An assessment of divers' willingness to pay for conservation of common pool resources

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Graduation: July 2019
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DECLARATION

I, Sandra Danai Makumbirofa, hereby declare that this research submitted to the North-West University, for the PhD study: An assessment of divers’ willingness to pay for conservation of common pool resources, is my own independent work, and all the sources quoted have been indicated and acknowledged by means of complete reference. This research has not been submitted before to any institution by myself or any other person in fulfilment of the requirements for the attainment of any qualification.

________________________________________  __________________________
Signature                                           Date
PREFACE

A conference paper emanating from this dissertation titled: Assessing divers’ willingness to pay for user fees in the Portofino Marine Protected Area was presented at the Quantitative Approaches in Tourism Economics and Management’s (QATEM) 2016 conference, South Africa on the 26th of August 2016.

A second conference paper emanating from this dissertation titled: Willingness to pay for user fees in Portofino MPA using choice modelling was presented at the Tourism Research in Economics, Environs and Society’s (TREES) 2018 Workshop in Potchefstroom, South Africa on the 14th of August 2018.

An article emanating from this dissertation titled: Willingness to pay for common pool resources: A comparison between Ponta do Ouro and Portofino was submitted to Journal of Ocean and Coastal Management.

Chapter 4 is in the process of being submitted to the Journal of Coastal Research as: Valuing different attributes of the scuba diving experience at Portofino using choice modelling.
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• Finally, I would not have done this without my Way Maker. Thank you my Lord for being my rock when I was weak and wanting to give up. Thank you for this opportunity, for the doors it has opened and for sustaining me through it all. I have experienced your grace day by day. Glory, glory!
ABSTRACT

Scuba divers diving anywhere in the world’s oceans must be concerned about preservation and conservation of the ocean and its ecosystem. Even other ocean users who regard conservation as a responsibility of the government cannot avoid taking responsibility for the sustainability of the ocean, which is vital for their income, medicine, recreation, coastal protection and biodiversity support. This responsibility is drawn from the fact that oceans and seas are common pool resources, and being subject to rivalry and non-excludability, they have realised degradation and depletion from human activities to current unsustainable levels.

The sustainability of the ocean and seas is managed and regulated by Marine Protected Areas (MPAs), which are established to protect and preserve marine ecosystems. Yet, these MPA’s are poorly funded and lack enough investment to implement their conservation strategies. This is an area that is vital in pushing for sustainable marine life resources, and yet so poorly studied in the European context, with revenues generated from fees that could be used to improve conservation efforts. One of the ways to evaluate the economic value of MPA’s and funding opportunities is through the user-payer principle. The user-payer principle encourages the user of a resource to pay for the environmental cost of using the resource. In addition, a user fee can serve as a tool to control the number of visitors so as to minimise marine ecosystem damage. This can aid in the environmental, economic and social sustainability of similar diving systems.

This thesis addresses the gap on encouraging funding opportunities for MPA’s, particularly Portofino MPA, in Italy, according to scuba divers, as a group of users of the MPA. This is done by way of willingness to pay studies using a double-bounded dichotomous choice method, discrete choice experiment method, and moderating and mediating effects method. The main objective of this study is to evaluate scuba divers’ willingness to pay towards marine conservation, investigate which environmental attributes they value the most, and their attitudes towards environmental protection and how it affects their environmental behaviour.

Data for the study were collected in two stages. The first set of data was collected in June and July 2016 from 442 scuba divers in Portofino, Italy, using a double-bounded dichotomous choice questionnaire. This data was used to explore the willingness to pay a user fee for conservation, as well as divers’ opinions about specific human behaviour and their effect on the ocean. The second set of data was collected in June and July 2017 from 556 scuba divers in Portofino, Italy, using a discrete choice experiment questionnaire. This data was used to investigate the trade-offs between four different environmental attributes in terms of importance, as well as the extent
to which divers’ egoistic, altruistic and biospheric values influence their willingness to pay for conservation. This study employs three different analyses towards its objective.

The first analysis involved a willingness to pay evaluation using a stated preference contingent valuation method called double-bounded dichotomous contingent choice method, where respondent divers were presented with a bid amount to pay for improvement in the Portofino MPA, and asked (yes/no) whether they would be willing to pay. Depending on their answer to the question, they would be asked a higher or lower bid amount. Using a probit model, the results show that scuba divers in Portofino are willing to pay €6.79 and those who are not willing to pay believe that the government is responsible for conservation.

The second analysis involved an evaluation of the environmental attributes that are most important to divers in Portofino, measured through willingness to pay, using another stated preference method called discrete choice method. Two choice sets were presented to the divers, each with two different options of a diving environmental scenario, with price tags representing the cost of having the scenario from which respondents were asked to choose. Using a multinomial logit, conditional logit and a multinomial probit model, the results showed that the environmental attributes valued the most are underwater visibility and reduced diver crowding.

