, 2002) for environmental resources. Consequently, unrestrained economic activity may drive biological diversity and resources towards degradation and extinction (Pearce and Moran, 1994). However, there are economic techniques with which to value environmental resources. Realizing the value of the environment motivates the establishment and maintenance of protected areas, which preserve ecosystems and economies into the future.

Ecosystems deliver various goods and services of great value that form a large, but hidden, part of the economy (Pearce and Moran, 1994, Costanza *et al.*, 1997, Balmford *et al.*, 2002). These include, but are certainly not limited to, the provision of and access to fresh water, clean air, food, fuel and materials with which to build shelter. Ecosystem services also control climate, populations and diseases, services that are crucial to human survival.

It is well established that ecosystems have faced widespread degradation due to growing anthropogenic threats (Hannah *et al.*, 1994, Pandolfi *et al.*, 2003, Worm *et al.*, 2006, Mora and Sale, 2011, Cardinale *et al.*, 2012). In response to this, governments have established protected conservation areas as tools for management. Over time, the objectives of protected areas have evolved. Like many protected areas, the formation of marine protected areas (MPAs) was first used as a tool of management for consumptive use, intended to aid in the recovery and restocking of fish populations. Now MPAs are also used as tools of ecosystem preservation and for the development of non-consumptive uses (Alban *et al.*, 2006) such as tourism and recreation. Yet the objectives of an MPA can often be conflicting, as multiple user groups make the most of the resources within an area. Consequently, MPAs are often faced with a balancing act of regulations for commercial, conservation, recreation and research demands on top of

preserving biological diversity (Agardy *et al.*, 2011), making them difficult to manage effectively in the long run. Furthermore, as the world population continues to grow exponentially, protected areas are often at odds with the needs of developing nations (Thur, 2010), compounding the issue of sustainable planning and management.

Protected areas face threats associated with public goods (Dixon and Sherman, 1991). Moreover, because of market failure, protected areas increasingly are difficult to justify on financial grounds, especially when compared to other land uses (Inamadar *et al.*, 1999). Thus, to be successful and viable in the world today, MPAs must be able to prove themselves on economic grounds or face the label of 'paper park,' an MPA that's only influence is written on paper.

To be viable over time, MPAs must prove the ability to generate their own financial support. While many other studies have applied economic valuation to MPAs, no known studies dedicated to contingent valuation (CV) have been applied to Mozambique MPAs. This study will explore the opportunity for user-pays systems to partially finance multi-use MPAs by applying CV to the Ponta do Ouro Partial Marine Reserve (PPMR) in southern Mozambique. A case study will provide insights into the theory of CV as well as marine based tourists' willingness to pay (WTP). The PPMR is a complex case study site that will yield a distinct yet replicable model of application.

1.1   Background to Environmental Valuation

The term biodiversity encompasses not only the richness of species, but also the ecosystems in which life resides. Various ecosystems play diverse roles in maintaining the planet as a habitable place for humans. Despite their importance, ecosystems face widespread degradation due to growing anthropogenic threats (Hannah *et al.*, 1994, Pandolfi *et al.*, 2003, Worm *et al.*, 2006, Mora and Sale, 2011, Cardinale *et al.*, 2012).

Ecosystem functions are the 'properties or processes' that occur naturally within a particular environment (Costanza *et al.*, 1997) that are influenced by global change and influence ecosystem services (Cardinale *et al.*, 2012). Ecosystem services are the goods and services that arise out of ecosystem functions and are specifically beneficial to humans (Table 1.1). Regulation and habitat functions are conditional to production and information functions (de Groot *et al.*, 2002), forming somewhat of a hierarchy of ecosystem functions.

Table 1.1 Ecosystem goods and services

Function	Components	Goods and services
Regulation	*Essential ecological processes & life support systems*	
	Gas, climate & nutrient regulation	Favourable climate
	Disturbance prevention	Storm, flood protection
	Water regulation & supply	Provision of consumptive water
	Soil retention and formation	Healthy, arable land
	Waste treatment	Pollution control
	Pollination	Pollination of wild plants and crops
	Biological control	Control of pests and diseases
Habitat	*Suitable living space for all species*	
	Refugium and nursery function	Biological and genetic diversity
		Commercially harvested species
Production	*Natural resources*	
	Food	Fuel and energy, fodder, fertilizer
	Raw materials	Building and manufacturing supplies
	Genetic, medicinal & ornamental resources	Drugs and pharmaceuticals, chemical models,
Information	*Opportunities for cognitive development*	
	Aesthetic, cultural and artistic, spiritual & historic information	Enjoyment of scenery, motivation of arts, folklore, religion
	Recreation	Outdoor sporting opportunities
	Science and education	Scientific research

Adapted from de Groot et al. (2002)

Despite the overwhelming evidence of the economic importance of ecosystem services (Costanza *et al.*, 1997, Balmford *et al.*, 2002), their value is largely undetectable in the marketplace. This is due to market failure and the public good characteristics of ecosystem services. Undetected market value leads to the loss of biodiversity and a decline in ecosystem services (Mora and Sale, 2011) that is exacerbated by the short-term benefits of ecosystem conversion (Balmford *et al.*, 2002).

Whether local, national or global, "economic invisibility" leads to the loss of ecosystem services (Pascual *et al.*, 2010:4). For instance, on a national level, the clear cutting of a forest would be revealed as positive GDP (MEA, 2005) because the short-term benefits of raw materials is evident in the market. Yet the lack of economic accounting for soil retention, disturbance regulation, habitat and other services provided by the forest results in an incomplete estimation of total social cost. Thus, with this economic invisibility, market failure is at the core of ecosystem degradation (Balmford *et al.*, 2002).

That human disruption of the environment can upset the goods and services provided by nature is not a new concept. In a detailed history of the relationship between economic theory and ecosystem services, Gómez-Baggethun *et al.* (2009) explore how shifts from pre-classical economics to neo-classical economics influence

today's approach to environmental policy. The concept of ecosystem services arose as a way to boost support for conservation by highlighting human dependency on the environment, and to make conservation a policy issue, in other words, to "frame ecological concerns in economic terms" (Gómez-Baggethun *et al.*, 2009:5). From an economic theory perspective, two schools of thought formed - Environmental and Resource Economics and Ecological Economics. While there are many nuances within the two camps, authors mention two main differences. Primarily, environmental economics and ecological economics contrast on whether manufactured capital can substitute, or compliments natural capital, respectively. Hence, while environmental economics views nature as embedded in the market, ecological economics perceives the market embedded in nature (Sagoff, 2013). Second, many ecological economists contest the cost-benefit approach of environmental policy-making. In essence, the argument insists that the language of environmental valuation lacks the ability to value the intrinsic pricelessness of nature and that valuation is inappropriate for intangible things (Gómez-Baggethun *et al.*, 2009).

For some ecological economists, neoclassical economics and environmental valuation have removed the morality of the decision making process around the environment and lead to the commodification of nature (McCauley, 2006). Yet, inherent in every choice is a valuation process. Whether choices and the uncertainty involved in them are explicit or not relies on acceptance of the process of valuation (Costanza *et al.*, 1997). To promote conservation is to place a value on it and promote it for the well-being of humans as, "all conservation judgements are value judgements and the values involved are human values" (Mace *et al.*, 2012:24).

Value has diverse manifestations. Environmental valuation provides an explicit analysis that can account for these various manifestations, not just marketable outputs (Balmford *et al.*, 2002). The real world example of a mangrove forest helps to illustrate the point. Mangroves serve a plethora of ecosystem services that, in addition to carbon sequestration, act as a biofilter, support a nursery for reef fish and commercially important fish species, and contribute crucial storm protection for coastal areas (Warne, 2011). Shrimp farming, which clear-cuts and drains mangrove forests, is a volatile boom and bust industry that provides short-lived services to the permanent detriment of vast swaths of mangrove forests. Accordingly, a valuation of mangroves found that intact,

with their manifold services, untouched mangroves are worth around 79% more to the economy than mangroves converted to shrimp farming (Balmford *et al.*, 2002).

Thus, understanding the total economic value of intact mangroves, or any other ecosystem and the services they provide, can promote environmental conservation. As Chapter 2 explains in further detail, total economic value can account for cultural use, existence value and other indirect and non-use values. While many economists agree on the theory behind environmental valuation, determining value, that is the method used to derive economic value, leads to disagreement amongst economists.

While economists generally accept economic valuation of ecosystem services, there are long standing debates surrounding the appropriate and most accurate methodology. Revealed and stated preference methods are two common approaches used to value non-market goods. This thesis focuses on the stated preference method of contingent valuation, the elements and intricacies of which the literature review considers in Chapter 3.

1.2   Marine Protected Areas Overview

For centuries, people have created methods to protect marine resources (Toropova *et al.*, 2010a). In ancient Hawaiian and Fijian cultures, traditional marine protected areas (MPAs) existed to protect fish stocks. These early MPAs were governed under the *kapu*, an ancient Hawaiian set of laws, and *tabu*, a Fijian set of laws that prevented or limited fishing in certain areas and monitored catch numbers. Western influence has corrupted many traditional MPAs, although governmentally established MPAs also have a rich history. Designated in 1879, the oldest MPA in the world is the Royal National Park in New South Wales, Australia (Davis, 2002). Declared in 1964, the Tsitsikamma National Park in South Africa is Africa's oldest MPA (WWF-SA, 2013).

As a consequence of the exhaustive reach of humans, and despite efforts to protect marine realms, today there is not a single ocean or sea untouched by humans. Even the deepest oceans trenches have evidence of human impact. The only natural protection seems to be the ice of the poles, where human impact is very low but still present. Ultimately, human impact is medium high to very high in over one-third (41%) of the world's oceans (Halpern *et al.*, 2008).

The definition and levels of classification for MPAs originates in terrestrial protected

area theory (Al-Abdulrazzak and Trombulak, 2012). While both marine and terrestrial protected areas have the same overall goal of protecting the biodiversity within certain locations, the similarity ends there. Aside from the obvious differences between land and sea, the most glaring difference between a marine and terrestrial protected area is that an MPA cannot be fenced. This results in the onerous task of exclusion and inclusion. If the marine life in a protected area is highly migratory, or even locally migratory, the possibility of targeting and extraction of that species outside the bounds of the MPA increases. Keeping out threats to the MPA, from oil drills to exotic invasive organisms, poses additional challenges.

The Convention on Biological Diversity (CBD, 1992) historically defined MPAs rather vaguely as "a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives." A more thorough description comes from Claudet (2011:2) who defines an MPA as:

> "[A] discrete geographic area of the sea established by international, national, territorial, tribal or local laws designated to enhance the long-term conservation of natural resources therein".

Claudet's description elaborates, stating that the interpretation of this definition can relate to various factors such as management of marine resources, sustainable use and socio-economic development. Thus, MPAs can consist of multiple use areas with both consumptive and non-consumptive activities within spatial zones. A protected area in which consumptive or extractive use is not allowed is known as a no-take zone, a marine reserve or a sanctuary zone (Al-Abdulrazzak and Trombulak, 2012). No-take zones also can have various levels of non-consumptive use zones where some areas may ban any access by any user group and others may permit activities such as swimming, surfing or boating. Often, no-take zones are embedded within MPAs as part of the MPAs multiple use zones (Claudet, 2011).

MPAs can be an effective approach to conservation of sea life and ocean ecosystems. With adequate enforcement and fishing restrictions, MPAs have proven to increase biomass of targeted species over time (Goñi *et al.*, 2011). Long-term positive effects of MPAs are known as spillover effects. Spillover occurs when the increase in biomass within a restricted fishing area also leads to an increase in biomass in surrounding areas (Alban *et al.*, 2006). This is a positive effect not only for biology, but also for fisheries, recreation and economies as a whole. While the positive effects of MPAs may

be vast (Claudet, 2011), indicators of an effective MPA can be difficult to quantify (Pelletier, 2011). Understanding all of the aspects of MPAs and the processes MPAs create ecologically and economically is a complex endeavour. Nonetheless, the establishment of an MPA is an "investment in natural capital" (Alban *et al.*, 2006:1) that has been proven as an effective tool for management (Alban *et al.*, 2006).

In 2002, the CBD set a world target to protect a representative 10% of all marine and coastal ecological regions by 2012 (Toropova *et al.*, 2010b). A study found that, in 2006, there were 4 435 MPAs, or 0.65% of oceans and seas that received any form of natural resource protection (Wood *et al.*, 2008). The study pointed out that, at the current rate, reaching the 10% goal would take decades, not six years. In 2010, a follow-up study found 5 878 MPAs covering 1.17% of marine areas (Spalding *et al.*, 2010), but the study attributed the increase in MPAs to the declaration of a small number of large MPAs. In fact, at the time of the study two very large MPAs were under development or approved for development. Including these two MPAs in the study would have added an additional 900 000 km^2. Including these MPAs would increase global coverage of MPAs to 5.1 million km^2 but these two MPAs would make up 20% of total global MPA coverage. Still, only 1.42% of oceans would be protected. In 2010, the deadline for the CBD 10% goal was extended to 2020 (Kearney *et al.*, 2012).

Because of the historically vague definition of an MPA, the designation of an MPA can have loose connotations. On one end of the spectrum is a case such as the Aliwal Shoal MPA in KwaZulu Natal, South Africa where shark nets kill endangered and protected species (Dudley and Simpfendorfer, 2006) including species that bring significant tourism revenues to the region (Dicken and Hosking, 2009) and a paper mill pumps effluent in a plume that covers the MPA crown area (Olbers *et al.*, 2009). On the other end of the scale is the Tsitsikamma MPA along the Garden Route in South Africa. The whole park a strict no-take zone with uncompromising patrols against fishing and extractive activities and a thriving tourism industry (SAN-Parks, 2013).

While multi-use zoning within MPAs allows multiple user groups to access and benefit from the area under a single management structure (Thur, 2010), multiple use zones can dilute the effectiveness of an MPAs goals of conservation (Al-Abdulrazzak and Trombulak, 2012). Furthermore, lending the suggestive title of MPA loosely and to areas with varying regulations, like in the cases of Aliwal Shoal MPA and Tsitsikamma MPA, may lead to a "false sense of conservation accomplishment" (Al-Abdulrazzak and

Trombulak, 2012:576) that misleads everyone from policy makers to the public. Worldwide, MPAs have increased their area of protection by 150% since 2003, yet many are "ineffective or only partially effective" with few true reserves (Toropova *et al.*, 2010b:7). These ineffective or partially effective parks are called paper parks.

Paper parks tend to lack effective management and thus yield little to no on-the-ground impact or benefit to marine conservation (Thur, 2010). This has led countries and conservation agencies worldwide to fight against paper parks. In 2008, regional initiatives in Micronesia, the Caribbean and the Coral Triangle[1] committed to set goals regarding MPAs and paper parks. Rather than highlighting the importance of increasing percentages of protected areas to meet the CBD targets, these initiatives encouraged efforts to effectively manage existing MPAs. Within the Caribbean, countries pledged to tailored goals. For example, the Bahamas pledged to protect an additional 20% of near shore marine resources but, significantly, it also committed to effectively manage a minimum of 50% of its existing protected areas by the CBD deadline of 2020 (Meliane *et al.*, 2010).

Lack of sustainable financing is the primary cause of paper parks. Without adequate and consistent finances, it is impossible to effectively manage and enforce rules and regulations within an MPA. Internationally, while stakeholders and political leaders increasingly acknowledge the need for and benefits of MPAs, increased financial resources and sustainable financing plans have been slow to follow (Meliane *et al.*, 2010). One challenge MPAs face is that they are often difficult to justify on financial grounds, especially when compared to other uses (Inamadar *et al.*, 1999). This is exacerbated within developing nations where daily subsistence fishing or farming take priority over future vitality (Lindberg, 2001). Therefore, to be sustainable and effective in the long run, MPAs must demonstrate their ability to generate their own revenues. While sustainable financing is essential for the success of MPAs, financing need not come entirely from external sources. Many MPAs have the capacity to generate some of their own funding.

User fees are a common method used to help generate funds for MPAs (Lindberg, 2001). User fees can come in a variety of different forms, from a per day access fee to an annual visitors pass. For user fees to be a sustainable source of financing, the fees must

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[1] The Coral Triangle is an ecologically defined area encompassing the Philippines, eastern Malaysian Borneo, eastern Indonesia, Timor Leste, Papua New Guinea and the Solomon Islands.

be based on the willingness to pay (WTP) of the targeted users of the MPA. This ensures that the user fee maximises possible revenues and aids in the fair spreading of costs. Basing fees on users' WTP also avoids issues that may arise from a miscalculation of fee structures, like overestimation. Overestimation of visitors' WTP could result in a sharp decline in expected revenues while underestimation may lead to challenges surrounding financial stability and sustainability. Without the data provided by a WTP study, MPAs could stand to lose the very users needed to help economically sustain the park especially if there are close substitutes, such as another nearby park or recreational site.

Because an MPA is a public good and does not have a traditional market driven supply and demand, the determination of an accurate fee system based on maximum WTP calls for the use of certain economic methods. Revealed preference methods analyse behaviour observed in existing markets whereas the technique to estimate the value of nonmarket goods employs hypothetical scenarios that fall under the category of stated preference methods (Mitchell and Carson, 1989). This study will use CV from the family of stated preference methods to determine the WTP of users of an MPA in southern Mozambique. As Chapter 2 explains in more detail, CV directly obtains the value an individual puts on a good or service, thus providing an indication of demand.

1.3   Mozambique: Country Overview

With the third longest coastline in the Western Indian Ocean (Costa *et al.*, 2005), and the second longest coastline in Africa, Mozambique spans the 2 470 kilometres of coast between the countries of Tanzania and South Africa (World Factbook, 2013). Encompassing 799 380 square kilometres, as slightly larger than Turkey, and slightly less than twice the size of California (World Factbook, 2013), Mozambique is the 35th largest country in the world (Figure 1.1).

Ranked as the 50th most populated country with the 32nd highest population growth rate in the world, Mozambique is home to roughly 24 million people (World Factbook, 2013: July 2013 est.). Mozambique ranks in the top 15 countries for highest birth and highest fertility rate. As such, the majority of the population is very young with 45% under the age of 14 years old (World Factbook, 2013).

Figure 1.1 Map of Mozambique
(Adapted from Dalet, 2012)

Life expectancy at birth is 50.7 years, placing Mozambique amongst the ten lowest life expectancies in the world (HDI, 2012). This is largely due to its ranking fifth in the world for people living with HIV/AIDS, approximately 1.4 million people, with a prevalence rate of 11.5% (UNAIDS, 2011). Within adults aged 15-49, 13.1% of females and 9.2% of males in Mozambique are living with HIV/AIDS (BTI, 2012).

Over 1.5 million people reside in the capital city of Maputo. The civil war from 1977-1992 resulted in a population movement to urban and coastal areas, a trend that has continued with an estimated increase in urbanization of 4% (World Factbook, 2013: 2010-15 est.). Currently, 38.4% of the population live in urban areas (BTI, 2012).

The government adopted Mozambique's current flag in 1983 (Figure 1.2). Although somewhat incongruous, the symbols and colours of the flag hold hints to the country's recent history and possibly towards its future. The red on the flag represents the struggle for independence; the yellow star is a symbol of Marxism, and a centre black strip is for pride in Africa (World Factbook, 2013), which all recall Mozambique's War of Independence against Portugal. Backed by the Soviet Union, Cuba, China and others, the Liberation Front of Mozambique (Frente de Liberação de Moçambique, FRELIMO) guerrilla forces lead sporadic armed conflict against Portugal rule, lasting from September 1964 until ceasefire in September 1974 (BBC, 2013a). After independence on 25 June 1975, FRELIMO presided over a one-party Marxist government, lead by President Samora Machel (BTI, 2012). While the official language remains Portuguese

today, only a small minority of Mozambicans speak Portuguese as their home language with Makhuwa, Tsonga and other Mozambican languages dominating (World Factbook,

Figure 1.2 Flag of Mozambique
(Source: Wikimedia Commons)

2013).

Mozambique's flag is the only national flag in the world with a modern weapon on it, the AK-47, signifying defence and vigilance (World Factbook, 2013). Yet the flag also has white stripes, the universal colour of peace. One interpretation of these contrasting symbols is that the AK-47 is of historical significance, evoking Mozambique's past bloody civil war while the fimbriated white of the flag represents hope for a future of prevailing peace. Indeed, the effective use of AK-47s put today's ruling party in power (Gordon, 1997).