The third analysis involved scuba divers investigating divers’ value orientations (egoistic, altruistic or biospheric) and how much it influences their willingness to pay. Following the value belief norm model, this analysis assumes that scuba divers base their beliefs on environmental degradation according to their biospheric, egoistic and social-altruistic values. Using the General Awareness of Consequences Scale (GAC), an exploratory factor analysis (EFA) and logistic regression model were conducted. Mediator and moderator effects were tested. Results show that though there are no moderating and mediating effects, high egoistic oriented divers are willing to pay the most, followed by low biospheric and neutral altruistic oriented divers.

Through these three analyses, the author was able to investigate the trade-offs among environmental attributes and scuba diver value orientations. Conclusions from these results were used to inform the MPA on how user-fees can be used as a reliable source of financing MPAs, the environmental attributes that are most important for scuba divers and the value orientations that trigger pro-environmental behaviour in scuba divers.

Key terms: Willingness to pay, Portofino MPA, contingent valuation, discrete choice experiments, egoistic, altruistic, biospheric.
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<th>Description</th>
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<tr>
<td>CL</td>
<td>Conditional logit model</td>
</tr>
<tr>
<td>CV</td>
<td>Contingent Valuation</td>
</tr>
<tr>
<td>DDCCVM</td>
<td>Double-bounded Dichotomous Choice Contingent Valuation Method</td>
</tr>
<tr>
<td>EFA</td>
<td>Exploratory Factor Analysis</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>GAC</td>
<td>General Awareness of Consequences</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GMP</td>
<td>Gross Marine Product</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>KMO</td>
<td>Kaiser-Meyer-Olkin test</td>
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<tr>
<td>MNL</td>
<td>Multinomial logit model</td>
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<tr>
<td>MNP</td>
<td>Multinomial probit model</td>
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<tr>
<td>MPA</td>
<td>Marine Protected Area</td>
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<tr>
<td>MSY</td>
<td>Maximum Sustainable Yields</td>
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<tr>
<td>VBN</td>
<td>Value Belief Norm model</td>
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<tr>
<td>WTP</td>
<td>Willingness to Pay</td>
</tr>
<tr>
<td>RISE</td>
<td>Research and Innovation Staff Exchange</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<tr>
<td>STATA</td>
<td>Statistics and data, statistical software package</td>
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CHAPTER 1 INTRODUCTION

1.1 Background

Of growing importance over the years is the rise in Marine Protected Areas (MPA) all over the world as a means to sustain the biodiversity in the oceans for future generations. The need for MPAs is a result of the exponential increase in the human population that continues to demand more of the earth’s finite resources. The International Union for Conservation of Nature (IUCN, 2016:4) defines a marine protected area as:

“A clearly defined geographical space, recognised, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.”

Currently, the world has approximately 17 000 MPAs covering at least 3.41% of the ocean’s surface (Thomas et al., 2014:17). There are different types of MPAs with characteristics that vary across nations and regions. The advantages of establishing MPAs are well known, and it is believed that by regulating and delimiting the use of the oceans, MPAs preserve the rich biodiversity of marine life as well as the services it provides to humankind.

Marine life not only provides aesthetic beauty but a habitat for the marine ecosystem. Therefore, the development of an MPA can decrease the fishing pressure; maintain increased numbers of diverse species; increase coral cover and structural complexity (Green & Donnelly, 2003:140). Species, such as coral reefs, are very important for coastal protection from waves and storms, and the provision of genetic resources (Asafu-Adjaye & Tapsuwan, 2008:1122).

MPAs further support the growth of marine tourism (scuba diving, snorkelling), educational opportunities and platforms for long-term research, including pharmaceutical research, through the development of drugs and the fishing industry, all of which are beneficial to the local economy (Department of the Environment and Energy, 2003). Marine tourism has grown exponentially over the years as millions of people take up scuba diving as a recreational sport. Divers travel to the popular sites in the Red Sea, Thailand and Malaysia for warm, tropical diving; Australia and the US for subtropical and temperate diving; polar locations for ice diving and cave diving in some inland sites in Africa and Australia (Musa & Dimmock, 2012:1).

The main source of attraction for scuba divers is the different marine species. However, these different species are fragile and prone to destruction from diver activity (Graver, 2010:110).
In order to achieve the main goal of sustainable scuba diving in Europe, this study will provide expertise, skills and insight into the economic viability of imposing a levy for conserving marine life in Portofino MPA using a 'willingness to pay' study. This idea comes from the user-payer principle, which is a neoclassical economic instrument for environmental conservation. The user-payer principle advocates that the user pays for the environmental cost of using a certain resource, and this ensures that the environmental externalities are included in the costs for private use of the resource (Santilli, 2013:110). The specific environmental attributes that the scuba divers value the most are also investigated: from water visibility and diver crowding, to abundance and diversity of marine life. This study further investigates the value orientations that encourage pro-environmental behaviour in divers.

1.2 Problem Statement

Scuba diving has become increasingly important over the years, especially in biodiversity rich coastal countries (Arin & Kramer, 2002:172; Barker & Roberts, 2004:481). Such countries attract a large number of divers every year, an activity that is economically beneficial in terms of employment and income. For example, Divezone (2019) and Divein (2019) report the importance of scuba diving in Europe and lists Italy as one of the best scuba dive destinations in Europe. In addition, Goffredo et al. (2004) cite that there are 6 million certified European scuba divers, making scuba diving tourism a lucrative business for any destination. In terms of scuba dive contribution, research by Saayman and Saayman (2017:34) reports that in Portofino MPA in Italy, on average a diver spends €110 per day, of which 50% of this goes to the local dive operator, and the rest is spent on accommodation, transport and food. Tapsuwan and Asafu-Adjaye (2008:431) also report increasing positive economic contributions of scuba dive tourism in Thailand. Indeed, scuba dive tourism is beneficial economically to the local communities.

However, modern day environmental problems are a result of various forms of unregulated human behaviour, from pollution of land, sea and air to climate change and loss of biodiversity (De Groot & Steg, 2007:318). Among these activities, to a lesser extent, is scuba diving through divers’ presence and feeding of marine life. These marine ecosystems are classified under common pool resources. Common pool resources are resources that are non-exclusive (impossible or very expensive to exclude additional users) and rival (consumption by one leads to a reduction in the amount left for other consumers) (Feeny et al., 1990:3; Healy, 1994:597).

In another definition, Ostrom et al. (1994:4) further explain that common pool resources yield finite flows of benefits, but their size or characteristics make it difficult and costly to exclude potential users who do not contribute towards their conservation. Therefore, if one diver destroys a coral
branch as they move underwater, then less coral branches are available for the next generation of divers to see.

Since common pool resources are non-excludable, the main problem is that no individual is readily willing to invest in conservation of these resources because there is no individual return to his investment and non-investors also reap the benefits of this investment (free rider problem). This problem also applies to MPAs, where lack of investment is a widespread problem that is restricting MPAs from effectively regulating and preserving marine life.

Lack of sustainable financing is the primary cause of failure for MPAs (Pascoe et al., 2014:147). Without adequate and consistent finances, it is impossible to effectively manage and enforce rules and regulations within an MPA (Depondt & Green, 2006:189). One such MPA that is constrained by lack of funding is Portofino MPA in Italy. This characteristic inhibits it from successfully implementing and achieving its conservation goals.

It is reported that one challenge that MPAs face is that they are often difficult to justify on financial grounds, especially when compared to other uses of government funding (Depondt & Green, 2006:189). MPAs mainly acquire funding from government subversions, and donations and trust funds, each with irregular fluctuations thus making them unsustainable (Depondt & Green, 2006:189; Reid-Grant & Bhat, 2008:129). For example, Reid-Grant and Bhat (2008:129) found that Montego Bay Marine Park in Jamaica is extremely underfunded; the MPA’s spending is higher than their income, because their income is inconsistent, unpredictable and undiversified. This makes it difficult for MPAs to effectively carry out their conservation goals.

Due to MPAs being subject to the tragedy of the commons if not managed properly, there are various groups of people who have access to oceans and marine systems who do not necessarily contribute to their conservation (Hardin, 1968; Davis & Tisdell, 1995:21; Carson, 2012:27). One such group of users are scuba divers who use the oceans and seas for recreational purposes, and should be concerned about their sustainability (since their experience depends on the conservation of these resources).

According to Graver (2010:110), scuba diving may harm the marine ecosystems, particularly coral reefs, in different ways including: smashing and therefore killing sea organisms while moving about underwater, stirring up clouds of silt (which can choke and destroy living things) from the bottom, and handling, feeding and touching sea animals. For instance, the Great Barrier Reef (which houses the world’s largest coral reef ecosystem) records at least 22% mortality of coral cover to date due to coral bleaching (Great Barrier Reef Marine Park Authority, 2016), with the northern part of the reef being affected the most. The exact amount of coral cover loss is unknown,
due to differences in measurements; however, in terms of scuba diver impact on the Great Barrier Reef, Brodie and Waterhouse (2012:10) report that divers who swim close to the corals destroy coral branches on each dive, and therefore, dive operators have to adhere to the international limits of divers per site per year.

Traditionally, scuba diving was regarded as having low levels of environmental degradation; however, the study done by Harriot et al. (1997:174) showed that the popular diving sites, which attract a large number of divers, are not limitless in terms of carrying capacity and should thus be regulated so as to mitigate the damage on the fragile marine ecosystem. The current generation of divers also have different perceptions and attitudes towards marine life and the consequences of their actions towards it. It was observed by Ojea and Loureiro (2007:807) that these different perceptions are influenced by the divers’ background and level of knowledge about the environment. Therefore, it is important to understand that divers’ willingness to pay will not only be influenced by their level of economic affordability but also by their characteristics and attitudes.