Two years after independence from Portugal, the opposition Mozambican National Resistance (Resistência Nacional Moçambicana, RENAMO) staged a revolt that turned into a violent sixteen-year civil war, during which both RENAMO and FRELIMO committed crimes against humanity (World Factbook, 2013). Mozambicans suffered greatly; around one million people died from fighting and starvation, and estimations of upwards of five million people were displaced (BBC, 2013a). The war reached a turning point after a suspicious plane crash that killed President Samora Machel. With a change in the constitution from Marxism to capitalism and peace talks with RENAMO, the new President Joaquim Chissano, paved the way for peace accords signed on 4 October 1992. Today, Mozambique is a multi-party democracy. In 2004, a peaceful transition between Chissano and elected president Armando Emilio Guebuza further highlighted

Mozambique's commitment to democracy. Leader of FRELIMO, President Guebuza was sworn in for his second term in office on 14 January 2010 (World Factbook, 2013).

The interpretation of the contrasting symbols of war and peace on the flag of Mozambique may not be so straightforward. While peace has widely prevailed in the past 20 years, international watchdog organisations cite concern over the strength of Mozambique's democracy with FRELIMO's constitutional majority in parliament (BTI, 2012). Recent clashes between government and opposition party RENAMO over suspected voter fraud in 2009, abuse of government powers and other social conflicts have shaken stability. In October 2012, RENAMO leader, Afonso Dhlakama, returned to a war-era bush camp and began retraining soldiers in using AK-47s (Jackson, 2012) (Plate 1.1). In June 2013, FRELIMO blamed RENAMO for deadly attacks on civilians. Despite RENAMO's threats to paralyse roads, railways and ports vital for Mozambique's exports, it denies involvement in the recent attacks (BBC, 2013b). Whether the emblem of an AK-47 on Mozambique's flag is a heedful tribute to its past or a bleak prophecy for the future remains inconclusive.

The open book resting on the Marxist star of the flag signifies the importance of education for all Mozambicans (World Factbook, 2013), yet Mozambique's education policy is ranked as four on a scale from ten (best) to zero (worst) (BTI, 2012). Contradictions again abound. While primary education enrolment has increased by over 10% from 2002-2009, with girls' enrolment increasing by one million, declining completion rates detract from enrolment advancements (UNICEF, 2012). At 44%, literacy, defined as those over the age of 15 that can read and write, is considerably lower than the sub-Saharan average of 62% (BTI, 2012).

Plate 1.1 RENAMO rebels with AK-47
(Source: Jackson, 2012)

Despite possible contradictions between war and peace, Marxism and democracy, an emphasis on education yet low literacy rates, the remaining elements of the flag, the colours green for riches of the land and yellow for minerals, and the symbol of a hoe for agriculture, are unequivocal. Agriculture is a large part of the average Mozambican's life with approximately 70% of people relying on subsistence farming (UNICEF, 2012) and accounting for 30% of the country's GDP (Ribeiro *et al.*, 2011). Mozambique exports cashew nuts, cotton, sugar and citrus (World Factbook, 2013) but tobacco is the county's largest agricultural export. The agricultural industry surrounding tobacco is a bright success story for economic development in Mozambique (Hanlon, 2007).

In addition to an abundance of minerals such as titanium, tantalum and graphite, Mozambique exports large amounts of aluminium. Although Mozambique has no aluminium reserves, the construction of a megaproject aluminium smelter plant, Mozal, has lead Mozambique to be one of the world's leading aluminium exporters; 55% of the country's export earnings in 2003 came from aluminium (Wood, 2011). Yet the most significant riches of the land come are untapped coal reserves, some of the world's largest (IRJ, 2011), and the largest natural gas deposits found in a century (Gismatullin, 2013).

1.3.1 Mozambique Economy

Much like the elements of its flag, Mozambique's economy is full of antinomies; both the World Bank and UNICEF have described Mozambique's economy as a paradox (Hanlon, 2007). As one of the strongest preforming African nations, Mozambique's growth rate of between 6-8% over the past decade puts it among the top ten fastest growing economies in the world (UNICEF, 2012)*.* Abundant natural resources including coal, hydropower and considerable natural gas reserves lead to predictions of continuing growth in the coming years (UNICEF, 2012). While Mozambique depends on foreign aid for 40% of its annual budget, donor assistance could decrease in coming years as commercial exploitation of natural resources grows (World Factbook, 2013). When considered in terms of growth rates in the decade after its civil war, Mozambique appears to be a foreign aid success story (Spector *et al.*, 2005).

While outwardly Mozambique's growth seems to be a positive result of foreign aid, other economic indicators suggest a darker picture. In July 1998, construction began on

the Mozal aluminium smelter. At the time the megaproject, at a cost of $2 billion, was the largest single, non-financial project funded by the International Finance Corporation, a member of the World Bank group, and was the largest investment in Mozambique ever (Wood, 2011). As a pioneer investment in Mozambique, a task force of ministers were assigned to ensure that the project moved forward smoothly; the megaproject was designed as a too-big-to-fail endeavour and was executed as a model that would create a framework for future investors and future megaprojects (Wells and Buehrer, 2000). This approach was effective and other megaprojects, such as the Sasol natural gas pipeline, the Cahora Bassa hydro-electricity facility and the Moatize coalmine, followed. Mozambique's strong economic growth has been driven by these foreign-financed, largely tax-exempt megaprojects (BTI, 2012) with Mozal contributing in excess of $400 million in foreign exchange earnings per year (Broadman, 2007). While megaprojects have delivered spillover benefits in the form of upgraded roads, bridges, waterlines and hazardous-waste facilities (Broadman, 2007), analysis of Mozambique's megaprojects has shown that large foreign investment has not resulted in a change in the structure of the Mozambique economy, or influenced positive change in other economic indicators (Wood, 2011).

While Mozambique's Gini Coefficient has decreased from 0.47 in 2003 to 0.45 in 2008 (World Bank, 2008), Mozambique's GDP per capita (purchasing power parity) is amongst the lowest in the world, at $1,155 (International Monetary Fund, 2013). Over half the population lives below the poverty line (World Factbook, 2013; 2009 est) with poverty "increasing and deepening" (Hanlon, 2007:15). Child malnutrition has increased almost at the same rate as Mozambique's economy (Hanlon, 2007). Correspondingly, the Human Development Index ranks Mozambique 185 out of 187, dropping from 184 in 2011 (HDI, 2012). Unemployment, by standard definition, has remained between 20-22% over the past 15 years (World Factbook, 2013). Taking into consideration that 75% of the population relies on subsistence agriculture, broadening the definition to include people who are occasional workers or idle self-employed gives a more accurate estimate of unemployment; the rate increases from 21% to 31% in most recent estimates (OECD, 2008).

As a whole, Mozambique seems to teeter between promise and deterioration. Mozambique is a functioning democracy. Significant growth rates of both its population and its economy along with vast untapped natural resources and the foreign

investment to exploit them show a side of Mozambique that is full of potential. However, as a developing country it faces challenges that a growing economy cannot solve and a growing population only exacerbates. These challenges are compounded by a violent history coupled with current conflict brewing. The direction Mozambique takes in the coming years hangs in the balance, as does the future of its nearly 24 million inhabitants.

1.3.2 Mozambique Marine Protected Areas

With its expansive coastline, dotted with around 44 islands and diverse ecosystems of mangrove forests, coastal lagoons, sea grass beds and coral reefs, Mozambique has much to protect. Despite its history of conflict and economic woes, Mozambique has shown a commitment to conservation by signing and adhering to various international treaties and agreements on conservation initiatives (DNAC, 2010).

While the implementation of these treaties and national environmental legislation, falls to the Ministry for the Coordination of Environmental Affairs there is no one government institution assigned specifically to conservation in Mozambique. The establishment and management of protected areas is the responsibility of the National Directorate for Conservation Areas (Direcção Nacional de Áreas de Conservaçáo, DNAC) under the Ministry of Tourism (Ministério do Tourismo, MITUR). This organizational structure puts the goals of tourism above those of conservation, which is evident in the mandates of DNAC. The first three mandates of DNAC focus on development strategies, licensing and proposed projects of eco-tourism and safaris and of the ten total mandates, only four have to do specifically with conservation areas (MITUR, 2010). Thus, it is evident that the priority of "protected areas is not biodiversity, ecosystem or ecological process conservation, but nature-based tourism" (CEPF, 2010:54).

Regardless of the primary purpose of protected areas, Mozambique has made a commitment to marine conservation that is evident in the number of MPAs in Mozambique, which includes Africa's second oldest MPA (Table 1.2). A focus on nature-based tourism is not necessarily in conflict with the promotion of protected areas as nature-based tourism also relies on biodiversity, ecosystems and ecological processes. In some ways, Mozambique's commitment to tourism above conservation has resulted in more and better managed MPAs. Mozambique has applied two Marine Conservation Agreements (MCAs) by transferring the rights of submerged lands from the state to private investors (Marine Conservation Agreements Toolkit, 2010a). In particular, as a

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result of MCAs, the Vilanculos Coastal Wildlife Sanctuary and North Quirimbas add an additional 310km^2 of protected marine areas to Mozambique, one-third of which is a no-take zone, that otherwise would not exist.

Table 1.2 Mozambique marine protected areas

Site	Established	Size (km^2)
Inhaca Island	1965	1
Bazaruto Archipelago National Park	1971	600
	2001[*]	1 430
Vilanculos Coastal Wildlife Sanctuary (Private)	2000	80
Quirimbas National Park	2002	1 522
North Quirimbas (Private)	2008	230
Ponta do Ouro Partial Marine Reserve	2009	678
Primeras & Segundas Archipelago	2012	10 400

[*]Expanded to include an additional 830 km^2

(Sources: Wells et al., 2007, DNAC, 2010, WWF, 2012)

The Vilanculos Coastal Wildlife Sanctuary was developed on a $10-13million investment from the Overseas Private Investment Corporation, an arm of the U.S. Department of State, and private sector investors from the U.S. and South Africa (OPIC, 2003). The 50-year concession of 25 000 hectares, which included 80 km^2 of marine area, was based on a low-density ecotourism project with "promise of significant commercial investment" (Spenceley, 2003:41).

Similarly, private investors out of the UK, working together with WWF, received a 50-year concession to 230 km^2 surrounding Vamizi Island in the North Quirimbas Islands. The island has since been developed as an exclusive luxury eco-tourism destination that finances the MPA (Marine Conservation Agreements Toolkit, 2010b). The protected area also consists of a strict no-take zone surrounding Vamizi Island 3km out to sea (Vamizi Island, 2012), approximately 110 km^2 of sanctuary zone in total.

Despite its woes, Mozambique has done a lot to promote MPAs and protects a commendable amount of its coastal and marine areas (Appendix I). Most recently, the declaration of the Primeiras and Segundas Archipelago as an MPA in 2012 increased the protection of Mozambique's continental shelf by 14.2%, boosting Mozambique's total marine protected area up to nearly 20% of its continental shelf (Table 1.3) and allowing

the country to lay claim to Africa's largest MPA.

Table 1.3 Coverage by MPAs of Mozambique's continental shelf to 200m

Area of continental shelf (km^2) to 200m depth	73 300
Area MPAs (km^2)	14 341
% continental shelf protected	19.6%

While Mozambique adds to the CBD goal of 10% of the marine realm protected by 2020, it lags behind other MPA recommendations. In 2003, at the World Parks Congress in Durban, it was recommended that 20-30% of MPAs be declared no-take zones (Wells *et al.*, 2007). This study has found it difficult to determine the percentage of no-take zones in Mozambique MPAs. Although Wells *et al.* (2007) estimated 40 km^2 of no-take zones in Mozambique, the site was unspecified by the authors. In the North Quirimbas, a 3km radius of no-take zone surrounds Vamizi Island (Vamizi Island, 2012), which is roughly 110 km^2. Within the PPMR, 40 km^2 is strict no-take zone. It is unclear how much of the Primeras and Segundas Archipelago MPA is no-take zone. With no other known no-take zones in the remaining Mozambique MPAs, the result is a miniscule percentage of no-take zones within MPAs (Table 1.4).

Table 1.4 No-take zones within Mozambique MPAs

Area MPAs (km^2)	14 341
Area no-take[a] (km^2)	150-190
% MPAs no-take	1.0-1.3%

1.3.3 Ponta do Ouro Partial Marine Reserve

The Ponta do Ouro Partial Marine Reserve (PPMR) is Mozambique's southern most MPA, declared on 14 July 2009. The reserve stretches from the border with South Africa (S26° 51' 32.40", E32° 56' 45.60") 86km to its northern most point past Inhaca Island (S 25° 55' 40.8", E33° 01' 26.4") and into Maputo Bay at the Maputo River Mouth (-26° 11' 38.40", +32° 41' 27.60"). From the high water mark to three nautical miles out to sea along the coast and one nautical mile in the Maputo Bay, the MPA protects 678 km^2 of marine realm consisting of coral reefs, mangrove forests and sea grass beds (Appendix II). Approximately 6% of the PPMR is a no-take zone.

The MPA includes habitats of many marine species vulnerable to or critically endangered with extinction, including five species of sea turtle, at least ten species of shark, dugongs, migratory birds (UNESCO, 2008), as well as a diverse Indo-Pacific fish community (Floros *et al.*, 2012). The park is under review by UNESCO as a potential World Heritage Site and it is classified as a globally important biodiversity site within the Eastern African Marine Ecoregion (EAME) (Guerreiro *et al.*, 2011). The Ponta do Ouro area is relatively undeveloped and, as a key biodiversity area, has high ecosystem service value and the ability to maintain the ecosystems necessary for such services (CEPF, 2010).

One of the many challenges the PPMR faces is the impossible task of protecting the wildlife within the park; with borders of GPS marks rather than fences, marine life is free to leave the reserve into unprotected waters. It is not only marine animals, but also habitats and ecosystems that may spread outside of jurisdictional or political boundaries (Guerreiro *et al.*, 2010). In the case of the PPMR, one border of the park is the international border that Mozambique shares with South Africa. Fortunately for the PPMR, on the other side of this border lies the iSimangaliso Wetland Park (IWP), a UNESCO World Heritage Site. Together, these parks have been declared a Transfrontier Conservation Area (TFCA) that together protect over 300km of continuous coastline (Davis, 2009).

While the PPMR was declared a TFCA in its early days, it appears to be a 'paper' TFCA and has no impact on the ground. The PPMR does not achieve general initiatives that define TFCAs. It lacks common goals and has dissimilar regulations on either side of the border; it has two separate management plans and no joint management structures in place (Guerreiro *et al.*, 2011).

1.3.3.1   Deep-water port

Mozambique's Prime Minister Alberto Vaquina's unwillingness to name the recipient of the concession (Macauhub, 2010) calls attention to the contentious and secretive nature of the port development. The source of the necessary US$7 billion has remained undisclosed as well. This lack of transparency has worried stakeholders locally and internationally who include the Mozambican government; local businesses and villages; the development's funders; the South African government; the World Heritage

Commission in Paris; and other international and local conservation groups (Carnie, 2012).

Port development within the MPA poses a direct threat to the areas richest reefs and to the PPMR as a whole. The reefs found within the core area of the PPMR are unique as some of the highest latitude reefs in the world (Celliers and Schleyer, 2008). The reefs with the most coral coverage and best quality are found on an 18km stretch of marginal reefs between Ponta Techobanine and Ponta Dobela (Plate 1.2) directly where the port construction is proposed (DNAC, 2010). Leatherback turtles (*Dermochelys* coriacea) and clownfish (*Amphiprion sp.*), two of ten "hit list" species identified by the International Union for Conservation of Nature (IUCN) to highlight the negative impacts of climate change on marine habitats, are found within the PPMR (Keating, 2010).

Plate 1.2 Site of proposed deep-water port

Regardless of the internationally recognized importance of the MPA, the PPMR is imminently threatened by the proposed construction of a substantial deep-water port within its core no-take zone (DNAC, 2010). The threat of the port has been looming since the 1960s and while its precise site has changed through the years, it has always fallen within what is now the PPMR. Although there have been many seemingly false starts to the port, Prime Minister Vaquina, announced in a press release in April 2013 that a concession for the megaproject had been granted. Vaquina did not disclose to whom the concession had been granted.

The port megaproject is expected to cost US$7 billion with the port complex occupying 30 000-hectares, 11 000 of which will be an industrial development zone (AIM, 2013). As there is no infrastructure at the site, the port must be built from scratch

(AIM, 2013), including extensive roads and an estimated 1 100km of railway (Macauhub, 2010) which will certainly include "unplanned urbanization" (CEPF, 2010:71) of the area.

The port development is not only a threat to the PPMR. The prospective effects of petro-chemical pollution, shipping traffic, light pollution, dredging and blasting pose threats to the PPMR, but also to the biodiversity and ecosystem services linked to, and found within, the IWP UNESCO World Heritage site which is located about 20km from the proposed harbor site. Because the port poses threat to South Africa's UNESCO World Heritage site, legal action has been taken against the South African government for "apparent failure to safeguard its first world heritage site" (Carnie, 2012). Ultimately, the development of a megaport in the sanctuary zone of an MPA is a threat not only to the legitimacy of Mozambican MPAs, but also to the sanctity of international conservation treaties and initiatives, raising significant questions about the obligations of signatory countries.

The development of a deep-water port is a relatively short-term investment that destroys any opportunity for future use of both the pristine coast and the coral reefs surrounding it. Upholding the area as a sanctuary leaves the opportunity for future use, exploration and even exploitation open. Not only are future use values protected, but also, by maintaining the PPMR, marine based tourism, and the revenues it brings to the area, can continue to thrive.

Biodiversity and the world's ecosystems are under increasing threats and degradation for short-term economic benefit. The long-term effects of these threats and degradation hurt the economy as vital ecosystem services decrease or disappear entirely and must be replaced by man-made attempts at providing the goods and services the environment delivered before conversion.

Environmental valuation provides the tools necessary to gain an understanding of the total economic value of ecosystems. The marine realm, taking up 71% of the earth's surface (NOAA, 2013), sustains multitudinous ecosystem services. Marine protected areas have been devised to protect these resources and services. With the second longest coastline in Africa, Mozambique has many potential and conflicting ways to utilize its vast marine resources. Nonetheless, Mozambique has committed a large proportion of its continental shelf to conservation in the form of MPAs. The country has been innovative in its approach, particularly with regards to financing MPAs by

granting concessions to private businesses dedicated to conservation. The PPMR is a relatively new MPA in Mozambique that protects globally important biodiversity areas, including a 40km^2 no-take zone. Mozambique faces a great challenge in the management and enforcement of the MPA given the threats it faces. Yet the PPMR may have the ability to generate its own income, which would increase the likelihood that it will be managed and enforced effectively.

1.4   Research Purpose and Objectives

The purpose of this study was to explore the potential of a user-pay system of finance for MPAs. The study took place within the Ponta do Ouro Partial Marine Reserve (PPMR) and the study site consisted of two main tourist areas: Ponta do Ouro, approximately 2kms from the South African border; and Ponta Malongane, 6kms north of Ponta do Ouro. Each site comprised a distinct range of clientele and amenities, ranging from holiday resorts to a dilapidated but heavily used campsite. Specifically, this study had the following objectives:

1   To determine the willingness to pay (WTP) of combined user groups and of individual user groups above the current PPMR usage fee for the MPA; and

2   To investigate the potential for the PPMR to increase revenues for conservation through the implementation of a user-fee for marine based activities.

Using contingent valuation (CV), a questionnaire was used to survey dive tourists at the two sites within the PPMR. The research collected data through interview surveys following the guidelines for CV usage as recommended by the National Oceanic and Atmospheric Administration's (NOAA) panel of economic experts (Arrow *et al.,* 1993).

The reefs within the PPMR are some of the highest latitude coral reefs in the world (Celliers and Schleyer, 2008) and draw marine based tourists to the area for a host of recreational activities including boating, dolphin swims, fishing jet skiing, kite boarding, scuba diving, snorkelling, spearfishing, surfing, swimming and others. The dive sites located within the southern section of the PPMR are some of Mozambique's most popular dive destinations (DNAC, 2010). In 2001 and 2002, an estimated 42 500 and 62 000 dives were executed in the area, respectively (Pereira, 2003).

Despite this demand, the local marine tourism industry and marine protected area management lack any information on the socio-economic aspects of dive tourism within

the PPMR. While previous studies have examined recreational diving relative to reef conservation, and demand for diving in PPMR (see Bjerner and Johansson, 2001, Pereira, 2003, Pereira and Schleyer, 2005), there is no data on the economic value of tourism to the area. Data and information on marine based tourism, specifically WTP for the near-pristine ecosystem, is non-existent. By using CV to survey tourists within the PPMR, WTP can be determined for the local resource. From this, MPA management can structure fee schedules around such data to maximize revenues from user fees, allowing for the financial sustainability of the park and consequently, the protection of a pristine ecosystem.