This study will investigate environmental attitudes of scuba divers and the importance of various aspects of the aquatic system in shaping their diving experience. Given that oceans and seas are common pool resources, the willingness to pay for conserving this common pool resource forms a central aspect in sustainable resource management and to this study. This willingness to pay is a way of measuring the economic value of an environmental good, in this case the MPA. Since environmental goods cannot be traded in a market system, their economic value can be measured using non-market valuation methods (Segerson, 2017:12). The measured values can then be used in public policy decision making, natural resource allocation, compensation for environmental damage, and in targeting user groups for monetary contributions towards conservation (Segerson, 2017:12). This is an area that is so vital in pushing for sustainable conservation of marine life and aquatic systems, which has been poorly studied in the European context.

This study will focus on Portofino MPA, a site chosen because it offers an abundance of red corals, and one of the most diverse groupers, barracudas and moray eels. The MPA is also highly representative of diving systems in a European context and a coral-reefs context, thus paving the way for future translation to other locations (Green Bubbles, 2015:6). Besides these reasons, the research at this dive site can shed light on the differences in willingness to pay for marine conservation by scuba divers in Europe and their reasons for not being willing to pay. Managing access to sensitive marine areas is key to achieving environmental, economic and social sustainability of the European diving systems.
1.3 Aims and objectives

The main aim of this study is to assess scuba divers’ attitudes towards environmental protection of common pool resources and willingness to pay to contribute towards marine life conservation in order to ensure that divers’ activity today is sustainable for future generations to enjoy.

The specific objectives of this research include:

1. To determine scuba divers’ willingness to pay for marine conservation and the reasons why they are willing or not willing to pay.
2. To determine the divers’ attitudes towards environmental protection and their perception of the effect of scuba diving on marine resources.
3. To evaluate the aspects of the marine resources that divers deem important, for instance good water quality, coastal development, reduction of sea bottom mortality.
4. To evaluate the feasibility of the user-payer principle in the context of scuba diving and its contribution towards sustainable scuba diving tourism.
5. To make recommendations on the applicability of a scuba diving levy that may guide policy decisions and regulations.

1.4 Method of investigation

The study will be quantitative, involving primary data collection in a MPA, secondary research through the literature study as well as an empirical study where the data collected will be analysed and the results will be discussed.

1.4.1 Literature review

A literature study will be conducted using the following key words: common pool resources, user payer principles, scuba diving, willingness to pay, user fees, marine protected area, marine life conservation, sustainability, contingent valuation, double-bounded dichotomous and discrete choice experiments, environmental concern, value orientations. A thorough research into the literature on marine protected areas and willingness to pay will be reviewed from online peer reviewed articles, review article publications, theses and academic books. The literature study forms the basis for the empirical study and places it in a theoretical context.
1.4.2 Empirical study

1.4.2.1 Study area

The empirical study consists of a case study site – the Portofino MPA in Italy. Portofino MPA is situated on the North-Western coast of Italy in an affluent small fishing village called Portofino. It hosts one of the most favoured marine sites in the Mediterranean because of copious amounts of the red coral population (the most important shallow-water coral population of the Ligurian Sea), the luxuriant coralligenous community, gorgonian populations, groupers, brown meagre, dentex and barracuda, to name a few (Lucrezi et al., 2017:389; ROCPOP Life Consortium, 2018). This MPA was chosen because it is highly representative of diving systems in a European context, thus paving the way for future translation to other locations (Green Bubbles, 2015:6). Besides these reasons, the research at this site can shed light on the differences in willingness to pay for marine conservation by scuba divers in Europe compared to previous studies, which are mostly based on Asian and Australian diving destinations, and their reasons for not being willing to pay. Two sets of data were collected from the Portofino MPA in June and July 2016, and June and July 2017. Full description of the site is discussed in Chapters 3 to 5.

1.4.2.2 Methods

The methods used in this study are aimed at measuring willingness to pay, which has its origin in consumer utility maximisation theory and demand theory. Willingness to pay, which is also referred to as the reservation price, is the maximum price that an individual accepts to pay for a resource (Varian, 1996:4). According to the consumer maximisation theory, individuals are assumed to make decisions based on the choice that maximises their utility. Individuals are also assumed to consistently reflect their underlying preferences in the stated willingness to pay amounts (Marta-Pedroso et al., 2012:5). In addition to this, it is important to remember that respondents’ stated preferences could be made out of strategic behaviour and in some instances do not always translate into actual behaviour (Farr et al., 2016:346).