1.5   Conclusion

This chapter presented an introduction to environmental valuation and to the context within which this study took place, particularly with regards to MPAs, the country of Mozambique and the PPMR. The goods and services provided by the environment are critical for the economy and human survival. In the past two decades, the importance and conservation of marine and coastal areas have been highlighted by international organisations. Specifically, the CBD set a goal for the protection of 10% of the world's marine and coastal ecosystems by 2020. Mozambique, despite its history of conflict, has declared nearly 20% of its continental shelf as MPAs, but like all MPAs, the enforcement and sustainability of Mozambique's MPAs rely on financial support. Mozambique's PPMR faces the looming threat of a deep-water port in its core no-take area.

This study employs contingent valuation to explore the potential for a user-fee system within the PPMR. Chapter two introduces contingent valuation (CV) and its role in economic valuation of ecosystem services. The chapter also provides a background to willingness to pay (WTP) and a discussion of applications of CV in MPAs aids in the selection of independent variables tested against WTP in chapter four. Chapter three covers the particulars of this study, including the design of the questionnaire used, a discussion of the methods of analysis and methods used to reduce bias in the study. The structure of chapter four begins with a summary of sample characteristics, followed by reporting of WTP and ends with economic analysis and a discussion of the results. Finally, chapter five concludes the study by revisiting the objectives, exploring policy implications and making recommendations for future study.

Economic Valuation and the WTP Method $\qquad$ **2**

Contingent valuation is a flexible survey-based method used to derive the economic value of quasi-private and pure public goods. As its name implies, it creates a contingent or hypothetical scenario surrounding a non-market good. This scenario contains a valuation question in which people are asked how they value a non-market good in terms of personal willingness to pay or willingness to accept compensation for the good (Mitchell and Carson, 1989).

This chapter reviews the literature behind the contingent valuation (CV) method as well as its application in other relevant studies. The chapter starts with an outline of the background and history of economic valuation and total economic value. What follows is a discussion of the contingent valuation method highlighting the NOAA Panel Report, conceptual objections to the method and elicitation methods. Finally, this chapter reviews other studies that have applied contingent valuation to marine protected areas (MPAs).

2.1 Economic Valuation

The field of economics traditionally focuses on the market mechanism, or the interaction between market prices and sales, to determine desired outputs. Yet optimal output only arises if a particular set of circumstances, or institutional arrangements are present in a market (Dasgupta, 1990). Failure to fulfil the institutional arrangements causes a malfunction in the market mechanism. Market failure occurs when the normally functioning supply and demand forces, which indicate desired outputs or resource allocation within the marketplace, fail to lead the market to an optimal mix of output, and thus are unsuccessful in maximizing the collective social utility. Public goods, like the environment and ecosystem services, are a common source of market failure (Pearce and Moran, 1994).

To address the issue of market failure and bring the importance of ecosystem services to the foreground, Costanza *et al.* (1997) published a landmark study of the total world value of ecosystem services. Through analysis of published studies and

original work, the study used benefits transfer[2] to calculate the economic value of 17 ecosystem specific services. The final estimation arrived at a total figure (updated to 2011 US$) of US$22.6-76.5 trillion (10^{12}) per year, an average of around US $46.7 trillion per annum. This estimation, though perhaps inflated, demonstrates that the benefits of ecosystem services lie nearly entirely outside of the market or are considerably undervalued in existing markets. As a result, the study concluded that social costs of ecosystem alteration or destruction, most likely far outweigh the perceived benefits.

Five years later, Balmford *et al.* (2002) tested the theory of social costs of land conversion. Rather than estimating total net values, the researchers established the value of ecosystem services, specifically undisturbed ecosystems, by contrasting the social benefits of the original ecosystem with the benefits of the altered ecosystem. Historically, people tended to regard land conversion as beneficial to human welfare as a whole because the calculation of land conversion failed to consider the true social costs associated with conversion, so the benefits to society appeared much greater than they actually were. When true social costs were accounted for, current conversions resulted in the original social benefits falling to almost zero. Balmford *et al.* (2002) tested this on numerous ecosystems such as coral reefs, tropical forests, wetlands and mangroves with the same result. The social benefit of services provided by an intact mangrove system exceeded the social benefit of conversion to shrimp farming by 70%. Overall, that is a benefit to cost ratio of conservation versus conversion of at least 100:1. The study concluded that the psychological denial of the effects of short-term gains "of remaining natural habitats is eroding overall human welfare" (Balmford *et al.*, 2002:953).

Among environmental economists, there is some disagreement with the figure Costanza *et al.* (1997) arrived at, citing concerns that the result was considerably more than the global GDP (Sagoff, 2013) and misuse of the benefits transfer method (Dixon, 2008). Nonetheless, both Costanza *et al.* (1997) and Balmford *et al.* (2002) both presented landmark studies in attempts to determine the economic value of ecosystem services. The economic value of an environmental resource or service is based on its use

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[2] Due to expense and time limitations, it is nearly impossible to determine economic value for all the ecosystems in the world. Thus, benefits transfer is the process of taking values from one study site and transferring those values to similar sites or whole ecosystems (Dixon, 2008).

and non-use values combined to determine the resources' total economic value (TEV) (Pearce and Moran, 1994). TEV is made up of both active use, that is, present consumptive or non-consumptive benefits or services along with the option of use in the future as well as non-use, derived from personal satisfaction from the good or service even if there is no intention to actively use it (Arrow *et al.*, 1993). Present direct use provides obvious economic benefits in terms of harvest yields and market prices whereas other elements of TEV are less obvious in the market. This is due in part to market failure when supply and demand functions do not lead to an optimal mix of output and thus not maximising collective social utility. Figure 2.1 presents a visual breakdown of the elements of TEV.
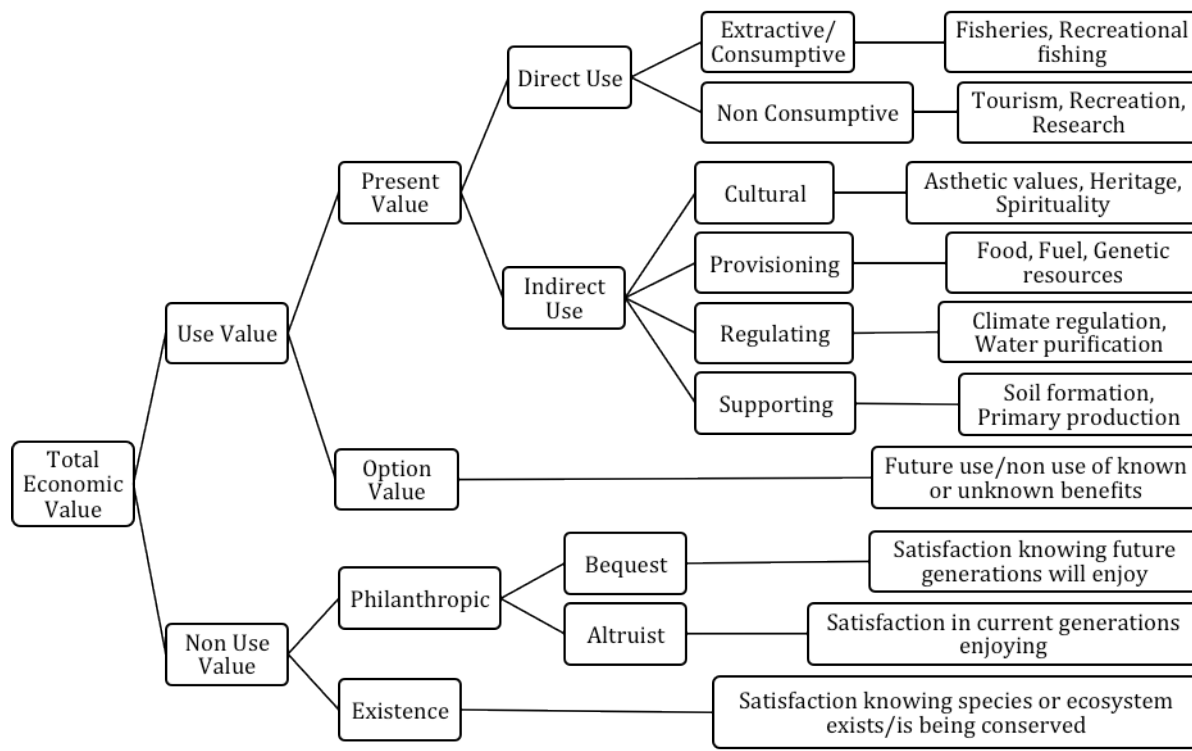
Figure 2.1 Elements of Total Economic Value
(Adapted from Pearce and Moran, 1994, Pascual et al., 2010)

Krutilla (1967) was first to acknowledge, in academic literature, that ecosystems have value beyond active use. Option value accounts for uncertain and unknown uses of present goods or services (Pascual *et al.*, 2010), but Krutilla argued that aspects of option value may be based entirely on sentimental feelings, not actual use. He writes,

"[T]here are many persons who obtain satisfaction from mere knowledge that part of wilderness North America remains even though they would be appalled by the prospect of being exposed to it... An option demand may exist therefore not only among persons currently and prospectively active in the market... but among others who place a value on the mere existence of biological and/or geomorphological (*sic*) variety and its widespread distribution" (Krutilla, 1967:781).

Today satisfaction from the mere knowledge of pristine or wilderness areas is known as existence value. Existence value is different from option value in that the former requires no direct use of the good or service in question; as Krutilla notes, it is purely sentimental. In a footnote to this description of existence value, Krutilla describes bequest motivation, defining another aspect of non-use value known as bequest value. In present day terminology, the components of philanthropic and existence value fall under their own heading of non-use value while option value remains as a separate component of use value.

Despite being able to define most aspects of TEV, the process of actually determining total economic value would be exceptionally costly and complicated. Thus any valuation is an estimation, a means to an end of better policy making and conservation (Reid and Boyd, 2008).

2.2   Contingent Valuation

How does one determine the economic value of a good such as a marine protected area? There are economic methods to value goods not commonly traded in the marketplace, like public goods. These fall into two families of approach, revealed preference and stated preference. The main difference between the two is that revealed preference relies on people to continue to act as they have in the past while stated preference depends on what people say they will do in the future (Mitchell and Carson, 1989).

Revealed preference draws on actual observation of consumer behaviour in existing markets. Ariza *et al.* (2012) designed a study to examine the relationship between two models of revealed preferences, Travel Cost Method (TCM) and Hedonic Prices (HP) at a popular beach on the north-western Mediterranean coast. The TCM focused on the costs, such as travel, recreational equipment and opportunity cost, which the tourists incurred

for their beach holiday while an analysis of HP focused on the differences in marketed prices of hotels and homes near the beach. By determining different packages of both public and private attributes, the HP method used in the study "decomposed the market prices of hotel rooms and houses into implicit prices of the different characteristics" (Ariza *et al.*, 2012:57). The study found that the two valuation methods did not positively correlate with the beach quality attributes, as the authors had expected them to, and recommended a more integral approach to beach valuation. The authors also assert that revealed preference can be an appropriate method for determining use values, but it cannot measure non-use values because it measures only observable behaviour in relation to market values.

When observable behaviour is unavailable, stated preference models provide the means with which to measure non-market goods comprehensively, including option and existence values. Contingent valuation and multi-attribute valuation fall under the family of stated preference. This thesis focuses on contingent valuation (CV), a survey-based method that polls a sample population to determine the economic value of non-market goods (Carson, 2012).

Although first mentioned in a paper on the benefits of preventing soil erosion (Ciriacy-Wantrup, 1947), the first application of CV in academic research was nearly twenty years later in a dissertation titled "The Value of Outdoor Recreation: An Economic Study of the Maine Woods" (Davis, 1963). Since then, over 7 500 studies have applied CV to value a vast array of goods and services (Carson, 2011). CV has been used successfully in determining willingness to pay for various non-market goods such as renewable energy (Wiser, 2007, Yoo and Kwak, 2009, Abdullah and Jeanty, 2011), recreational fish restocking (Cantrell *et al.*, 2004, Palmer and Snowball, 2009), health care (Eckerlund *et al.*, 1995, Gyldmark and Morrison, 2001, Kim *et al.*, 2011) and even a clear night sky (Simpson and Hanna, 2010).

2.2.1 Willingness to Pay Method

Contingent valuation (CV) addresses the willingness to pay (WTP) of people either to assure a benefit or gain, such as access to a protected area, or to avoid a cost or loss, like the extinction of an endangered species. CV also asks people about their willingness to accept (WTA) compensation to go without a benefit or gain, or to accept a cost or loss

(Pearce and Moran, 1994). The economic value of non-market goods arises from the data that people provide in response to WTP questions.

In 1993, the National Oceanic and Atmospheric Administration (NOAA) under the United States Department of Commerce, reviewed the CV method and concluded that, when following certain guidelines, CV was a reliable method by which to value natural resources (Arrow *et al.*, 1993). The guidelines to CV discussed in the NOAA Panel Report are extensive. The panel warns against cursory use of CV, but the report states that a study need not adhere to every guideline to be considered reliable (Arrow *et al.*, 1993). Of all the NOAA Panel Report's guidelines, Portney (1994) emphasizes the seven most important. Each is discussed below:

1   *Rely on personal interviews over other methods of survey*: Face-to-face interviews allow for visual aids such as maps and photos, but also allow for respondent's questions to be answered and comprehension gauged. Other methods include the use of a combination or singular use of mail, telephone and, more recently, web-based surveys (Lindhjem and Navrud, 2011, Nielsen, 2011).

2   *Questions should focus on willingness to pay (WTP)*: Addressing WTP for a future good, rather than WTA for something that has already happened, yields a more reliable and accurate study (Carson *et al.*, 2001). This is primarily because respondents are more familiar with paying for a good and, in general, it is more difficult to convince the respondent of the WTA scenario (Kling *et al.*, 2013).

3   *Structure WTP question in referendum format*: The NOAA Panel reasoned that voting for or against a particular good or service in a referendum format is likely more familiar to respondents (Arrow *et al.*, 1993). This sort of take-it-or-leave-it approach is most commonly found in the market place where there is a listed price that the consumer either accepts and purchases the item, or rejects and does not purchase (Arrow *et al.*, 1993). Since the panel report, this has been challenged (Rowe *et al.*, 1996, Reaves *et al.*, 1999) in favour of other elicitation formats discussed later in this chapter.

4   *Describe the scenario comprehensively:* The scenario must be presented in such a way that the respondent understands what is being valued and the outcomes of such value. If the respondent is not given factual and detailed information about the scenario, he or she may provide a WTP value for something other than what the researcher hopes to value. This leads to an incomplete understanding of the

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subject under study. Whittington and Pagiola (2011) recommended using visual aids to meet this requirement of the NOAA Panel Report and suggest that the use of visual aids in a CV study are indicative of a high-quality CV study.

5   *Respondents must be reminded of budget constraints:* A meaningful reminder of the respondent's financial responsibilities and desires help in eliciting a more reliable WTP value. This forces the respondent to consider how he or she will restructure his or her budget to accommodate the additional payment for the service in question. A method called cheap talk reminds the respondent of other financial commitments and helps the respondent to make a reasonable estimate (Carlsson *et al.*, 2004).

6   *Respondents must be reminded of substitutes to the good:* Just as the respondent must be reminded of the restructuring of budget that accompanies agreeing to pay for a good or service, the respondent must also be reminded of close substitutes to the good or service in question (Portney, 1994). If a close substitute offers the same good or service for free, the respondent needs to be aware of this information to make an informed WTP answer.

7   *Debrief respondents:* Debriefing follow-up questions to the WTP question gives the opportunity for respondents to clarify choices as well as to understand the reasoning of the respondent for their particular choice. Debriefing questions also aid in determining whether the respondent fully understood the hypothetical situation (Carson, 2012).

In consideration of these guidelines, the NOAA panel report endorsed CV as a method by which passive-use and existence value can be reliably measured (Arrow *et al.*, 1993). Despite this affirmation of CV studies, critics decry CV as an unsound method of valuation. So while each CV study has intricacies unique to the study, the researcher must choose which guidelines best apply (Venkatachalam, 2004) and this flexibility is easily misused.

That being so, Thur (2010) proposed another set of guidelines. To evaluate the reliability of a study, and for that study to be of use to future studies, certain details must be presented in a CV study. These are to express supporting details including response rate, respondent's length of trip, origin and activities on trip. Additionally, the study must clarify measurement of WTP with regard to the dollar-year and the temporal payment scheme (Thur, 2010), preferably using the nomenclature of Carson and Louviere (2010). Thus, certian supporting information for a CV study must be

presented with the data in order for other researchers to be able to gauge the level of application.

2.2.2 Conceptual Objections to CV

As a method of economic valuation, CV has a long history of debate and application. Detractors cite the method as "deeply flawed" (Diamond and Hausman, 1994:62) and argue that the "hopeless" (Hausman, 2012:43) method should be done away with, and valuations of public goods should be left to professionals (Hausman, 2012). Proponents contend that CV surveys bridge the gap between policymakers and the public (Burgess *et al.*, 2012) and that, in CV surveys determining public valuation, the public is the expert (Hanemann, 1994). Further, the method has gained robustness through examination; the challenges of validity and reliability, and potential forms of bias identified in the literature, are now better understood and more easily avoided (Hoyos and Mariel, 2010).

2.2.2.1 Validity and Reliability

Critics point to the problem of scope and embedding as a continuing challenge to the validity of CV studies (Diamond and Hausman, 1994, Hausman, 2012). Scope failure occurs when WTP is equal or close to the same value for different goods of varying scope. When a person places the same value on, or increased value, on a part of a desired good compared to the whole good, not only is there an issue with scope sensitivity, but economic theory of consumer demand, where people should be WTP for more of a good, is threatened (Heberlein *et al.*, 2005). However, scope insensitivity may not be a sign of an unsound study.

To explore questions of scope insensitivity, Heberlein *et al.* (2005) designed an inclusive study that examined scope based on an economic and social psychology theory. The study set out to test scope sensitivity of property owners in Wisconsin on four intentionally diverse environmental goods: water quality of local lakes, the wild wolf population of Wisconsin, local American Indian spear fishing and biodiversity. The results of the large survey (n=617) cast doubt on the notion that scope insensitivity is evidence of a failed study. While an increase in water quality and decrease of

spearfishing showed scope sensitivity, the study found that proportionally, the scope sensitivity was not present in any of the four environmental goods. Follow-up interviews elicited the reasoning behind the data. For the environmental good of the wolf population, respondents explained that while a small increase in wolves was desirable, a greater increase was not. Thus, respondents were willing to pay for an increase to 300 wolves but not willing to pay for an increase to 800 wolves. Similar cognitive arguments surrounded the other three environmental goods. The authors came to three conclusions based on the data. First, knowledge, preference and experience all influence individual preference of a part over the whole. Second, and in keeping with the first conclusion, knowledge and experience with both the part and the whole increases validity in CV studies. Finally, "there is more to validity than simply showing scope" (Heberlein *et al.*, 2005:19).

This final conclusion echoes the position of Carson *et al.* (2001), that lack of sensitivity to scope is a risky reason to invalidate, not just a study, but also CV as a whole. Carson (2012) reiterated the point that insensitivity to scope is natural even in well-designed CV studies. He suggested that rather than dismiss a study that fails the test of scope, rather "listen with an open mind" (Carson, 2012:35) to the story that the insensitivity of scope tells; insensitivity of scope can be explained by declining marginal utility, where less additional utility is gained from each additional unit of the good delivered (Rollins and Lyke, 1998).

Critics of CV cite the discrepancy between willingness to pay (WTP) and willingness to accept (WTA) compensation as also violating the tenets of economic theory (Hausman, 2012). Hicks (1939) defined two categories of consumer surplus measure, compensating variation and equivalent variation. The Hicksian demand function uses indifference curves to establish the demand of a consumer trying to minimise expenditure when holding utility constant. It is this demand function that provides the basis for the measure of WTP or WTA compensation (Venkatachalam, 2004). In theory, WTP and WTA should be close to equal but in practice a divergence, and sometimes a large one, is present between the two.

In studies comparing the two, WTA is usually larger than WTP. One explanation for this is that WTP is constrained by income while WTA is not (Willig, 1976), that is, a person can only pay so much for a good. The endowment effect explains why compensation for parting with something that is already known and owned has more

value in a person's mind than something unknown that they may purchase (Kling *et al.*, 2013). To address the discrepancy between WTP and WTA, the NOAA Panel Report recommendation was that only WTP should be used in CV studies (Arrow *et al.*, 1993).

2.2.2.2 Potential forms of Bias

The presence of bias can jeopardise the validity and reliability of CV. Over time, as CV has developed as a method, definitions of biases have changed and what once were listed as many different biases, such as strategic, information and hypothetical bias, are often lumped together (Carson, 2012). This section discusses various forms of bias that may affect any CV study while biases specific to the elicitation method used in this study are addressed in section 2.2.3.1.

Obvious overstatement or understatement of WTP challenges the validity of a CV study (Arrow *et al.*, 1993). This challenge arises from the core of CV – a contingent or hypothetical scenario. When stating WTP for a hypothetical scenario, the respondent may fail to consider real budget constraints (Whittington and Pagiola, 2012), may not consider the contingent scenario in its real-life application (Venkatachalam, 2004), or may act strategically (Carson, 2012).

Hypothetical bias often arises when the contingent scenario is not specific and realistic to the respondent. Thus, the effects of hypothetical bias decrease when the respondent is familiar with the good in question (Mitchell and Carson, 1989). In a WTP study of Komodo National Park, Indonesia, Walpole *et al.* (2001) strived for a realistic market scenario. The study asked respondents about an entrance fee based on the fact that access to the park, rather than environmental quality, is more tangible and realistic. Taking care to address hypothetical bias in such a way is important for a valid study. Numerous studies have found that when compared to revealed preferences (hedonic pricing and travel cost model), contingent valuation often gave a conservative estimate of WTP (Carson, 2012) which ultimately is more desirable and may produce a more reliable result (Arrow *et al.*, 1993).

The NOAA Panel Report highlighted the importance of the accuracy and adequacy of the information provided to respondents in a CV survey (Arrow *et al.*, 1993). This guideline was in reference to information bias, where respondents' WTP is influenced by the information given about the scenario. The information in the hypothetical

scenario must be factual and sufficient to allow an informed valuation of the good (Carson, 2012). If the respondent is only informed of the benefits of a proposed program, he or she may be influenced toward a higher WTP. Likewise, if only the costs of the proposed program are presented, a WTP bias based on that information might result. Limiting information bias has less to do with providing extensive information and more about providing balanced and accurate information (Carson and Groves, 2007).

Samuelson (1954) introduced the basis of strategic bias in relation to public goods. He notes, "it is in the selfish interest of each person to give *false* signals, to pretend to have less interest" (Samuelson, 1954:388) in the proposed good or service than they really do. Two types of strategic bias operate on different types of false signals. The first is free riding. Free riding occurs when people users do not pay for the service or benefit they receive, thus getting something for nothing (McNeely, 1988). In a CV survey, the free rider problem arises when a person understates his or her true WTP with the assumption that others will pay and the good will be provided (Venkatachalam, 2004). Alternatively, free riding occurs when a person states that he or she will pay, but when payment is actually collected, the person does not pay and free rides off the people who do pay (Carson *et al.*, 2001). Over-pledging is another type of false signal. An over-pledging respondent pretends to have more interest than they really do. The respondent thus overstates his or her true WTP in an attempt to increase the value of the good or service and the chance that it will be provided (Venkatachalam, 2004). Nonetheless, by following the guidelines of the NOAA Panel Report and creating a hypothetical scenario that respondents take seriously, strategic bias will often lead to an underestimation of WTP (Carson, 2012), and a conservative estimate of WTP is favourable (Arrow *et al.*, 1993).

Driven by the desire to adhere to pro-social behaviours or to please the interviewer, respondents can consciously or unconsciously state upwardly biased WTP figures. Aptly named a "warm glow" or interviewer bias, this bias remains a contentious issue for critics of CV (Diamond and Hausman, 1994, Hausman, 2012). The NOAA Panel Report cited warm glow as a potentially damaging criticism of CV (Arrow *et al.*, 1993). There are various methods to mitigate the occurrence of warm glow. Neutral, well-trained interviewers can diminish the effect of warm glow when the respondent tries to answer the question in a way which will please the interviewer (Carson *et al.*, 2001). A study

tested the effectiveness of neutral, well-trained interviewers and found that whether respondents answered the standard valuation question face-to-face or in a sealed envelope, there was no significant difference in WTP estimates (Carson *et al.*, 1994, in Carson *et al.*, 2001).

Careful wording of questions can also reduce warm glow or interviewer bias. Formatting questions using a counterargument helps to avoid agree-disagree questions, which are not recommended by survey methodologists due to respondent acquiescence (Schaeffer and Presser, 2003). In a review of studies examining this occurrence, Schaeffer and Presser (2003) suggest the solution to potential bias arising from agree-disagree questions is forced-choice (FC) questions. Beyond providing greater reliability and validity than agree-disagree questions, FC questions decrease respondent ambivalence and yea-saying (Schaeffer and Presser, 2003). Furthermore, FC does not impart social norm hints or the personal view of the interviewer to the respondent.

2.2.3 Questionnaire Design

CV asks respondents to state their maximum WTP for a good or service based on a hypothetical scenario. The scenario is discrete to each study, but there are well-established and standard elicitation methods to determine WTP. Elicitation methods rely on either open- or closed-ended questions (Mitchell and Carson, 1989). Bidding games are closed-ended questions. Eliciting WTP with a bidding game (BG) involves asking the respondent if he or she is willing to pay increasing amounts until their maximum WTP is reached. A study of entrance fees for a national park in Malaysia used a BG to determine the maximum willingness to pay of both local Malaysian and international tourists. The researcher asked tourists if they were willing to pay an entrance fee from a pre-determined low, medium or high value and then increased or decreased the bid value based on the tourist's response eventually arriving at the tourist's maximum willingness to pay (Samdin, 2008). BGs often have problems with starting point bias, as the respondent may base his or her WTP on the initial value presented in the elicitation question (Mitchell and Carson, 1989).

Open-ended (OE) elicitation format leaves the question of WTP open to the respondent, asking the respondent to state any value as their WTP. While this approach eliminates starting point bias, it is typically an unfamiliar approach whereby

respondents' are faced with placing a value on a public good (Arrow *et al.*, 1993). To convey a more familiar consumer experience to the respondent, the NOAA Panel Report thus recommended the use of dichotomous choice (DC). Also called referendum format, with DC the respondent provides either a yes or no response to a stated value. Where a BG continues until the value that the respondent is willing to pay is reached, DC is a take-it-or-leave it approach that obtains a discrete interval of the respondents' WTP (Hoyos and Mariel, 2010). DC is the most familiar format for the majority of respondents, as most transactions use a take-it-or-leave-it stance (Arrow *et al.*, 1993). Double-bound dichotomous choice (DBDC) is usually recommended over single-bound dichotomous choice (SBDC) because the latter is "notoriously imprecise" (Alberini *et al.*, 2003:42), providing limited information on the respondent's WTP.

Reaves *et al.* (1999) designed a study to test whether DBDC, in fact, provided the ideal attributes as an elicitation method when compared to OE format and a third format, the payment card. The payment card (PC) is "somewhat of a hybrid" of OE and DC. That is, rather than an unconstrained open-ended or strict dichotomous choice, the PC provides guidance for the respondent's WTP response by presenting values on a card and asking the individual to choose the value that is closest to his or her maximum WTP. The pre-tested tri-format survey was sent by mail to 1 500 people in South Carolina, USA. The researchers divided the surveys to distribute 500 of each question format. Reaves *et al.* (1999) found that the DBDC "has a lower response rate (although not statistically significant), a higher item non-response and higher level of protest response than does either the OE or PC format" (Reaves *et al.*, 1999:377). The authors admitted that the application of DBDC favours face-to-face rather than mail survey format, but they concluded that the PC delivers the lowest non-response rates and the lowest proportion of protest bids, making it the most desirable format of the three elicitation formats tested.

2.2.3.1   Payment Card

The NOAA Panel Report warns that CV methods may result in an overstatement of true WTP and urges conservative design of surveys that produce an underestimation of WTP, which is considered more reliable than an overestimation (Arrow *et al.*, 1993). As a method of elicitation, PCs provide a conservative estimate of WTP (Thur, 2010).

Liberal and traditional practitioners of CV using PCs estimate WTP by assuming the respondent's actual WTP lies somewhere between his or her stated WTP and the next highest amount on the card. Using the respondent's selected WTP as his or her maximum WTP, instead of assuming it lies somewhere above the stated amount, leads to a more reliable and conservative estimate of true WTP (Thur, 2010).

In addition to the biases discussed in section 2.2.2.2, bias can also come from elicitation method or format. Although the NOAA Panel Report recommendation of the referendum format, empirical evidence of bias arising from the use of the payment card (PC) format is lacking (Rowe *et al.*, 1996). Additionally, studies since the NOAA Panel Report have established PC as a reliable elicitation method by examining the consistency of PC results compared to two other elicitation approaches (Reaves *et al.*, 1999), the incidence of range or centring bias with PC (Rowe *et al.*, 1996) and the efficiency of PC (Kerr, 2000).

Biases associated with PC surveys are most commonly attributed to range and centring (Mitchell and Carson, 1989). Range refers to the highest and lowest bids on the card and centre is the middle value visually presented on the card. Because of the relative unfamiliarity of being presented with a card with payment values on it, respondents can be easily influenced by suggested ranges (Whitehead, 2006) or centre values, either of which may ultimately skew respondents' WTP response (Mitchell and Carson, 1989).

Range and centring biases may be relatively easy to observe in a dedicated study, as there would be an evident shift in values as range or centre change. Rowe *et al.* (1996) tested this hypothesis on biases by designing four versions of a PC for a survey. The survey asked metro-Denver, Colorado residents their maximum WTP for disposal and to fund clean up of hazardous waste sites in the state. Each version had a corresponding PC with twenty-four cells and notable variations in range and centre; version four had a range of $0-$200, and a centre of $16 compared to the next highest card, and version three had a range of $0-$1000 and a centre of $35. With an average response rate of 58%, the authors found no statistically significant change in WTP responses among the differing versions of PC. Thus, the study rejected range and centring biases in PCs that used exponential scales and that allocated adequate upper values.

Rowe *et al.* (1996) concluded that a lingering question remains regarding the ideal number of cells on a PC. Each cell on a PC is a division of the highest bid on the card.

Rowe *et al.* argued that, with a large number of divisions, the respondent can choose the number closest to their exact WTP. This makes the PC an efficient elicitation method. However, the authors noted that visual crowding created by multiple divisions can frustrate respondents and could result in an increase in 'don't know' responses. Therefore, each PC must establish a balance so that the number of cells is adequate to detect the nuances of individual WTP and not excessive thus overwhelming and confusing the respondent.

Kerr (2000) tested the hypothesis of visual crowding to determine if increasing the number of divisions increases the incidence of 'don't know' responses. In other words, do more cells confuse respondents or provide more accuracy? He tested this hypothesis by determining what value university students place on hypothetical videotaped lectures and private study rooms. The study examined the effect of the number of divisions on each payment card between $1 and $300. For each of the two scenarios, he used three payment cards with varying numbers of divisions: six, ten and fifteen. There were also cells for zero bids, greater than $300 and 'don't know'. The payment cards also had the same upper, central and lower bids, thus eliminating any possible range or centring bias. Kerr found that efficiency did not correspondingly increase with the number of assigned divisions, nor did it limit the number of 'don't know' responses. He concluded that fewer cells may result in more reliable WTP responses for the PC elicitation format.

While fewer cells may decrease the number of 'don't know' answers, the issue of the rate of change between cells causes other PC issues. The change between bid values can be either incremental or exponential. If there is a small difference between the starting point and the highest bid, an incremental scale is beneficial. Blaine and Smith (2006) measured the WTP of local Ohio residents to fund the purchase of a conservation easement program for a local watershed. The PC offered five bid values, from $1 to $5. This yielded an efficient measure of WTP as the card represented most values. On the other hand, if there were a large difference between the starting point and the highest bid, using incremental bid values may provide too few options of values or become visually overwhelming to participants, leading to protest bids or 'don't know' responses (Rowe *et al.*, 1996).

In the metro-Denver hazardous waste study, Rowe *et al.* (1996) argued for using an exponential response scale with the PC elicitation method. A PC exponential response

scale presented bid values that increase at an increasing rate, at a consistent rate of change. However, the equation put forth by Rowe *et al.* (1996) resulted in numerous values at the lower end of the scale and fewer, more widely spaced values at the higher end thus not providing an adequate range of choices on the PC.

2.3   Application of CV in marine protected areas

 As public goods, marine protected areas (MPAs) are a source of market failure. The monetary benefits provided by protected areas are often underestimated (Dixon and Sherman, 1991), causing the supply and demand functions to fail to deliver successful optimization of collective social utility. Additionally, because the lack of funding for MPAs limits the influence and effectiveness of the areas, policy makers and researchers look for economic solutions to market failure. Implementing or increasing user fees for MPAs is a common approach to address lack of funding (Depondt and Green, 2006, Peters and Hawkins, 2009 and sources therein). Provided that a researcher is aware of and accounts for biases and sources of error, CV is a reliable method of determining user and visitor WTP for a user fee.

Scuba divers are a commonly studied user group when evaluating user-fees within MPAs (Arin and Kramer, 2002, Asafu-Adjaye and Tapsuwan, 2008, Tapsuwan and Asafu-Adjaye, 2008, Thur, 2010). Scuba diving is a fast growing international tourism activity. In 2010, the Professional Association of Diving Instructors (PADI), the largest international scuba diving certification agency, cited a 66.1% increase in membership worldwide since 1996 with over 135 000 members in 2010 (PADI, 2011). Dive tourism relies on healthy near-shore marine ecosystems, specifically coral reefs. The protection afforded to MPAs often encompasses and yields this type of environment and thus attracts dive tourists. The MPA in this study is an established and popular dive spot for South Africans (Pereira and Schleyer, 2005) and increasingly for Mozambicans and foreign divers (Stromvoll, pers. comm., 2012)

Are entrance fees an appropriate vehicle for the funding of MPAs? In a desktop study, Peters and Hawkins (2009) examined eighteen studies of WTP for entrance fees to MPAs that attract divers and snorkelers. The majority of the eighteen studies concerned the conservation of reef habitats. In general, even though people thought access to the environment should be free, users were willing to pay for marine conservation. The median WTP for entrance to fourteen sites was $5 a day. The authors concluded that

entrance fees were potentially a good source of funding for MPAs.

The desktop study of entrance fees to MPAs (Peters and Hawkins, 2009) examined several forms of entrance fees. As this study is focused around a per day usage fee, a review of thirty-three per day usage fees MPAs in the Caribbean, Gulf of Mexico and Southeast Asia (Appendix V) was conducted. A similar result to Peters and Hawkins (2009) was found. Although tiered systems, where foreigners were charged double that of locals, extended the range of user fees to a maximum of $50, the mean per day usage fee was $6.

The study by Peters and Hawkins (2009) also highlighted the fact that visitors to MPAs often report a higher WTP than the current entrance or user fee. The study cited substantial increases in user fees in placess such as Bonaire in the Caribbean (from no fee to $25 per annum), Komodo National Park in Indonesia, (from $0.87 to at least $17 per visit depending on length of stay), Koh Phi Phi in Thailand (from $0.50 to $6 per visit) and Vietnam (from no fee to $2.50 per visit), all as a result of WTP studies carried out at each location. A WTP study at Gunung Gede Pangrango National Park, Indonesia also found there was opportunity to increase user fees when the WTP of tourists was higher than the present charge and had not been changed for ten years (Nuva *et al.*, 2009). Although scuba divers are often WTP more than the current entrance fee, many dive businesses operating in MPAs voice concerns that increasing fees will result in a decline of business (Thur, 2010). Yet, as user fees become more common internationally, the attitudes of dive operators tend to change towards cooperation and acceptance with transparency of the MPA management crucial for trust (Depondt and Green, 2006).

2.3.1 Selection of Variables as Determining Factors of WTP

The NOAA Panel Report suggested a number of categories or items to help interpret WTP. These items included, but were not limited to, respondent income, prior knowledge and interest in the location, and environmental views (Arrow *et al.*, 1993). This section continues to explore CV studies in MPAs, but with the added focus of establishing valid variables to test as determining factors of WTP in this study.

Economic theory suggests a positive relationship between WTP and ability to pay. Thus, income is a common determining factor of WTP. In a study of three different beaches, in the Philippines, the beach with the lowest WTP for MPA enforcement was a

popular backpacking area where respondents tended to have lower income levels than those at the other two beaches (Arin and Kramer, 2002). Higher incomes predicted higher WTP of visitors for operating costs to the National Marine Park of Zakynthos, Greece (Togridou *et al.*, 2006) and in Thailand, higher income positively affected WTP a dive fee at the Similan Islands, but it was only significant for Thai divers and not international divers (Asafu-Adjaye and Tapsuwan, 2008).

Although not mentioned in the NOAA Panel Report, education can often positively affect WTP. As with income, the Philippines study also found that WTP increased with years of college (Arin and Kramer, 2002). A study of WTP for protection programs at an MPA in Vietnam found that high-income and high-education could predict at least a 30% higher WTP. Within the group of high-earning, highly educated respondents, Vietnamese respondents had a 50% higher WTP than foreign respondents (Lindsey and Holmes, 2002). At Koh Phi Phi in Thailand, education was a significant determinant of WTP for a user fee regardless of international or local status (Seenprachawong, 2003).

MPAs that serve as diving destinations tend to attract both local and international tourists. Both the Similan Island study (Asafu-Adjaye and Tapsuwan, 2008) and the Vietnam study (Lindsey and Holmes, 2002) mentioned international or local status as potential variables for determining WTP. Other studies have found that whether a respondent is foreign or local can effect WTP (Walpole *et al.*, 2001, Arin and Kramer, 2002, Seenprachawong, 2003), but with varying effect and significance.

Some studies have shown that environmental attitudes and interest can impact WTP. Typically individuals that identify themselves as more environmentally aware tend to have a higher WTP than those that do not (Spash, 1997, Blaine and Smith, 2006, Asafu-Adjaye and Tapsuwan, 2008). Yet this is not always the case and in the literature there are some seemingly contradictory results regarding the relationships between environmental concern and WTP.

Contradictory responses between environmental concern and WTP were apparent in a study of the WTP for dive tags at St. Eustatius in the Caribbean (Riley *et al.*, 2006). Respondents reported being very pleased with the diving conditions with 89% of divers reporting good or excellent satisfaction. Respondents also expressed a high concern for the local marine environment. Yet when it came to WTP to maintain and protect the area, only 72% of divers were willing to pay more than the current dive tax (Riley *et al.*, 2006). The question arises as to whether the reason behind WTP is based on genuine

value for the good or the warm glow effect (Peters and Hawkins, 2009), discussed in section 2.2.2.2. In many other studies, environmentally aware people tend to have higher WTP. In the study of the National Marine Park of Zakynthos in Greece (Togridou *et al.*, 2006), environmental knowledge and concern had a positive effect on WTP while in the Similan Islands, divers that were active in environmental conservation activities had a significantly higher WTP than those that were not (Asafu-Adjaye and Tapsuwan, 2008). In the case of the St. Eustatius study, a robust follow-up question to the CV scenario may have teased out the beliefs that led to the contradiction between a concern for the environment, satisfaction with the dive experience and the lack of WTP for the maintenance and protection of the marine resource.

Being environmentally aware or active in conservation activities can be difficult to measure due to potential yea-saying and pro-social behaviour. To avoid bias and for a more thorough understanding of respondent environmental attitudes than typical questions yield, Spash (1997) recommended a two-tier measurement of attitudes. He first suggested a direct question using a Likert scale for respondents to state how they consider their environmental awareness. Follow-up questions on environmental belief about which the respondent does not know the exact purpose and therefore is more likely to answer according to their personal beliefs are then asked (Spash, 1997).

General environmental awareness or concern is commonly reported as a factor in determining WTP but determining whether awareness of the study site itself has a relationship with WTP is not. In the literature, there were few studies that sought to determine whether the respondent awareness of being in an MPA was a determining factor of WTP. A recent study at the Dalai Lake Protected Area in China surveyed 2000 tourists for their WTP for biodiversity conservation and environmental protection. The study found that awareness of being in a protected area led to significantly higher WTP bids for biodiversity conservation (Wang and Jia, 2012). Determining respondent awareness of being in a protected area may provide important information about respondent knowledge and experience of the good being valued, especially if the good is access to the protected area. While increased knowledge and experience of a good leads to increased validity of a CV study (Heberlein *et al.*, 2005), hypothetical bias is reduced when the respondent is familiar with the good (Mitchell and Carson, 1989).