According to Lusk and Hudson (2004:3), if utility maximisation is assumed subject to a budget constraint, the common pool resource (which is the MPA in this study) will be denoted by $q$ in a non-market setting, where the diver chooses the level of MPA conservation $v_m$ that maximises utility, resulting in the Marshallian demand curve $v_m(p, y, q)$; where $p$ is the willingness to pay price and $y$ is the income. If there is a possible improvement in the quality of conservation in the MPA from $q_0$ to $q_1$, then the value that it places on this improvement can be estimated by determining the magnitude of the willingness to pay so that:

$$v(p, y - WTP, q_1) = v(p, y, q_0)$$  \hspace{1cm} (1.1)
If the willingness to pay is greater than the proposed price, the diver will enjoy the Hicksian consumer surplus (Le Gall-Ely, 2009:92). A valuation function is found by regressing the diver’s willingness to pay on a vector of socio-economic, demographic and attitudinal variables of the diver (Marta-Pedroso et al., 2012:5). In this way, willingness to pay enables an individual to weight the value of a resource in monetary terms.

Theory suggests three methods of calculating willingness to pay, including: methods using real data to estimate price elasticities or hedonic prices; methods using surveys to calculate willingness to pay (conjoint analysis, contingent valuation, choice experiments) and incentive-compatible methods (Vickrey auctions and bidding lotteries) (Le Gall-Ely, 2009:92). This study will use the data collected from Portofino MPA to investigate the objectives of this study, using stated preference methods, namely; the contingent valuation method (double bounded dichotomous choice questionnaire); and since recent research has proven that willingness to pay does not only depend on the demographic factor, the discrete choice experiment method will also be used. These methods were chosen because contingent valuation methods (such as the double bounded dichotomous choice questionnaire), though they have imitations, are commonly used and have proven to be more efficient and less biased than other methods of valuation (Diamond & Hausman, 1994:46; Kanninen, 1993:145; Lopez-Feldman, 2012:3). Discrete choice experiments were chosen because they give additional information on the specific environmental attributes that respondents value to be more important (Castellani et al., 2015:92; Vega & Alpízer, 2011:255).

In a contingent valuation method (discussed in Section 3.3.3), respondents are asked how much they are willing to pay (WTP) for a predetermined increase in the quality of the environment (Morgas et al., 2006:7). In this case, scuba divers were asked for their willingness to pay for conservation of marine life in a Portofino Marine Protected Area. In a discrete choice experiment method (discussed in Section 4.3.3), which follows the Lancaster (1966) approach of utility derived from resource attributes and McFadden’s (1974) random utility theory, respondents are asked to state their choice from different choice sets with different combination of environmental attributes for diving. Additionally, this research introduces environmental variables, including the GAC scale (discussed in Section 5.2.2), which follows the value belief norm model and measures respondents’ value orientations and its effect on pro-environmental behaviour.

Understanding the different divers’ perspectives towards marine life sustainability and the main causes of depletion will assist in understanding their attitudes towards paying for the resource on which their activity is dependent. By using these methods, this study will give a more reliable estimation of how much divers are willing to pay in user fees towards marine life conservation,
the particular environmental attributes they value more important and the value orientations (egoistic, altruistic and biospheric) behind their decisions.

Contingent valuation method was chosen because, as a direct method of valuing goods and services, it allows for flexibility of asking hypothetical scenarios that respondents can make a choice from and non-use values can be estimated (Lopez-Feldman, 2012:2). The double-bounded dichotomous choice method was chosen over the open-ended or payment card methods because it was proven to be more efficient and reliable in valuing environmental goods, according to the National Oceanic and Atmospheric Administration (NOAA).

Like any method, double bounded dichotomous methods have limitations including hypothetical bias, since it is based on hypothetical questions, starting point bias, where respondents are influenced by the initial bid, shift effects where the respondent’s WTP shifts when presented with the second bid, anchoring effects bias where respondents update their WTP based on the second bid and ‘yea saying’ or the incentive incompatibility effects (Asafu-Adjaye & Tapsuwan, 2008:1125). Due to the different forms of bias that may arise, this study collects a large sample to increase the accuracy of the responses (therefore reducing non-representative bias), thoroughly explaining the purpose and importance of giving truthful responses, as well as giving out questionnaires with different starting bids.

The advantages of the two methods used in this study are that they are relatively easy to conduct, efficient and they both offer respondents hypothetical environmental scenarios for investigating the mean willingness to pay for a resource and for its attribute (Börger et al., 2018:141). The difference is that, while the contingent valuation methods investigate the value of the sum of attributes of a resource in monetary terms, the discrete choice methods conceptualise the resource as consisting of different attributes, which all contribute to its value (Börger et al., 2018:142).

Compared to other valuation methods, these methods are less biased (see Arana & Leon, 2006:476; Chilton, 2007:664; Hanemann et al., 1991:1260; Ojek & Loueiro, 2007:811; Zawojska & Czajkowski, 2017:19. The study made use of Excel, SPSS and STATA, according to the steps in Lopez-Feldman (2012:2); Ojoa and Loueiro (2007:811); and Vega and Alpizer (2011:255). A more detailed discussion of each will be given in the relevant chapters (see chapter 3 section 3.3.3, chapter 4 section 4.3.3, and chapter 5 section 5.3.2 and section 5.3.3.