Frequency or level of use has been shown to increase WTP. Frequency of use of an MPA can be measured in the number of prior visits to the site while level of use can be

measured by the number of days of the current visit. In Komodo National Park, Indonesia 465 independent travellers to the park were interviewed using a dichotomous-choice bidding format to determine the WTP for park entrance. The study found that for the most part, the current visit of individuals that accepted the bid value tended to be longer than those who refused the bid (Goodwin *et al.*, 1997 in, Peters and Hawkins, 2009).

There are countless variables that may influence WTP. Some, like income, education, and foreign or local residency are commonly reported in the literature and tend to be straightforward. Others variables, like determining environmental knowledge or knowledge and interest in the area are more complex due to the numerous ways to gauge them as well as the potential for warm glow effect or interviewer bias. Although the NOAA Panel Report (Arrow *et al.*, 1993) did not suggest the variables of gender or age and in the literature of similar studies, gender or age rarely proved a significant factor in determining WTP, this study will include those variables as a point of reference. In total, this study will test the effect of eleven independent variables on WTP. These variables are described in Section 4.3.

2.4 Conclusion

This chapter covered the background to CV where economic valuation of quasi-private and public goods includes more than just use values. Landmark studies in the valuation of natural resources over the years were highlighted to illustrate the extent that market failure leads to uneconomical land conversion and large social costs. CV was introduced as a method used to value non-market goods. The debate over the reliability and validity of CV is two decades old and on going, yet heeding sources of bias and conceptual concerns discussed in this chapter add robustness to a CV study and can increase the likelihood of accurate estimates of economic value. There are numerous elicitation methods used to determine willingness to pay. This chapter focused on the payment card and justified its use in this study for practical and reliability considerations. Various sources showed that the payment card provides more conservative estimates, lower instance of protest bids and lower non-response rate. The chapter ended with a review of various WTP studies in MPAs and a review of independent variables that other WTP studies found significant helped determine the independent variables used in this study. Some studies mentioned at end of this

chapter will appear again in Chapter Four to compare the results of this study to past studies. The next chapter details the research design and methods of this study.

Research Design and Methods **3**

The aim of this chapter is to provide a comprehensive account of the design and applied methods specific to this study. The chapter starts with a description of the study site, the Ponta do Ouro Partial Marine Reserve, Mozambique. The objectives outlined in the introduction are restated including a statement of purpose and the sampling strategy. The next section includes elements of the questionnaire, including a description of the payment card format. As this study involved human subjects, a statement of ethics precedes the description of data collection and entry. Finally, the chapter ends with a discussion of the statistical models applied to the data and touches on the sources of potential bias highlighted in the previous chapter.

3.1   Study Site

This study took place in two small coastal villages of Ponta do Ouro and Ponta Malongane, located 6km apart within the PPMR in the Matutuine district of southern Mozambique. Ponta do Ouro is the largest tourist town in the PPMR and has the busiest launch site. Ponta Malongane is a private campsite from which a single operation conducts scuba diving and dolphin swims. It is the next largest tourist area.

Throughout the PPMR, regulations stipulate that only licensed operators can offer scuba diving and swimming with dolphins. For fishing activities, both charter operations and private boats are allowed. Thus, the targeted interview sites were eight diving centres, a dolphin swim centre and two fishing shops in the town of Ponta do Ouro and in Malongane, the activity centre for both dolphin swims and diving and one fishing shop.
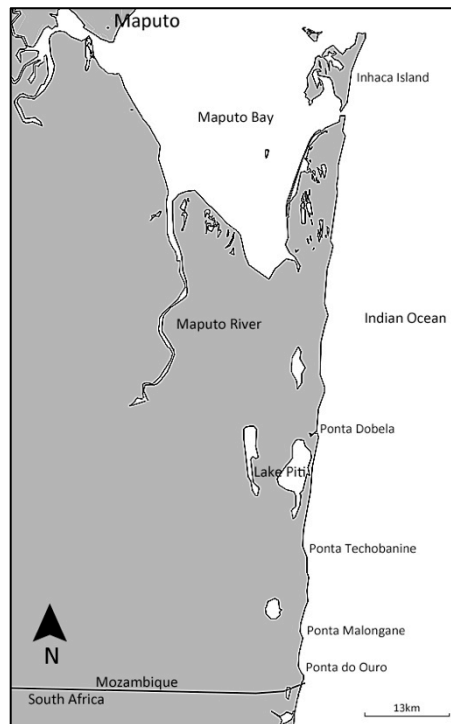
Figure 3.1 Study site

3.2   Research Objectives

The purpose of this study was to explore the potential of a user-pay system of finance for MPAs. The PPMR presents a case study of what marine based tourists are willing to pay for access to an MPA. Specifically, this study had the following objectives:

1 To determine the willingness to pay of combined user groups and of individual user groups above the current PPMR usage fee for use of the MPA; and

2 To investigate the potential for the PPMR to increase revenues for conservation through the implementation of a user-fee for marine based activities.

3.2.1 Sampling strategy and target population

This study consisted of an empirical analysis of the WTP of marine based tourists for a per day usage fee to the PPMR. Marine based tourists were defined as individuals that engage in the marine tourism activities of scuba diving, dolphin swims and fishing. This study used both primary data, collected by means of a questionnaire, and secondary

data, provided by PPMR and the National Directorate for Conservation Areas (Direcção Nacional de Áreas de Conservaçáo, DNAC). Primary data collection occurred from November 2012 until April 2013, coinciding with the tourist seasons for the PPMR (Figure 3.2).

Figure 3.2 Total individuals participating in all activities
Source: *DNAC (2012)*
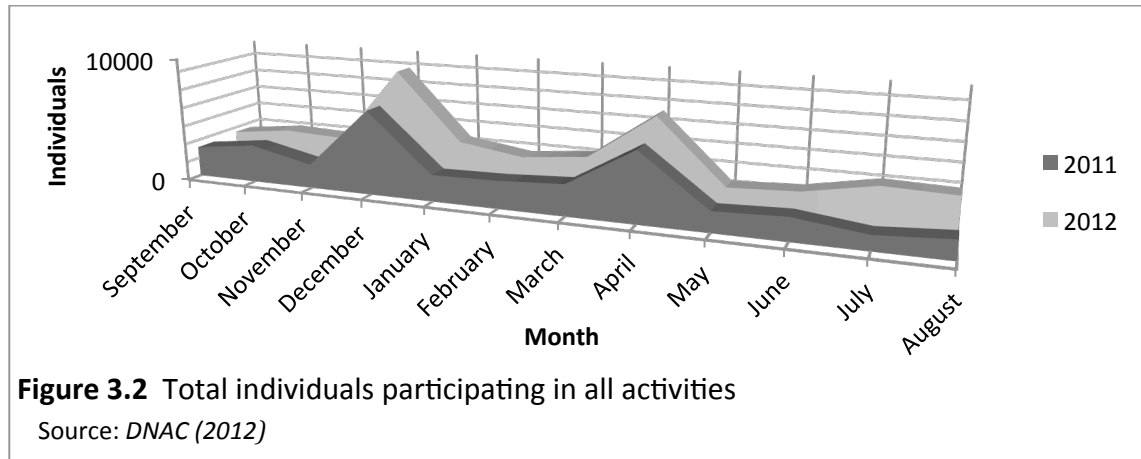
The target population for this study was tourists over the age of 18, who paid for their own travel to the area and engaged in scuba diving, fishing or swimming with dolphins while on holiday. Although there are other marine based tourism activities that occur within the PPMR, the target population had a point of contact with the PPMR, as each activity required launching at a distinct, monitored beach launch site. Therefore, the target population would be the most cost effective group from which to collect a user fee. The PPMR has collected data on total individuals on launches of dive, dolphin and fishing boats since January 2011. Scuba divers made up more than half (67%) of all the launches within the PPMR, dolphin swims made up 20% and fishing boats, both chartered and personal, made up 13% of the launches. These data aided in the construction of a stratified sample of respondents and resulted in a representative population of the targeted user groups.

3.3   Questionnaire Design and Content

Stated preference and CV guides (Mitchell and Carson, 1989, Arrow *et al.*, 1993, Carson, 1999, Bateman *et al.*, 2002), survey methodology guides (Payne, 1951, Schaeffer and Presser, 2003), interviews with stakeholders and focus groups influenced the structure and content of the questionnaire. The questionnaire was pretested on scuba divers before application in the field and a pilot study of 30 marine based tourists influenced the final questionnaire (Arrow *et al.*, 1993). The next section describes the

final questionnaire (Appendix III).

The questionnaire consisted of open- and close-ended question formats asked tourists for information about their activities, environmental views, WTP and socio-economic backgrounds. Visual cue cards accompanied the questionnaire to supply supplementary information, such as a map of the area (Appendix II) and to prompt the respondent (Carson, 1999). The final version of the questionnaire contained five sections as detailed below:

1 *Introduction:* This section briefed the respondent on the purpose of the study and explained why the respondent was asked to participate (Carson and Hanemann, 2005). The introduction included the estimated time the survey would take, as well as the confidentiality and voluntary nature of the questionnaire. It was required that the respondent gave consent to participation before to proceeding with the questionnaire (Whittington and Pagiola, 2011).

2 *Time, Activities and Satisfaction within the PPMR:* The first questions related to the respondent's activities and time at the site. These background questions aided in the segmenting of respondents into categories for comparison, such as first time tourists versus multiple visit tourists. Additionally, these questions provided some insight into the knowledge and experience the respondent had of the area and with his or her particular activity, including whether the activity was consumptive or non-consumptive. People with increased knowledge and experience of a good being valued tend to state more reliable bid values leading to increased validity (Heberlein *et al.*, 2005). Visual cue cards (Carson, 1999) gave the respondent various answer options. A visual scale was presented from which the respondent ranked satisfaction of activities. If the respondent identified himself or herself as a scuba diver, there were additional questions relating to certification levels and years diving.

3 *MPA background and environmental attitudes:* The next section covered environmental attitudes and interest as well as respondent knowledge of the MPA. This section conveyed accurate and adequate information (Arrow *et al.*, 1993; Carson and Groves, 2007) about the MPA, avoiding emotive or biased language, and included a map of the area (Appendix II). Gauging environmental awareness can

prove difficult as respondents may yea-say in favour of social norms (Spash, 1997). Thus, this question was carefully worded to limit bias. Respondents were first asked a direct question regarding environmental beliefs:

Q15: How environmentally aware would you consider yourself?
☐ NOT AT ALL   ☐ SLIGHTLY   ☐ MODERATELY   ☐ VERY   ☐ EXTREMELY

Following this question was a question about consumer choices that the respondent did not know the exact purpose of (Spash, 1997). Respondents were asked:

Q17. Do you use the South African Sustainable Seafood Institute (SASSI)'s consumer guide to make your seafood choices?

Although the question asked about a South African consumer guide, consumer seafood guides are not limited to South Africa. At least 22 countries have locally relevant sustainable seafood guides (WWF, 2013). Whether an individual makes sustainable seafood choices may be a "narrow and specific" way to gauge environmental awareness (Kemmerly and Macfarlane, 2009:408), nevertheless, the respondent had already identified him or herself as a marine based tourist with some particular interest in the marine environment. This identification suggested that the health of the marine environment, and by association sustainable seafood choices, was relevant to the respondent. Sustainable consumer behaviour, that is whether the respondent made sustainably guided seafood choices, may supply clues and context to the respondent's self-ranking of environmental awareness.

4 *Contingent Valuation scenario*: The contingent valuation scenario was a per-day user fee, collected by a government controlled conservation agency, which would go towards the protection of biodiversity in the MPA. The valuation question reminded the respondent of other budget constraints (Arrow *et al.*, 1993) before the respondent was presented with a payment card. The interviewer asked the respondent to bid his or her WTP based on the values on the card and gave the respondent the opportunity to state other values not listed.

The payment card did not include a zero bid. The valuation section was divided into two parts, first asking if the respondent was willing to pay, then asking how much. The first question in the valuation section determined whether the

respondent was "in the market" for or willing to pay anything (Whittington and Pagiola, 2012). The first question was included to reduce non-response to the payment card question (White *et al.*, 2005). Because the respondent expressed WTP for access before the valuation scenario, it was not necessary to include a zero bid on the PC.

The PC had 20 cells with incremental threshold values between R1 and R200 and an option for other or higher values (Rowe *et al.*, 1996). After the valuation question, respondents were asked an open-ended follow-up question, allowing him or her to clarify their choice, which increases the reliability of their answer (Whittington and Pagiola, 2012). The follow-up question also provided insight into the reasoning of why the respondent made their particular choice (Portney, 1994).

5   *Socio-economic details:* The interviewer recorded race, gender and home language. The interviewer presented the respondent with visual cue cards with brackets of possible answers to four of the demographic questions. The responses to these questions were pre-set in categories delineated with letters.

3.4   Ethical Code of Conduct

Working with human subjects requires adherence to strict ethical principles. The Department of Economics and Economic History Ethics Committee approved the questionnaire for use on 5 November 2012. The methods used in this study adhered to the code of conduct of the Rhodes University Higher Degree Guide and the Rhodes University Ethical Guidelines for Human Subjects. Additionally, research in Mozambique was carried out under permit number 07/2012 (Appendix IV).

3.5   Data Collection

Data consisted of responses to 120 usable questionnaires. The total number of collected surveys was constrained by project budget, the ability to engage tourists, and interviewer time. Administration of questionnaires was face-to-face at two tourist hotspots within the PPMR.

Depending on activity and location, the method of approach varied. Divers were most receptive, and therefore primarily surveyed at their respective dive centres during dive planning in the evening or after returning from a dive. Likewise, dolphin tourist surveys

took place at the dolphin activity centre after tourists returned from a dolphin swim. The best approach to fishermen was at the fishing shops and campsite in Ponta do Ouro, at the launch site and local restaurants.

Respondents were asked only questions that they qualified for, thus, there were thirty-two questions for scuba divers interested in sharks and twenty-two questions for non-divers. The questionnaire took between 8-12 minutes to complete, depending on whether the respondent was a diver, dolphin tourist or fisherman and could stretch on longer if the respondent had additional comments, questions or suggestions.

Data from questionnaires was captured directly into an Excel spreadsheet at the end of each survey day. Each questionnaire was dated and assigned a numerical code to keep track of the electronic entry and its corresponding hardcopy questionnaire. The data was checked for errors during entry and again at the end of the study. While entry errors were few, the numerical code assigned to each sample ensured an easy reference to entry errors.

There were a number of small adjustments made to the data before analysis, specifically to categorical variables. A dummy variable for country of residence was created, dividing respondents into African or non-African residence. Similarly, a dummy variable was created for education divided respondents into two groups, categorised by those with university education and higher and those with tertiary education or less. Finally, household monthly income, also a categorical variable, was divided into above and below R30 000.

3.6   Statistical Analysis

Data was analysed in R using Probit and OLS regression (R Core Team, 2013). In both regression models, WTP was the dependent variable tested against variables described in the literature review (Section 2.3.1) and detailed in chapter four. Independent variables were checked for correlations before analysis.

The regressions aimed to understand how the independent variables predict and explain variations dependent variable Y, in this case WTP. The OLS regression model makes the assumption that the value of the dependent variable is linear but inexact,

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + u_i$$

where β_0 is the *y*-intercept or the value of Y_i when *x*=0. $\beta_1, \beta_2 \dots$ is the coefficient that describes the size and direction of the relationship between $x_1, x_2 \dots$ and Y_i. The model

assumes that the regression residual, or unobservable random error term u_i, has a mean of zero for all *i*, has the same variance for all *i* and assumes no correlation across variables (Cottrell, 2011).

The linear model used the WTP bid based on the payment card as the dependent variable. Some studies presume the true WTP of the respondent falls within the range of the adjacent values on the card (Arin and Kramer, 2002) while other studies use the actual value of the WTP bid to ensure a conservative estimate of WTP figures (Thur, 2010). Thus, in keeping with the recommendations for conservative estimates in contingent valuation studies (Arrow *et al.*, 1993), this study used the stated WTP bid value in both models.

When the dependent variable is dichotomous, problems can arise from using a linear regression model. The Probit model addresses some of the issues with binary dependent variables through constraining estimated possibilities (Nagler, 1994). Because a dichotomous dependent variable *Y* will only have observable values of 0 and 1, the Probit model assumes that there is an unobserved, latent dependent variable Y^* that is a function of the value *Y*. Thus, in a similar model to the linear regression model, the Probit model assumes that

$$Y_i^* = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + u_i$$

and that

$$Y_i = 1 \; if \; Y_i^* > 0$$
$$= 0 \; otherwise$$

For the Probit analysis, if the respondent was willing (unwilling) to pay more than R20 as a daily user fee, the observation was denoted with a 1 (0). The value of R20 was chosen based on a clear break in the data at R20 with a significant gap on either side, providing a natural point of division.

Unlike the OLS model, where the estimated coefficient is the marginal effect of the variable, in the Probit model estimated coefficients show the multiplicative effect of a variable. Therefore, the estimated coefficients need to be transformed into marginal effects. This was done in R by calculating the average of the sample marginal effects as described by Fernihough (2011).

To test for accuracy of the results, resampling was done using the bootstrap R package (Canty and Ripley, 2012). In a literal sense, a bootstrap is a loop at the back top

of a boot that is used to pull it on. Although literally impossible, the phrase, "to pull oneself up by one's bootstraps," is a metaphor meaning one improves one's position by using one's own efforts and resources at hand. In statistics, bootstrapping is a resampling technique where repeated samples are drawn from the sample data which itself is used as a population (Efron and Tibshirani, 1993). In this study, a nonparametric bootstrap was used to avoid potential deficiencies that arise from assumptions about the form of the population and through deriving the sampling distribution explicitly (Fox, 2002). The original data was resampled as a data set the same size as the original data (n=120) where the new sample values were taken from the original data with replacement. Thus, the while the original data sampled the population, the bootstrap data sampled the original data, or "the population is to the sample as the sample is to the bootstrap sample" (Fox, 2002:2).

3.7   Sources of Bias and Study Limitations

The payment card was chosen as the elicitation method for this study because of its ability to provide conservative estimates (Thur, 2010) which are deemed more reliable than overestimations (Arrow *et al.*, 1993). Additionally, the PC generally has fewer protest-bids and a lower non-response rate than other methods such as dichotomous choice (DC) and open-ended (OE) (Reaves *et al.*, 1999). Steps against range and centring bias were taken by providing adequate upper values (Rowe *et al.*, 1996) and a visually pleasing format (Kerr, 2000).

As discussed in chapter two, hypothetical bias may arise in different forms such as failure to consider budget constraints or lack of familiarity with the good in question (Arrow *et al.*, 1993, Venkatachalam, 2004, Whittington and Pagiola, 2012). To address hypothetical bias that may be based on lack of familiarity, the valuation question centred on an access fee. An access fee is a tangible and realistic good compared to environmental quality or biodiversity itself, fulfilling the recommendation that the good being valued is specific and practical to the respondent (Mitchell and Carson, 1989). Another source of hypothetic bias arises when the respondent fails to consider budget constraints. This survey reminded the respondent that they might have other things they wish to spend their money on while on holiday before being presented with a payment card.

While respondents were familiar with the activities they were participating in, many

did not know that they were in an MPA. Therefore, it was necessary to convey factual and unbiased information (Arrow *et al.*, 1993, Carson and Groves, 2007, Carson, 2012) about the MPA. Although the cognitive ability to absorb the consequences and significant details of the scenario were limited to the timeframe of the questionnaire, the questionnaire contained information that slowly built up a background of the MPA and the scenario. Thus by the time the valuation question was presented, the respondent had some time to understand and absorb the information before making a WTP decision (Arrow *et al.*, 1993).

Because sampling took place from November until April the following year, peak season and low seasons tourists were included in the study. Additionally, based on data from the MPA (DNAC, 2012), a stratified sample of user groups was taken to avoid sampling bias. By allocating a percentage of the total sample to each activity, a representative population was sampled.

Questions were carefully worded in an attempt to avoid bias (Carson *et al.*, 2001). In addition to reminding the respondent of budget constraints, questions that may lead to pro-social responses were formatted as forced choice (FC) whereby lessening the potential for pressure on the respondent to answer as social norms may dictate. Respondents were encouraged to respond in terms of how they felt rather than what they thought the "right" answer should be.

Nonetheless, despite measures taken to avoid bias, sources of bias may still be present in this study. There were limitations to this study in terms of scope and budget, which opens the possibility that the sample data presents only a superficial understanding of the population that may not accurately reflect the population. The relative lack of comparable studies within the region also posed a challenge in verification of results, but the study was compared to other studies at comparable sites internationally. Therefore, the results of this study must be viewed with caution and would benefit from a follow-up study or be viewed as a pilot to a larger scale study.

3.8 Conclusion

This chapter presented a discussion specific to the design and methods of the PPMR case study. The chapter laid out the particulars of this study to ensure that the methods used may be easily replicated or applied to future studies. Because the focus of this chapter surrounded the design and method of the study, justification behind the

decision for various approaches, such as elicitation method, questionnaire content and measures put in place to limit or minimise various forms of bias that the WTP method is prone to were not covered but can be found in the chapter two. The case study described in this chapter surveyed a stratified sample of marine based tourists with a questionnaire that included a payment card for a contingent valuation based on the scenario of a per-day usage fee within the PPMR. Data collection consisted of face-to-face interviews at two locations within the PPMR and contained a maximum of thirty-two questions. Data was checked for errors and dummy variables were assigned to categorical variables prior to data analysis. Finally, this chapter described the applied statistical models the results of which close the following chapter. Chapter 4 reports and discusses the results of the questionnaire and statistical analysis.

Results & Discussion   **4**

This chapter describes and discusses the characteristics of the sample and the results of the contingent valuation (CV) study. As mentioned in chapter three, this study obtained 120 usable surveys and this chapter begins with a preliminary analysis of the characteristics of the population sample, including an in-depth look at scuba diver characteristics. The next section addresses the research question, reporting the willingness to pay of marine based tourists to the Ponta do Ouro Partial Marine Reserve (PPMR) and again providing a more detailed discussion of willingness to pay of scuba divers. The chapter ends with an econometric analysis and the regression model used to analyse the data. Throughout, the results are discussed in terms of their relevance, potential meaning and comparison to other studies.

4.1   Sample Characteristics

Table 4.1 is a frequency chart of general socio-economic and demographic characteristics of the sample as a whole.

Respondents represented 11 countries on five continents. A majority of the 86% of African respondents were from South Africa (93%). The small proportion of respondents from Mozambique is consistent with the 4% of Mozambicans at another study site in Mozambique (Tibiriçá *et al.*, 2011) and the 2.8% Mozambicans at the same study site (Pereira and Schleyer, 2005). Of the respondents from South Africa (n=97), over half (55%) lived in Gauteng province, which is the most populated province and has the highest GDP in South Africa (*Census 2011: Census in Brief*, 2011). Correspondingly, 78% of the highest earning (>R81 000[3] per month after tax) South Africans resided in Gauteng. The majority of other South African respondents lived in coastal provinces, primarily KwaZulu Natal (32%).


[3] 1USD = R9.85 (29 October, 2013)

**Table 4.1** Socio-economic and demographic characteristics

Variable	n	%	Variable	n	%	Variable	n	%
Continent			**Education**			**Race**		
Africa	104	**86%**	Primary	1	**1%**	Black	4	**3%**
Australia	1	**1%**	Secondary	14	**12%**	Coloured	5	**4%**
Europe	6	**5%**	Tertiary	58	**48%**	Indian	4	**3%**
Middle East	1	**1%**	Higher Degree	47	**39%**	White	107	**89%**
North America	8	**7%**						
Language			**Gender**			**Occupation**		
Afrikaans	32	**27%**	Female	48	**40%**	Government	14	**12%**
English	77	**64%**	Male	72	**60%**	Private sector	82	**68%**
Portuguese	7	**6%**				Retired	2	**2%**
Other	4	**3%**				Self-employed	14	**12%**
						Student	5	**4%**
Income (in thousands)			**Age**			Unemployed	2	**2%**
<R20	28	**23%**	18-20	2	**2%**	Other	1	**1%**
R21-R40	30	**25%**	21-30	38	**32%**			
R41-R60	17	**14%**	31-40	35	**29%**			
R61-R80	18	**15%**	41-50	29	**24%**			
R81-R100	11	**9%**	51-60	12	**10%**			
>R100	16	**11%**	61+	4	**3%**			

Respondents represented seven language groups. All respondents who spoke Portuguese as their home language (6%) resided in Mozambique. Likewise, all respondents who spoke Afrikaans as their home language (27%) resided in South Africa.

Respondent age and gender show typical trends found in other similar recreational areas (Figure 4.1). This study had more male respondents than females. In other studies of marine protected areas, it is typical to have higher percentages of males (Arin and Kramer, 2002, Ahmad, 2009, Stithou and Scarpa, 2012). A slight majority of respondents between 21-30 years old indicates a younger trend than the mean age of 34,9 years found in a study at the same location in 2001-2002 (Pereira and Schleyer, 2005). Similar to this study, study at a marine park in Greece found 46% of respondents under the age of 30 (Togridou *et al.*, 2006) while an ecotourism study in Indonesia reported 53% of respondents between the ages of 21-30 (Nuva *et al.*, 2009).

Figure 4.1 Respondent age and gender
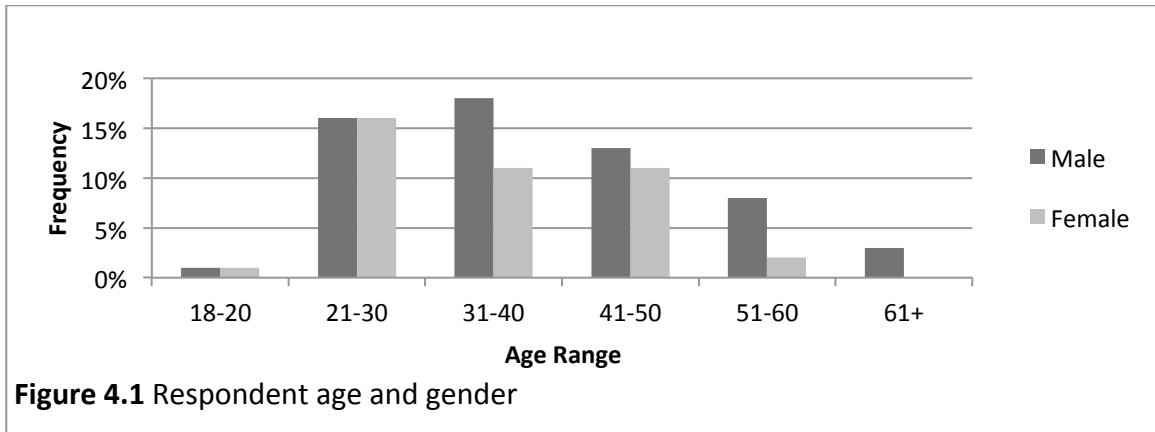
The majority of respondents indicated a high level of education (88% with a tertiary education). This result is similar to that found at another beach destination in Mozambique where 84% of respondents had at least one university degree (Tibiriçá *et al.*, 2011). Of those respondents with a higher degree, 72% earned less than R60 000 a month after tax while all of the respondents who earned over R100 000 per month after tax had at least one university degree (Figure 4.2).

Figure 4.2 Respondent income and education
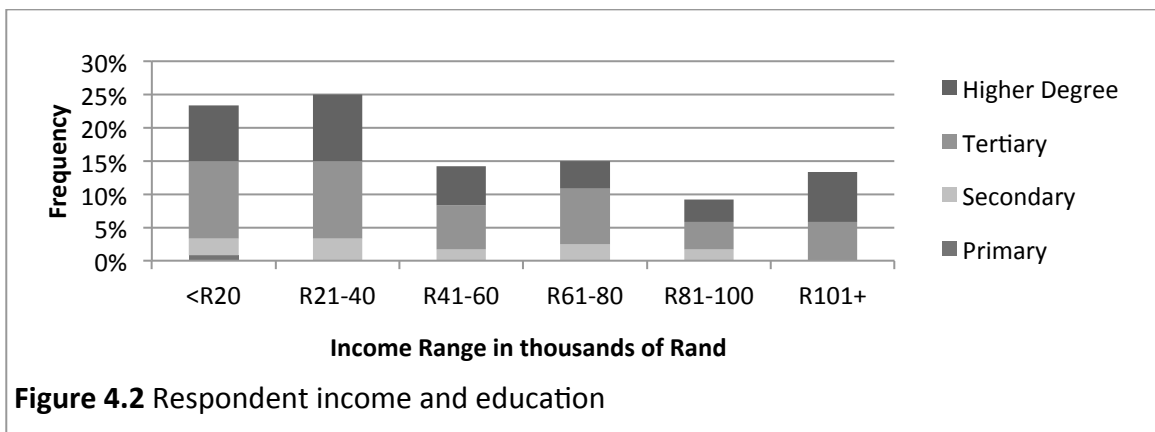
4.1.1 Current and Previous Visits to Site

Respondents reported the number of previous visits and length of stay in days for their current visit (Table 4.2). With some respondents reporting visiting up to two hundred times, there was a large difference between the median and mean of previous visits but the visit was novel for some; 36% of respondents were visiting for the first time.

The majority of foreign respondents (88%) and one-third of Mozambican respondents were visiting for the first time. In contrast, South Africans were more likely to be return visitors with 27% visiting for the first time. Nearly a quarter of South

African respondents had previously visited more than ten times, suggesting a loyal group of repeat holidaymakers.

Table 4.2 Respondent previous visits and length of current stay

	Mean	Median	Mode	SD	Min	Max
Previous visits	10	2	0	24,95	0	200
Length of Stay	7	5	4	5,59	1	30

Corresponding to the tendency of increased visitor numbers over long weekends and holidays (DNAC, 2012), 45% of respondents reported their current visit length as 2-4 days. Nearly one-third of respondents stayed from five days to one week, with the mean length of stay seven days. Respondents participating in dolphin swims tended to stay shorter periods, with half reporting their current visit as between 2-4 days. The most common dolphin swim packages are one-day excursions followed by three-day excursions (Skinstad, pers. comm., 2013), which may explain the shorter stay for dolphin swim tourists. On the other hand, 47% of all fishermen stayed between four days to one week and 24% stayed between ten days and two weeks.

The questionnaire required respondents to provide their top two reasons for choosing the area as a holiday destination (Figure 4.3). There was little difference in response between user groups and just over half of all respondents cited natural attractions (sea activities and sea life) as the main drawcard of the area for a holiday. The low instance of choosing the 'other' category indicates that the options were well represented. Respondents that chose 'other' were asked to describe what drew them to


Figure 4.3 Main factor for choosing holiday location   n=236

58
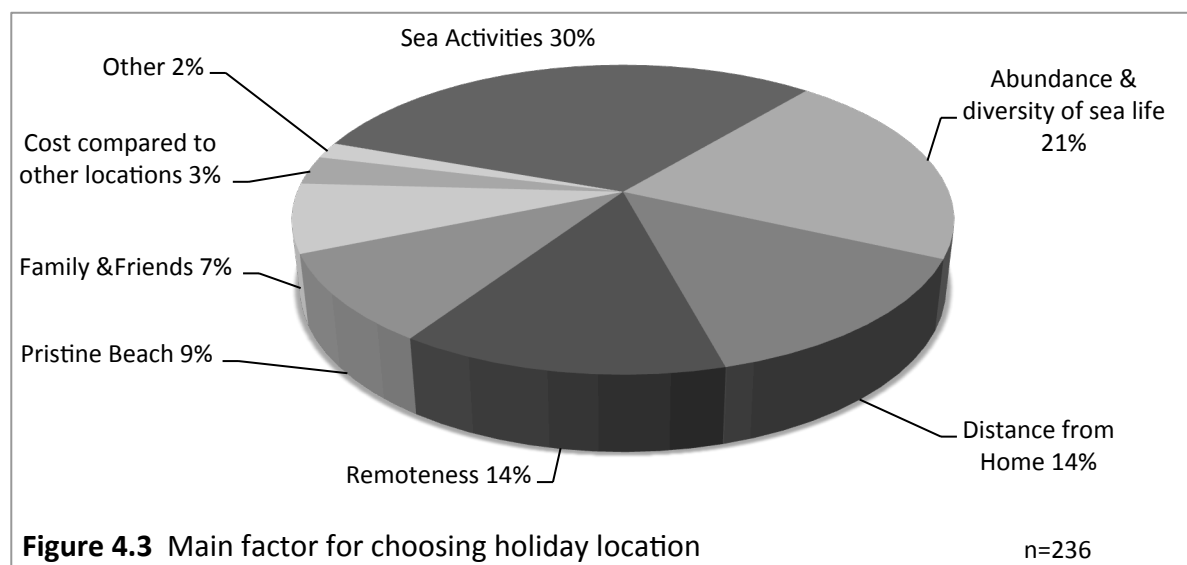
the area. Answers included turtle walks, off-road driving and drinking.

4.1.2 Environmental Awareness

By self-evaluation, over half of respondents (54%) considered themselves to be very environmentally aware. Respondents also provided information about their awareness of MPA status as well as their personal consumer choices, which added further background to environmental awareness.

Individuals with at least one degree were more likely to consider themselves environmentally aware. This is consistent with other studies that reported on environmental awareness. In a study of user fees in the Philippines, Arin and Kramer (2002) discussed the expectation that higher education may lead to higher environmental awareness which was confirmed in a study on WTP for dusky kob restocking where results suggested a positive relationship between higher levels of general education and environmental awareness (Palmer and Snowball, 2009).

Fishermen were most likely to consider themselves very or extremely environmentally aware (88%), followed by scuba divers (85%) and dolphin swim tourists (65%). Because a fisherman or diver must invest in equipment and education, he or she may be more likely to take an interest in the environment, particularly the ocean. This interest may lead to a higher level of environmental awareness. In contrast, dolphin swims are not a specialized activity compared to fishing and scuba diving; even individuals that cannot swim are able to participate in the activity (with a lifejacket). Thus using the same logic, the entry-level nature of dolphin swims may attract individuals having their first nature experience and who, therefore, consider themselves to be less environmentally aware. In total, 42% of respondents were aware of being in an MPA. Amongst fishermen, 59% were aware of being in an MPA, the highest awareness level of the three activity groups (Figure 4.4).

Figure 4.4 Knowledge of MPA by activity
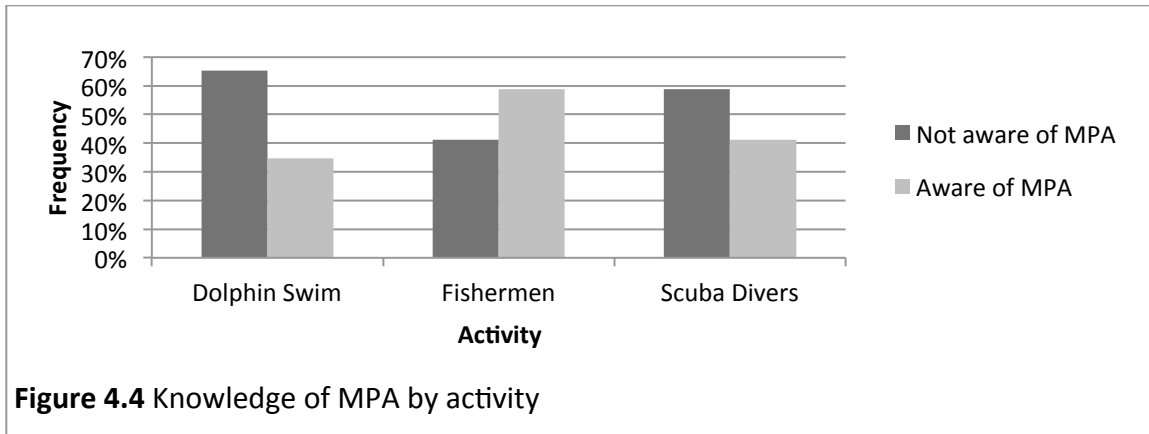
Fishermen, when compared to the other two activity groups, face more rules and regulations, and often more personal responsibility. Fishermen, as consumptive users, are the only group allowed to operate from a private boat within the MPA whereas both scuba diving and dolphin swims are restricted to charter operations. Therefore, while the rules and regulations regarding these non-consumptive activities are the responsibility of the operator to abide by and pass on to the individual as necessary, the fisherman must have personal knowledge of the MPA. As non-consumptive users, less than half of scuba divers and dolphin swim tourists were aware of being in an MPA, with awareness levels at 41% and 35% respectively. Amongst scuba divers, this low level of awareness contrasted with the high percentage of individuals who considered themselves very or extremely environmentally aware as well as with the high knowledge (78%) of the current diver tax, discussed in section 4.1.3.

Nearly half of all respondents (48%) used the South African Sustainable Seafood Initiative (SASSI) seafood guide or a comparable guide. Considering that over half of all respondents (51%) cited either sea activities or abundance of sea life as the main factor for choosing the area for a holiday, this could suggest a link between consumer behaviour and action.

There were notable differences in use of the SASSI consumer guide between activity groups (Figure 4.5). Fishermen were the most common users of the SASSI consumer guide with 80% using the guide. While a slight majority of dolphin swim tourists (52%) used the guide, surprisingly, the slight majority of divers (51%) did not use the guide when eating seafood. Again, this result contrasts with scuba divers' high self-evaluated levels of environmental awareness. In fact, these usage figures seem somewhat of a contradiction. Although fishermen were consumptive users of the MPA, their use of a

60

seafood guide suggests an interest in sustainability and usage of the resource beyond their holiday. Conversely, although abundance and diversity of sea life was one of the top reasons scuba divers chose the area as a dive location, half did not refer to a consumer guide when eating seafood. Scuba divers, as non-consumptive users of the MPA, were less likely to use a seafood guide suggesting an incongruous relationship between the long term sustainability of their activity, their level of environmental awareness and their consumer choices.

Figure 4.5 Use of SASSI guide by activity
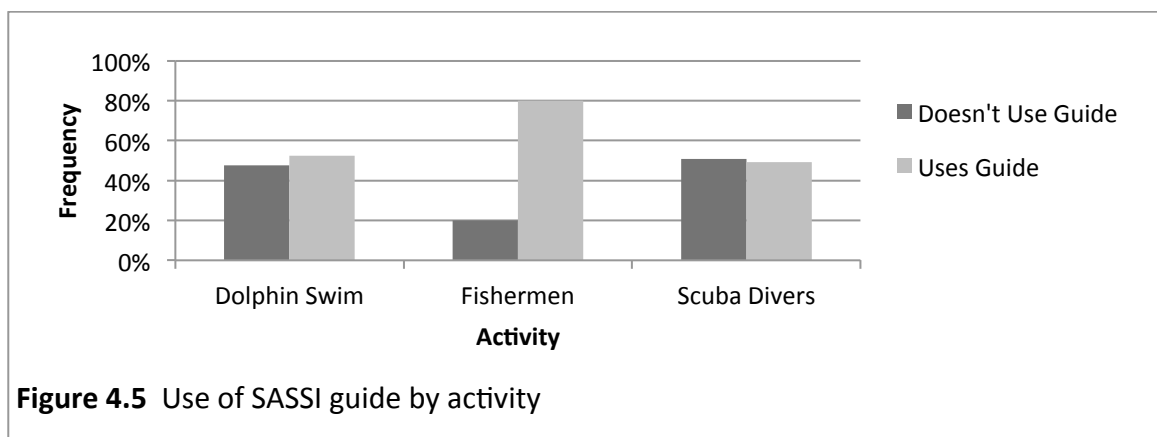
As the group most aware of the protected status of the MPA and most likely to use the SASSI consumer guide, fishermen both appeared to be and self-reported as the most environmentally aware group. This suggests, at least for this activity group, a complementary relationship between self-ranking of environmental awareness, knowledge of the MPA and consumer behaviour. Comparably, dolphin tourists had lower knowledge of being in an MPA, had a 50% chance of using the SASSI guide and were less likely to consider themselves very environmentally aware.

A consumer seafood guide seems to be an internationally accepted concept. Exactly half of all foreign respondents indicated that they used a comparable consumer seafood guide in their home countries (Figure 4.6). One-third of Mozambicans indicated that they used the SASSI guide as Mozambique does not offer an equivalent consumer seafood guide. Excluding the 11% of respondents that did not provide a response to the question, 57% of South Africans reported using the guide. Although the majority of South Africans reported using the guide, it was expected that more South Africans, especially those living near the coast, would use a seafood guide. This expectation came from the growing presence of SASSI in South Africa. In South Africa, three nationwide

grocery suppliers and two nationwide seafood restaurants have public and time bound commitments to sustainable seafood with most displaying and providing SASSI seafood guides in their stores (WWF, 2010).