1.5 Chapter division

This thesis is structured as a combination of three articles, with each article addressing specific research objectives. The articles are presented in the same structure with an introduction, a
literature review, a description of the data and methodology, a discussion of the empirical results, and a conclusion. The six chapters in this dissertation will be structured as follows:

**Chapter one** serves as an introduction to the research and the problem statement set out, the objectives and the method to be used.

**Chapter two** gives a theoretical background for the articles that follow, so that they are placed into perspective. This background includes marine protected areas, marine life depletion, common pool resources and the notion of user fees.

**Chapter three** contains the first article discussing and presenting results of the willingness to pay for conservation in Portofino (currently under review for the Journal of Ocean and Coastal Management).

**Chapter four** contains the second article, which will discuss and present results from the discrete choice questionnaire which reveals the environmental attributes that divers value the most in the Portofino MPA (currently in the process of being submitted for the Journal of Coastal Research).

**Chapter five** contains the third article, which investigates value orientations, most notably egoistic, altruistic and biospheric value orientations and the extent to which they influence pro-environmental behaviour in divers.

**Chapter six** draws conclusions from the three articles. It will also discuss possible solutions and recommendations, and suggest areas for further research and limitations.
CHAPTER 2 MARINE PROTECTED AREAS AS COMMON POOL RESOURCES

2.1 Introduction

The aim of this chapter is to review the theoretical literature on common pool resources, particularly marine protected areas, as well as marine life depletion and the user-payer principle, since it is on these principles that the empirical research is constructed. This user-payer principle approach is used because it advocates equitable sharing, among resource users, of the costs incurred due to environmental degradation of an MPA (Reynisdottir et al., 2008:1077).

The marine ecosystem provides a diverse range of important benefits to society and the environment. On the one hand, there are fishermen in Bangladesh and Tanzania who fish for subsistence consumption and scuba divers diving for recreation in Malaysia, and on the other hand, there are scientists in Panama who examine the diverse reef compounds for medicinal purposes. The existence of the ocean and marine life provides for employment, livelihood, food (good source of protein and other nutrients), protected shelter, and protection for coastal communities and the surrounding environment (Gore, 2011).

Matters of the marine ecosystem are complex in nature. This is because the ecosystem involves environmental processes that occur within and between the biosphere and the abiotic environment, as such that negative effects in each environment are inseparably interlinked with the other, without recognising political boundaries. The same applies in the marine environment. Thus, the marine ecosystem cannot be improved without considering the biological interdependence of the oceans, as well as the social and economic systems (GESAMP, 2001:1).

Since the global degradation of the marine ecosystem is growing exponentially, economic theory explains that it is the problem of market failure in terms of open access resources, appropriation externalities and failure of provision (Huang & Huang, 2017:88).

According to welfare economics, markets thrive when the product or service is at rivalry and excludable (Timilsina, 2016:3). The reason for the market failure is that for a market to be efficient, the product or service needs to be excludable and non-rival. A product or service is excludable when it has property rights and non-rival when one person’s consumption does not make the resource unavailable to the next person. Since the commons are non-excludable with open access, they are immediately susceptible to disincentives and appropriation externalities (Marshall, 1998:8, McKay & Jentoft, 1998:21). Appropriation externalities are inadvertent (and
often not reimbursed) negative effects that a person’s actions have on others (Daly et al., 2015:1; Segerson, 2017:3). The depletion of the ocean’s resources and marine life is an example of this.

Marine ecosystems are classified under common pool resources. Common pool resources are more like public goods in that they are sufficiently large, thus it is difficult, but not impossible, to define recognised users and exclude other users altogether (Feeny et al., 1990:3; Healy, 1994:597). However, each person’s use of such resources subtracts benefits that others might enjoy (Ostrom, 2008:11), thus leading to the tragedy of the commons and lack of incentive to privately pay for a product that is open access. One of the ways to ensure sustainable use of marine resources is by applying the user-payer principle, as a means of sourcing out funds for conservation goals of marine protected areas.

This chapter is a discussion of the literature on common pool resources, the tragedy of the commons consequence, theory on the user-payer principle and willingness to pay. The aim is to discuss the literature that will serve as a baseline for the concepts that will be used and investigated in this study. This is achieved by providing an overview of common pool resources in section 2.2, followed by a description of marine ecosystems 2.3. The literature on marine protected areas is provided in section 2.4. Section 2.5 discusses the user-payer principle and willingness to pay, and finally, section 2.6 concludes the chapter.

2.2 Common pool resources

Common property is defined in Ciriacy-Wantrup and Bishop (1975:714) as the sharing of property rights of very large resources in which most of the owners have equal rights to use finite resources. Such resources are prone to inefficient resource use as individuals pursue their own interest as much as they profitably can, and in so doing, they disregard the impact of their actions on resource availability for the future (Ostrom & Hess, 2007:4; Schlager, 2004:145). For many, particularly neoclassical economists, population growth resulting in poverty has exerted pressure on common resources, thereby creating what is known as the tragedy of the commons (Gurung, 2005:1; Sandler, 2010:318).

Consumption of common pool resources by individuals and groups has been conceptualised by psychologists as a social dilemma. Social dilemmas are defined by two properties (a) when the monetary payoff to each individual is higher, if he or she defects (i.e., chooses non-cooperatively), regardless of others’ choices, and (b) when the monetary payoff for all individuals in the group is higher if all cooperate than choose if they choose otherwise (Roch & Samuelson, 1997:221). In other words, social dilemmas can be described as situations in which (a) individual group members can obtain (at least in some circumstances) higher outcomes if they pursue their
individual interests, while (b) the group obtains higher outcomes if all group members further the group interest (Van Dijk, 1999:109). This definition emphasises the fundamental conflict between individual and collective interest inherent in this form of social interdependence (Roch & Samuelson, 1997:221).

Social interdependence evolves when individuals make decisions that coincide with the interests of others, so that by furthering their own interest, they either help others or disadvantage them. Much of what is known about the way people handle the conflict between their personal interests and group interests comes from experimental research on social dilemmas.

Common resources can be distinguished into two different types, depending on the ownership. There are open access resources, where the resources are owned by the public and everyone has access to it (for example the ocean, air), and the second is common property resources, which are different in that the resource is owned by the local community or a community of owners (fishing grounds, irrigation system) (Holden, 2005:340). The oceans are difficult to regulate in terms of excluding users because of their enormity and the spatial mobility of marine life such as fish (Chao, 2018:124). This, coupled with the free rider problem where individuals benefit from the conservation investments of other individuals, leads to what is become known as the tragedy of the commons.

2.2.1 Tragedy of the commons

According to the theory of the tragedy of the commons postulated by Hardin (1968), when a resource is said to be common property, the resource is freely available for everyone to use, such that the users compete with one another for greater use of the resource, all of which leads to the disadvantage to themselves, the resource and the society (Ciriacy-Wantrup & Bishop, 1975:713). Hardin (1968:1243) describes the social dilemma that occurs when unconstrained consumption of a common property resource leads to exponential degradation and depletion, which the main cause he attributes it to is the increase in population on a finite resource. This is applicable to MPAs as more and more divers and other users visit the MPA and impose a threat of continued damaged on the already vulnerable and finite ocean resources. Walker et al. (1990) further explains that in the absence of private property rights or a central planner, the users of common pool resources will overinvest in appropriation of the resource. It is thus evident that this tragedy of the commons is visible in today’s problems of resource depletion, pollution and a reduction in economic benefits for the communities around the oceans and seas (Segerson, 2017:3; Tornell & Verlasco, 1992:1208).
2.2.1.1 Models of common pool resources

Hardin (1968) offered two models for the tragedy of the commons, which are the capitalist model, the socialist model and another recommendation, which was offered by McKean (1995:1), called the anthropological model. In the capitalist model, it is believed that resources that are open access and available to everyone are prone to depletion. This is because the world population is still increasing exponentially, whilst the amount of resources available is either staying constant or decreasing (Gurung, 2005:1). This natural unbalance is exerting more pressure on the already compromised oceans causing more degradation and depletion (Segerson, 2017:3). With no property rights, individuals get to maximise their marginal benefits as they free ride on the collective bearing of the costs (Berge, 2007:4). The free rider problem is a situation where a public or common pool resource allows people who have not paid their share of the costs of using the resource, to enjoy the full benefits of the resource (Groves & Ledyard, 1977:783).

Liberal economics recommend that by making the oceans private, the costs can be internalised and owners of the property can conserve it since it will be in their best interest to do so (Gurung, 2005:1). Therefore, the capitalist models assume rational thinking, on the part of the owner, to manage the resource at its maximum use so as to remain competitive within the market. It further assumes that the competition allowed in markets (owing to the invisible hand) always successfully leads to efficient management and allocation of resources (Gurung, 2005:1; Segerson, 2017:3).

On the other hand, there is the socialist model, which offers an opposite view of managing common resources. According to the socialist model, common property resource depletion is caused by the inequitable distribution of resources among the population (Gurung, 2005:1). This calls for the government to nationalise common resources so that there is an equitable distribution that is believed to promote efficient resource management. This model disqualifies the rise in population as a factor causing resource depletion. It assumes that each family’s chosen family size is a result of a rational financial choice. It assumes that a family that decides to have extra children, does so to gain extra manpower for agriculture or the other informal ways they make money. This decision is made in order to sustain a family that is poor as a result of the disproportionate allocation of resources between the wealthy and the poor families. Therefore, by nationalising resources, the individual maximisation problem that leads to resource depletion can be minimised as a result of the equal distribution that is assumed to bring a social transformation in resource users (Gurung, 2005:1).