Figure 4.6 Use of SASSI guide by country
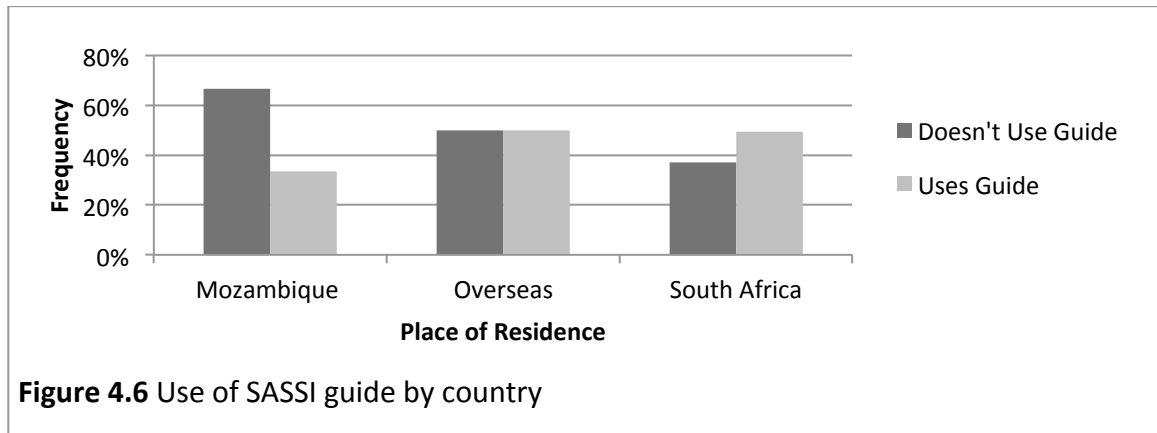
4.1.3 SCUBA diver tax

Although 78% of divers were aware of the dive tax, only one-third of divers were able to state the correct amount of the current dive tax. Divers in the St. Eustatius National Parks study were similarly unaware of the price for single and annual dive passes due to purchasing a dive package (Riley *et al.*, 2006). Similarly, at this study site, the dive tax is included in the price of the dive. Of the one-third of divers who knew the price of the dive tax, most were from one dive operation that listed the dive tax on the dive planning board. All divers surveyed at that operation were aware of the dive tax and knew the current charge.

4.2 Willingness to Pay

All respondents answered positively to the primer question "Do you think it is reasonable for users of a protected area to be charged a user fee?". Some respondents only agreed with the statement in theory (n=33) and raised concerns about user fees. Concerns included corruption and misuse of funds (46%), the payment vehicle or rate (27%), adequate management (21%) and foreign involvement (5%). The frequency and amount respondents were WTP for a usage fee is reported in Figure 4.7.

Throughout the design and application of the survey instrument, efforts were made to ensure a conservative estimate of WTP. The mean WTP of R43.75 is lower than the average found in a sample of thirty-three studies of per day usage fees at MPAs in the

Caribbean, Gulf of Mexico and Southeast Asia (R60.8, Appendix V). This suggests that the mean WTP value is a conservative estimate of WTP for all user groups within the PPMR.

Figure 4.7 (chart data): Frequency on y-axis (0 to 50), Willingness to Pay on x-axis (<R15, R20-30, R31-50, >R50).

Mean: R43.75
95% CI*: R38.8-R48.84
Std.Dev.: R28.5
Median: R40
Mode: R50
Range: R1-150

*95% Confidence Intervals were calculated with bootstrapping using 10000 draws with replacement   n=120

Figure 4.7 WTP Frequency and amount
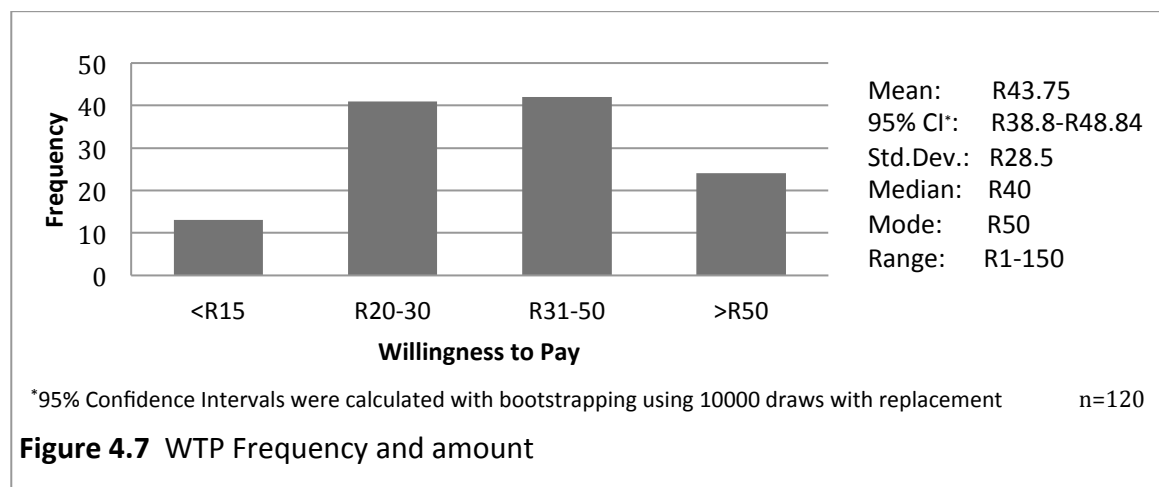
Foreign respondents had a higher mean WTP (R62.5) than African respondents (R32.7). Within Africa, South Africans had a higher mean WTP (R41.4) than Mozambicans (R36.7). While the mean WTP appears higher for foreign respondents, the mean percentage of monthly income that South Africans were willing to pay was slightly higher (0.16%) than foreign respondents (0.14%). Mozambicans were WTP an average of 0.13% of their monthly income.

Scuba divers had the highest mean WTP of the three activity groups at R45.2, which is also higher than the total sample mean. Both dolphin swim tourists and fishermen had a mean WTP below the total sample mean at R41.7 and R39.7, respectively. Respondents that viewed themselves as very or extremely environmentally aware had a higher mean WTP (R45.8) than those who considered themselves moderately or slightly environmentally aware (R29.9).

Mean WTP varied amongst activity groups depending on the respondent's awareness of being in an MPA but the effect varied and did not reach statistical significance. Nonetheless, it is of interest to note for future studies. Although fishermen were most aware of being in an MPA, the one-third that was not aware had a higher mean WTP (R46.4) than those who were aware (R35). The opposite was true with the other two activity groups. This difference was less obvious amongst scuba divers, with mean WTP of R47.6 of aware respondents and R43.5 of unaware respondents, than amongst dolphin swim tourists, with a mean WTP of R50.6 for those aware and R37 for those

unaware.

Mean WTP decreased slightly with length of stay. The valuation question asked for WTP per day so the longer the visit, the longer the total user fee amount would be. Respondents staying between 2-4 days had a mean WTP of R46 while those staying one week had a mean WTP of R37. A similar trend arose in mean WTP of respondents who were visiting for the first time (R46.8) and those who had visited over ten times prior (R38.2).

4.3   Econometric Analysis & Discussion

Two regression models were used in the econometric analysis of the data, a linear model and a Probit model. This section is divided into subsections that detail the form and output of each model followed by a discussion and comparison of the two outputs in relation to this study as well as others. Details of the methods used as well as reasoning behind the determination of independent variables was discussed in both the literature review and methods chapters and will only be briefly touched on again in this section. Both the linear and the Probit models were multivariate models applied to the data to explain the causal effect of select independent variables (Table 4.3) on an individual's WTP bid or WTP more than R20, respectively. Variables were tested for multi-colinearity and no significant relationships were found.

A priori expectations for both models were as follows: an increase age, income, those with a university education, environmental awareness and knowledge of being in an MPA were expected to positively impact on WTP; residency in an African country was expected to negatively impact on WTP; as a respondent's number of days visiting the site or previous visits to the site increased, it was expected that WTP would fall. *A priori* expectations for the influence of gender or activity on WTP are not possible.

Table 4.3 Independent variables

Age	Age in years
Income	Monthly income: >R30 000 = 1, <R30 000 = 0
African	Home country: Resident of African country = 1, non-African countries = 0
University	Education: University degree or higher = 1, no university = 0
Male	Gender: male = 1; female = 0
ActivitySCUBA	Scuba diver = 1; fisherman or dolphin swim = 0
ActivityFISH	Fisherman = 1; scuba diver or dolphin swim = 0
MPA	Awareness of being in MPA: aware = 1; unaware = 0
Enviro	Environmental awareness: 1 = slight; 2 = moderate; 3 = very; 4 = extremely
Days	Length of current stay in days
Prior	Number of prior visits, 0 = first visit

4.3.1 Linear Model

The linear regression used the least squares method. To ensure a conservative estimate, the actual bid WTP value was used as the dependent variable. The model assumes that the WTP value is linear but inexact taking the form of

$$WTP = \beta_0 + \beta_1 Age_i + \beta_2 Income_i + \beta_3 African_i + \beta_4 University_i$$
$$+\beta_5 Male_i + \beta_6 Activity_i + \beta_7 MPA_i + \beta_8 Enviro_i + \beta_9 Days_i + \beta_{10} Prior_i$$
$$+ u_i$$

Table 4.4 shows the output of this model, illustrating the effects of the various independent variables on respondents actual WTP. The adjusted r-squared value shows that the model can account for 12% of variation in WTP. All *a priori* expectations were met in the OLS model.

In the OLS model, an income of over R30 000 per month after tax was significant as a determinant of WTP at the 5% level. An income of over R30 000 increased the WTP amount by R13.60, *ceteris paribus*. Environmental awareness also had a positive impact on WTP (p<0.10). Environmental awareness increased WTP amount by R6.70. Being an African resident (as compared to a resident of non-African countries) was a significant negative factor in determining WTP (p<0.05), which decreased the WTP amount by R17.50 holding all other variables in the model constant.

Table 4.4 Linear regression model coefficients

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	23.9423	17.4849	1.369	0.1737
Age	0.2432	0.2385	1.020	0.3101
Income	13.5941	5.5792	2.437	0.0165 **
African	-17.4864	7.4815	-2.337	0.0213 **
University	5.1876	7.8389	0.662	0.5095
Male	-3.9428	5.2702	-0.748	0.4560
ActivityFISH	-1.2122	9.4754	-0.128	0.8984
ActivitySCUBA	0.4855	6.7737	0.072	0.9430
MPA	4.0083	5.1384	0.780	0.4371
Enviro	6.6636	3.5302	1.888	0.0618 *
Days	-0.6519	0.4636	-1.406	0.1626
Prior	-0.1353	0.1039	-1.303	0.1955

Signif. codes: '**' 0.05 '*' 0.1 ' '

Residual standard error: 26.66 on 107 degrees of freedom

Multiple R-squared: 0.2127,   Adjusted R-squared: 0.1244

F-statistic: 2.409 on 12 and 107 DF, p-value: 0.008386

4.3.2 Probit Model

When the dependent variable is dichotomous, that is when there are two mutually exclusive and exhaustive categories, a Probit model is appropriate to avoid common problems with linear regression (Noreen, 1988). This model takes similar form as the linear model discussed in the above section but instead of the actual WTP bid made by the respondent, the dependent variable was binary. For the binary choice in this model, the sample was divided into individuals willing to pay more than R20 (1) and individuals willing to pay R20 or less (0). The model takes the form

$$WTP_i^* = \beta_0 + \beta_1 Age_i + \beta_2 Income_i + \beta_3 African_i + \beta_4 University_i$$
$$+ \beta_5 Male_i + \beta_6 Activity_i + \beta_7 MPA_i + \beta_8 Enviro_i + \beta_9 Days_i$$
$$+ \beta_{10} Prior_i + u_i$$

Table 4.5 shows the effects of the independent variables on WTP of over R20. The pseudo-R^2 was 0.12 indicating a 12% increase in the log-likelihood function (Hoetker, 2007) as derived and interpreted by McFadden (1974). *A priori* expectations were met and consistent with the OLS model except for education, which was negative.

Table 4.5 Probit model coefficients

	Estimate	Std.Error	t value	Pr(>|z|)
(Intercept)	1.293834	1.039696	1.244	0.2133
Age	0.010081	0.013588	0.742	0.4581
Income	0.307589	0.305153	1.008	0.3135
African	-1.050354	0.588362	-1.785	0.0742 *
University	-0.228573	0.403046	-0.567	0.5706
Male	-0.178119	0.290515	-0.613	0.5398
ActivityFISH	-1.321587	0.577285	-2.289	0.0221 **
ActivitySCUBA	-0.933033	0.457844	-2.038	0.0416 **
MPA	0.267810	0.289197	0.926	0.3544
Enviro	0.329534	0.191690	1.719	0.0856 *
Days	-0.004791	0.025250	-0.190	0.8495
Prior	-0.003875	0.005165	-0.750	0.4531

Signif. codes: '**' 0.05 '*' 0.1 ' '

(Dispersion parameter for binomial family taken to be 1)

McFadden Pseudo R^2: 0.12020691

Null deviance: 130.39 on 119 degrees of freedom

Residual deviance: 114.71 on 107 degrees of freedom

Four variables were statistically significant in the Probit model. The marginal effect of an African resident (as compared to a resident of non-African countries) decreased the probability of being WTP more than R20 by 28% when other variables are held at sample mean. Respondents whose main activity was fishing, rather than scuba diving or dolphin swims, had a 36% lower probability of being WTP more than R20 (significant at the 5% level) Similarly, the probability of being WTP more than R20 fell by 25% if respondents were in the MPA primarily for scuba diving, as compared to those who were there for fishing or dolphin swims (significant at the 5% level). Finally, for the four levels of environmental awareness, each increase in self-ranking of environmental awareness level (for example from slightly to moderately) would increase the probability of being WTP more than R20 by 8%.

4.3.3 Discussion

Both models present results that help to understand the variables that influence WTP in this study. The Probit model analysed how the independent variables influenced the probability of respondents being WTP more than R20, while the linear model analysed

the effects of the independent variables on the amount respondents were WTP.

Construct validity tests whether the results of a CV study are consistent with economic theory (Carson *et al.*, 2001). In this study, where *a priori* expectations were met in all but one case, the test of construct validity was met. The result of income positively correlating with respondent WTP adds to the reliability of a study (Whittington and Pagiola, 2012), showing that the results of this study can be viewed as meeting tests of both validity and reliability. In the OLS model, income had a positive impact on WTP significant at the 5% level. Although income was not statistically significant in the Probit model, its positive influence on WTP in both models is consistent with demand theory that a higher income would lead to a higher WTP. This positive relationship with WTP also suggests that the respondents considered their budget when giving their bid value and that they took the hypothetical situation of the user fee seriously.

In the Probit model, African residency had a negative effect on WTP (p<0.10) suggesting that foreign visitors were more likely to be willing to pay more than R20. Likewise, in the linear model, African residency had a negative impact on the amount respondents were WTP (p<0.05), suggesting that respondents from African countries had a lower WTP than respondents from overseas. The perception of an MPA with regards to effectiveness and regulation may vary between foreign and local respondents accounting for the variation in WTP. A variation in WTP between foreigners and residents is common. In a study of access fees at Pulau Payar Marine Park, Malaysia, foreigners' WTP was more than twice residents' WTP (Yeo, 2005). However, in a study of entrance fees to a national park in Costa Rica, residents' WTP was significantly higher than foreigners' WTP. The authors suggest that this result may be due to the high level of pride that Costa Ricans have for their parks and natural resources but they suspect rather that the result may be due to cultural-strategic bias (Shultz *et al.*, 1998).

A positive relationship between environmental awareness and WTP in both models (p<0.10) suggests that increased environmental awareness may increase WTP. These results also meet the test for construct validity as WTP is often higher amongst those who care for the environment (Carson *et al.*, 2001). Similarly, a study in Mexico found that providing information to respondents about the marine environment tended to lead to a higher WTP for a coral fund to raise revenues for coral protection in the area

(Casey, 2006) which suggests that positively influencing environmental awareness is potentially a way to increase WTP within a specific park.

Activity influenced WTP in the Probit model; both scuba divers and fishermen were less likely to be willing to pay more than R20 ($p<0.05$) than dolphin swim tourists, holding other variables constant. Both scuba diving and fishing involve an investment in time and equipment and currently already have various fees associated with them in the PPMR such as fishing permits and diver tax which may cause them to be less likely to be willing to contribute more than R20 on top of other expenses. Dolphin swims require neither prior investment in learning skills nor acquiring of equipment and have no additional fees on top of the cost of the trip itself.

Knowledge of being in an MPA had a positive impact on WTP although it was not a statistically significant result. While this question in the survey was straightforward and was carefully worded to avoid bias, additional questions about specific knowledge of the MPA may have strengthened the parameters by which to measure basic knowledge of the MPA. In this study, only about half of the sample knew they were in an MPA, by increasing information available to visitors, their value of the resource, and thus WTP, would increase, as this result has shown.

The negative impact of the respondent's days of current visit and prior visits on WTP suggest familiarity with or frequency of use of the site leads to decreasing WTP. This result is consistent with diminishing marginal utility. It was also congruous with mean WTP values, which decreased slightly with length of stay. Respondents staying a week or more had a lower WTP than those staying only 2-4 days. Similarly, respondents visiting for the first time were WTP R8.6 more than those who had visited over ten times prior.

4.4 Conclusion

This chapter described and analysed the results of the questionnaire and contingent valuation study. The preliminary analysis of the characteristics of the population sample found that mainly, visitors to the PPMR were a loyal group who made repeat visits to the site. The typical holidaymaker was a white, male South African who spoke English as his first language, was between the ages of 21-30 years old, had at least a tertiary education and made between R21 000-40 000 a month after tax. The mean WTP for access to the PPMR was R43.75. Two models were used in the econometric analysis of

the data, which found environmental awareness and foreign or local residency to be statistically significant determinants of WTP.

Conclusion **5**

As a country, Mozambique presents numerous paradoxes. Most significant to this study is the country's apparent dual commitment to marine protected areas and industrial scale coastal growth. The Ponta do Ouro Partial Marine Reserve (PPMR) is a biodiversity hotspot that maintains countless ecosystem goods and services. Like many ecosystem goods and services, the economic benefit of the PPMR in its current, unconverted state is largely hidden from the market and thus megaprojects, like the deep-water port, on the surface can appear as a more profitable use of the land than a protected area. However, by employing tools of environmental valuation, a greater understanding of the total economic value of the PPMR arises. Contingent valuation of marine based tourism within the PPMR aids in revealing aspects of non-market value of an MPA.

MPAs face many challenges vying for the financial support that is necessary for meaningful and effective management. When an MPA can generate its own revenues, the financial burdens of the park decrease and the opportunity for success increases. As shown in this study, user fees can provide a sustainable source of income for MPAs. By revisiting and discussing the objectives of this study, this chapter highlights the potential for user fees within the PPMR. This chapter then provides policy recommendations and considerations for the PPMR based on the results of this study. Finally, the chapter ends with recommendations for future study.

5.1   Objectives revisited

This study had two objectives based on the concepts and methods of contingent valuation, willingness to pay and user fees. Primarily, the study aimed to determine the willingness to pay of the combined user groups of dolphin swim tourists, fishermen and scuba divers. Based on a stratified sample of these user groups, the mean WTP of all user groups was R43.75. This is lower than an international average of thirty-three MPA per day user fees (R60.8). Individual user groups were also of interest and there was some variation around the total mean WTP. Scuba divers were above the total mean WTP with a mean WTP of R45.2. Both dolphin tourists and fishermen had mean WTP

below the total mean at R41.7 and R39.7 respectively (section 4.2). However, the Probit model showed that dolphin swim tourists were more likely than other user groups to be willing to pay more than R20.

The second objective of this study was to investigate the potential for the PPMR to increase revenues through the implementation of a user-fee for marine based activities. The results of this study suggest that a user fee for scuba divers, dolphin swim tourists and fishermen could be a source of revenues for the PPMR. Based on the data of total individuals on launches provided by the PPMR (Figure 3.2), it is possible to calculate an estimate of what implementing a user fee, based on the mean WTP of this study (R43.75), would bring in terms of revenues to the PPMR in a year. Over the years 2011 and 2012, the PPMR reported an average of approximately 36 800 total individuals on launches per year, which if paying a user fee of R43.75, would bring in R1 654 122 per year. This estimate must be viewed with caution. On one hand, marine based tourism operators have argued that the data provided by the PPMR may be an overestimation of total tourists to the area. During this study, some operators expressed concern regarding double counting of individuals on launches. Also, activity guides are virtually indistinguishable from clients and are easily double or even triple counted at the launch site. Thus, to account for possible over counting, one passenger was subtracted from the average passengers per launch data from the PPMR. The total individuals on launches per year then averaged a conservative estimate of 33 434. If these individuals paid R43.75 per day, the PPMR would see revenues of R1 462 738 per year. On the other hand, the PPMR data is likely to be an underestimation of total marine based tourists. The PPMR data is primarily collected from Ponta do Ouro, the busiest launch site within the PPMR. PPMR management has little data from Ponta Malongane, the second busiest launch site, which could account for up to double the launches of Ponta do Ouro (Wagner, pers. comm., 2012). Due to limited resources, representatives of the PPMR are not able to monitor every launch site within the park and therefore cannot maintain an accurate count of marine based tourists. A 2001-2002 study of dives in southern Mozambique, which included both Ponta do Ouro and Ponta Malongane, estimated an average of 52 250 dives per year (Pereira and Schleyer, 2005), which suggests that the PPMR data on individuals on launches, at least for scuba diving, is a significant underestimate. Doubling the PPMR data results to a non-conservative estimate of 75 617 individuals, bringing revenues to the PPMR of approximately R3 308 244. Thus,

the estimated range of revenues per annum of a user fee is R1 462 738 – R 3 308 244. This figure is an indication of the non-market value of the MPA to current users, both consumptive and non-consumptive, that would be lost if the proposed deep-water port goes ahead.

5.2   Policy Implications

Respondents voiced concerns about corruption, misuse of funds and adequate management of the PPMR. This suggests that a lack of transparency, lack of management or lack of enforcement could lead to opposition of a user fee. Thus, the implementation and collection of a user fee must be unambiguous and the use of revenues from a user fee must be well documented and conspicuous.

The finding of higher WTP for foreigners than African residents reinforces the potential of a discriminatory pricing scheme for user fees within an MPA. Other studies finding the same result (Shultz *et al.*, 1998, Seenprachawong, 2003, Yeo, 2005) highlight the opportunity to increase MPA revenues by charging nationals of a country less than visitors. Nevertheless, discriminatory pricing should be approached with caution as the administrative difficulty in determining nationality may, in some locations, outweigh the benefits. In the case of the PPMR, implementing a user fee has logistical challenges to start with, adding a discriminatory pricing scheme may exacerbate those challenges particularly because the lower WTP was found in a region, southern Africa, rather than one country.

By increasing the environmental awareness of marine tourists through signs, education centres and knowledgeable park rangers, there is potential to increase the amount of a user fee in the future. Simple signage and business participation is effective in passing along information within an MPA; e.g. the one dive centre in the PPMR that had notices up about the dive tax, all divers surveyed there knew about the dive tax.

In this study, only about half of the sample knew they were in an MPA. Increasing and improving information available to visitors would increase their value for the resource, and increase WTP. Activity centres informing user groups about the MPA could act as a passive approach to increasing awareness. The presence of park rangers at the launch site, an educational centre that highlights MPAs and research within it, as well as educational talks for user groups could result in more active engagement of user groups.

5.3   Future Study

The Ponta do Ouro and Ponta Malongane areas will continue to grow as will tourism throughout the PPMR, nonetheless, PPMR management must use caution when implementing user fees to the area and policy decisions should be based on additional study of the area. Specific to the PPMR, a study that includes other tourist areas such as Ponta Mamoli, Ponta Milibangalala, Ponta Chemucane and Santa Maria would include WTP bids of both high-end tourism locations and remote campsites that may provide insights into the potential for discriminatory pricing at luxury resorts. A holistic study that includes local community input, particularly with regards to pro-poor tourism and fishing rights, would further enrich the understanding of the area. Applying other revealed preference models, such as a choice experiment would be beneficial, as this study can be used as a comparison. Finally, recreating this study and comparing the results would add legitimacy to user fee structures.

On a broader scale, similar research in MPAs should focus on the awareness of user groups of being in an MPA. In the literature, there are very few instances of studies determining whether respondents were aware of being in an MPA or if they knew what an MPA was. In this study, both operators who made their livelihoods within the MPA and tourists specifically using the MPA had limited knowledge of the PPMR, as well as MPAs conceptually. This could be a significant variable to WTP and one that may be easily influenced through educational initiatives and signage.

Additionally, the results surrounding use of the South African Sustainable Seafood Initiative guide suggest that further study on consumer behaviour and environmental views could be investigated on a larger scale. Sustainable consumer choice initiatives are gaining popularity in many countries and an investigation of this would provide insights into how such choices influence WTP.

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Appendix I. Location of Mozambique MPAs

Appendix II. Map of Ponta do Ouro Partial Marine Reserve
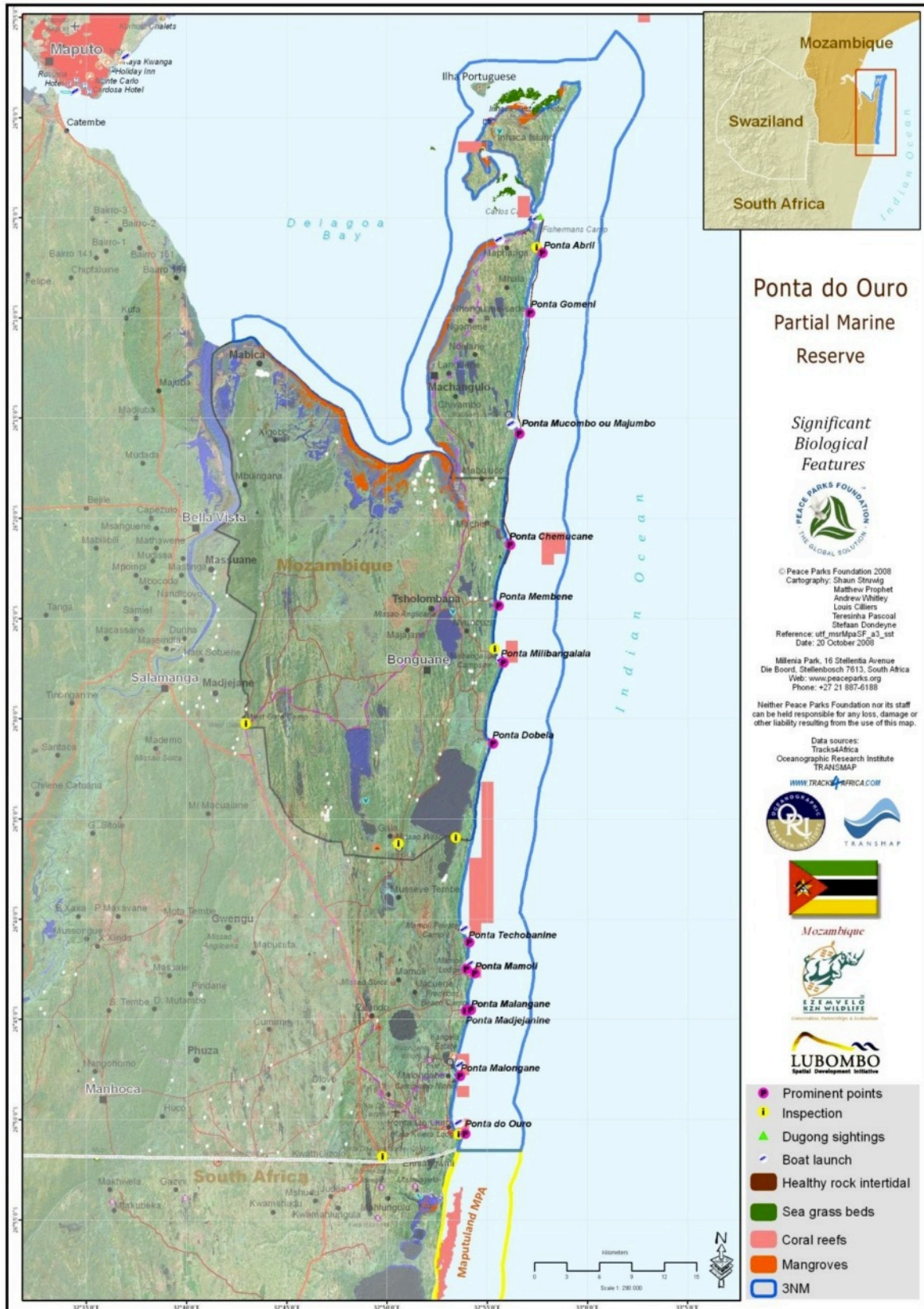
Appendix III. Questionnaire

Contingent Valuation Study   **Ponta do Ouro Partial Marine Reserve**

Introduction: **DATE:**

Hi, my name is _____. I'm a master's student at Rhodes University in South Africa, doing a study to determine the value of marine based tourism to this area. Would you help me by taking part in a survey about your activities here? It takes about 10 minutes.

This survey is confidential and voluntary. It is anonymous so your responses will never be associated with your name. If at anytime you'd like to stop, just tell me.

Please feel free to ask questions for clarification or if you want to add anything, that's fine. I will be writing down your responses on this sheet. I will also be using a number of cards for you to follow along with during the questions. Please stick with the current card and do not move ahead.

ACTIVITIES:
First I'd like to learn a little about your time here and your activities on holiday here.

1. How long are you here in (CIRCLE ONE) Ponta do Ouro / Malongane / Mamoli? _____

2. Not including this trip, about how many times have you been here before? _____

Please look at this card (CARD 1)

3. Of these options, what would you rank as the TOP TWO factors in choosing this area as a holiday destination?

A	SEA LIFE	F	PRISTINE BEACHES
B	COST	G	REMOTENESS
C	DISTANCE	H	SEA ACTIVITIES
D	FRIENDS/FAMILY	I	OTHER

Next card (CARD 2).

4. Of these activities, what is the MAIN ACTIVITY you will do on this trip? (CHECK ONE ONLY)

A	DOLPHIN TRIP	C	FISHING/SPEAR FISHING	G	SUN/SAND
B	SCUBA DIVING*	D	SURFING/SUP	F	OTHER: PROBE

5. Using the scale on the bottom of the card, how would you rank your satisfaction of this activity on this holiday? ENTER # _____

6. What OTHER ACTIVITIES will you participate in on this trip?

A	DOLPHIN TRIP	C	FISHING/SPEAR FISHING	G	SUN/SAND
B	SCUBA DIVING*	D	SURFING/SUP	F	OTHER: PROBE

*IF ANSWER TO Q4 OR Q6 DOES NOT INCLUDE SCUBA DIVING, SKIP TO Q15: PPMR.

1

SCUBA:

7. Approximately how many dives have you done? _____

8. What is your certification level? (AS OFFERED)

A	DISCOVER SCUBA DIVER	D	RESCUE	G	I AM NOT CERTIFIED
B	OPEN WATER	E	DIVEMASTER	H	DON'T KNOW
C	ADVANCED OPEN WATER	F	INSTRUCTOR +		

9. Did you know that all SCUBA divers currently pay a divers tax?

☐ YES   ☐ NO
  *IF YES, DO YOU KNOW HOW MUCH THE CURRENT DIVE TAX IS?   _____

SHARKS:
10. Are you interested in diving with sharks?

☐ YES   ☐ NO (SKIP TO Q15)

11. Have you dived with sharks before?

☐ YES   ☐ NO
  *IF YES WHERE?   _____
          *IF PINNACLES, SKIP TO Q13

12. Have you dived Pinnacles before?

☐ YES   ☐ NO

13. Using this same satisfaction scale as before (SHOW SCALE CARD) how would you rank your satisfaction of your MOST RECENT Pinnacles Dive? ENTER # _____

(IF ANSWER IS BELOW 3) Is there a particular reason you answered this way? _____

Pinnacles reef is known for its sharks. 19 species of sharks have been recorded in the greater area. Currently dive operators are not allowed to bait for sharks in this area. However, baited shark dives are common in South Africa as well as other shark diving destinations worldwide, including marine protected areas.

14. Some people think that baited diving is dangerous and they prefer to see sharks naturally, even if there is no guarantee that they will see one on a dive. Other people prefer baited dives for the near guarantee of seeing sharks and the chance for up close photo opportunities. How do you feel about baited dives? FOR AGAINST   DK

2

The next few questions are about your environmental attitudes and some background information on this area.

15. Using this scale (SHOW SCALE CARD 2), how environmentally aware would you consider yourself? ENTER # _____

16. Do you eat seafood?

☐ YES ☐ NO (IF NO, SKIP TO Q18)

17. Do you use the South African Sustainable Seafood Institute (SASSI)'s consumer guide to make your seafood choices?

☐ YES ☐ NO

The next card (CARD 3) is a map. We are in a Marine Protected Area (MPA). Since 2010, 86km of Mozambique's shoreline has been an MPA. The MPA begins at the border with South Africa and extends north around Inhaca island into Maputo Bay.

18. Before this survey, were you aware that this area is a Marine Protected Area?

☐ YES ☐ NO

*IF YES, DOES IT BEING AN MPA POSITIVELY AFFECT YOUR DECISION TO HOLIDAY HERE?

☐ YES ☐ NO

The MPA is under review as a potential World Heritage Site and it is classified as a globally important biodiversity site. The MPA was designated to protect this. Because of its uniqueness, people are drawn to this area for tourism and recreation. This has caused development along the coast to rapidly increase. The majority of the development is for tourism, like a tar road from the border to Maputo and a high-end resort in Ponta do Ouro.

19. Some people think that increased tourism development will positively impact the area with increased revenues to the marine protected area and more jobs for local people even if there are potentially more people using the area. Others think that increased development will negatively impact the area through more traffic, trash even if there are potentially more funds for the protected area. Which do you most agree with? POSITIVE NEGATIVE
DON'T KNOW

We have about ten more questions.

Marine Protected Areas are designed to protect and conserve the marine environment. That means that there are restrictions on what you can do within them, like you can't drive on the beach or catch reef fish. As a (**MAIN ACTIVITY**) there are rules on what you personally can do.

READ ACCORDING TO ANSWER GIVEN TO Q4:

DOLPHIN/SNORKEL: For dolphin swims/snorkelling, the most shallow and diverse coral reefs are in the no-go sanctuary zone of the marine protected area. Also, if dolphins enter the sanctuary zone, you cannot follow them. This may limit your encounters but provides a sanctuary for the dolphins.

DIVING: For divers, this limits the reefs you can dive on. Although not located in this bay, some of the most productive and expansive coral reefs in Southern Africa fall within the no-go sanctuary zone.

FISHING: In terms of fishing, some very productive reefs just north of here are off-limits to you. Known 'hotspots' are no longer open to fishing. This limits your fishing options but provides a sanctuary zone for fish to restock.

These regulations ensure that the area remains pristine and that fish and other marine animals are protected. To enforce these regulations and to protect the area's biodiversity, MPAs must receive adequate funding. User fees are a common way to help finance this, like a game reserve. This MPA is financed by an international NGO and the Mozambican government, however this doesn't provide enough funds for a fully functioning MPA. Currently there is no user fee and the people who use this MPA do not help to finance its protection.

20. Do you think it is reasonable for users of a protected area to be charged a user fee?

☐ YES ☐ NO (IF NO, PROBE. SKIP TO Q25)

21. According to the management plan for this MPA, you will be charged a user fee for (MAIN ACTIVITY). The user fee is payable through your dive centre/activity centre/fishing shop and will be checked on the beach. The proceeds go to fund that is controlled by a government conservation agency to protect the biodiversity in this area. Please take a look at this card (PAYMENT CARD). Here are several suggested amounts for a per day usage fee. Keeping in mind that there are other things you may want to spend your money on, what is the highest amount that you are PERSONALLY willing to pay PER DAY as a user fee for (MAIN ACTIVITY)?_____

DEMOGRAPHICS/CHARACTERISTICS:
Sex: M F   Race: W B C I P   Language: E A P O

I have just a few more questions. Remember, your answers are confidential. Some of the questions have answers listed as letters on these cards. For those questions, please just reply with the corresponding letter. When answering, please just provide the letter that best describes you.

25. Where do you currently live? _____

26. What do you do for a living? _____

27. Looking at this card, what letter corresponds with your age? ___

28. On this card, what letter best describes your education? ____

29. On the next card, excluding your travel costs, like filling up on petrol, approximately how much will this trip cost for your group? That is, how much will you spend on your activities, lodging, food and drinks? _____

30. How many people are in your group? ___

31. For statistical purposes, what is the letter that best describes your PERSONAL monthly income after tax? _____

32a. Do you have a dual income household?

☐   YES   ☐   NO (SKIP TO END)

32b. What letter best describes your monthly, TOTAL HOUSEHOLD income after tax? ___

End: Thanks for your time. Are you satisfied with all of your answers or would you like to go over any of them for clarification before we finish?

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Appendix IV. Research Permit

Direcção Nacional das Áreas de Conservação
Credencial de Investigação/Levantamento/Recolha

Apenas para uso oficial:	
Nº da Credencial	07/2012
Tipo de actividade	Pesquisa
Data	09/03/2012

Eu, Francisco Pariela, na qualidade de Director Nacional das Áreas de Conservação, confirmo por este meio que foi concedida a Sra Clare Keating, uma Credencial de investigação / levantamento / recolha de dados para o projecto seguinte: Socio - economic Aspects of Marine Based Tourism with a Focus on Shark Diving within the Ponta do Ouro Partial Marine Reserve, Mozambique Esta Credencial inicia no dia 10 Março de 2012 e expira no dia 10 de Março de 2013.

Igualmente por este meio solicito que as autoridades da Reserva Marinha Parcial da Ponta d´Ouro facilitem o desenvolvimento de quaisquer actividades relacionadas com este projecto, obviamente no total respeito pelas normas e orientações científicas da Área de Conservação.

Atenciosamente,

(Director Nacional)

Direcção Nacional das Áreas de Conservação
Av. 10 de Novembro, Praceta de Varietá n.º 40, Maputo
Tel/Fax +25821303633
Email: afirmino21@yahoo.com.br

Appendix V: MPA User Fees

Country	MPA Name	Fee per diver/day
Colombia	Corales del Rosario[1]	$2,00
Colombia	Isla Gorgona[1]	$10,00
Dominican Republic	Del Este[1]	$2,00
Dominican Republic	Parque Submarino La Caleta[1]	$3,00
Indonesia	Bali Barat[2]	$3,00
Indonesia	Bunaken[2]	$5,00
Indonesia	Padaido Komodo[2]	$3,00
Indonesia	Nusa Mengangan[2]	$1,00
Malaysia	Johor[2]	$2,00
Malaysia	Pahang[2]	$3,00
Malaysia	Pulau Payar[2]	$3,00
Malaysia	Pulau Redang[2]	$4,00
Malaysia	Pulau Tioman[2]	$4,00
Mexico	Isla Mujeres, Punta Cancun y Punta Nizuc[1]	$1,00
Mexico	Costa Occidentel de Isla Mujeres[1]	$1,00
Philippines	Apo Island[2]	$3,00
Philippines	Apo Reef Buffer[2]	$2,00
Philippines	Boracay[2]	$2,00
Philippines	Dauin Sanctuary[2]	$1,00
Philippines	Hilutungan Marine Sanctuary[2*]	$50,00
Philippines	Nalusuan Fish Sanctuary[2]	$1,00
Philippines	Pescador Island [2]	$4,00
Philippines	Savedra[2]	$4,00
Philippines	Tubbataha[2*]	$50,00
St. Lucia	Soufriere[3]	$4,00
Thailand	Mu Ko Ang[2]	$5,00
Thailand	Mu Ko Chang[2]	$5,00
Thailand	Mu Ko Lanta[2]	$5,00
Thailand	Mu Ko Similan[4]	$6,00
Thailand	Mu Ko Surin[2]	$5,00
Thailand	Mu Ko Tao[2]	$5,00
Thailand	Nang Yuan[2]	$2,50
US Virgin Islands	Buck Island Reef[1]	$2,00
Total Mean		**$6,17**
1USD=R9.85		**R60.77**

[1] Green and Donnelly, 2003, [2] Depondt and Green, 2006, [3] Barker and Roberts, 2004, [4] Tapsuwan, 2005 in Peters and Hawkins, 2009

[*] Indicates presence of tiers system, value reported is fee paid by foreign tourists