The third model, anthropological model, motivates for the amalgamation of all the forces that affect the management of a resource. This includes economic, social, historical and political influences (Ostrom, 2009:422). This requires the government to identify and foster cohesive
socio-economic and political systems with the community rather than ignoring and imposing a new management system (Yabuta et al., 2014:3). The model assumes that individuals who live around the resource and benefit from its consumption will always act in the best interest of the resource in order for it to be sustainable (Yabuta et al., 2014:3). The benefit of this approach is that since the community is involved in the management plan, in accordance with the cultural economic and political influences at play, implementation of the plan will be accepted and carried out (Chao, 2018:123). This model has been reported successful by empirical research of Ostrom and Cox (2010:451); Gutierrez et al. (2011:386); Claudet and Pelletier (2004:129); and Himes (2007:601). However, the downside to the anthropologist model is that for a management plan involving the community to be successful, it requires the community to be homogenous and small-scale with a stable population and environment. This requirement makes it hard to apply this model to complex heterogeneous communities.

Objectively, the capitalist model and socialist model fail to address each other’s views. On the one hand, the capitalist model is inadequate in relation to environmental goods such as the oceans, which do not have a market. This means the invisible hand is absent to regulate the use of the resource, which can lead to mismanagement due to a lack of regulation (Segerson, 2017:3). In addition, the capitalist model encourages the unequal distribution of resources, as the wealthy are given bigger portions and the poor are given the smaller peripheral portions of the resource (Gurung, 2005:1). This only increases resource depletion in the long run.

On the other hand, the socialist model is inadequate in that it overlooks the effect of an increase in population on limited resources as well as the fact that nationalisation of resources does not always guarantee an efficient management of a resource (Gurung, 2005:1).

Despite these limitations to both models, Vollan and Ostrom (2010:923) have found that common pool resources do not always result in degradation because not all individuals maximise their self-interests in the short-term; and some individuals work collectively to minimise loss and yield shared benefits. The anthropological model considers a situation where resource users (government, business owners and the community) are involved in the planning and implementation of a sustainable approach to using the ocean, which ensures that the ecosystem is not disrupted and completely depleted. This involves using the resource in a more suboptimal and conservative way, bearing in mind that it is a fragile ecosystem with a restoration rate.

A management plan, similar to that of a MPA (discussed in section 2.4), can be established with the goal of maximising annual sustainable growth. Kagi (2001:8) proposes that in order to achieve maximum sustainable yields (MSY), the current stock of marine life should be maintained at the peak growth rate. This will enable resource users to utilise the ocean up to a certain cap (carrying
capacity) yet maintaining the current stock levels. Therefore, the goal is to use only what can be replenished in that same year.

Consider Figure 2.1, where the growth rate of ocean marine life is a function of its current stock levels. The assumption is of a logistical rate of growth. Assuming that marine life stock levels are measured on the vertical axis and marine life harvesting is measured on the horizontal axis, then the growth rate is an inverted U curve because the marginal harvesting only increases yield up to a certain point (MSY). When this point is reached additional harvesting reduces the yield. The point $S_{MSY}$ shows the highest growth rate that can be achieved, and this gives an annual harvest of MSY. However, if the stock levels decrease to below $S_{MSY}$, then smaller sustainable yields will be attained. This is because the yield per unit of harvesting reduces the stock levels. Furthermore, if the stock levels further decrease below point $S_1$, the rate of growth of marine life will be negative and the resources near depletion (Kagi, 2001:8). At this point, if resource use is not stopped completely, the stock levels will continue to decrease further until they reach zero.

![Figure 2.1: Maximum sustainable yields.](Source: Kagi, 2001:9)

If the MPA and its marine life are not regulated stock levels decrease to below $S_{MSY}$, to give a short-term optimal economic return for resources users, then the long-term sustainable economic yields will be reduced. In conclusion, the establishment of MPAs as tools for sustaining ocean resources is possible, with the trade-off being sub-optimal returns that ensure that stock levels are allowed to be replenished (Kagi, 2001:9).
With this in mind, the next section will discuss the marine ecosystem in terms of the general causes of marine depletion, the impact of scuba divers as well as the consequences of marine depletion.

2.3 Marine Ecosystem

A large percentage of the world’s population lives along the coast, and a large proportion of society gain from the use of marine and coastal resources (GESAMP, 2001:1). The distinctive beauty of marine life, their immense diversity, the atmosphere that tropical life gives, and the leisure it provides, attracts millions of people from all over the world. Coral ecosystems around the world, for example, sustain roughly 850 million people living within 100km of coral reefs, who derive benefit from reef productivity such as food security, employment, coastal protection, and tourism (Burke et al., 2011:11). Marine organisms are a central component of humankind, including fisheries, construction materials, habitat, medicine, coastal protection, nutrient cycling and resources for tourism (Lucrezi et al., 2013:52). From the ecological perspective, coral reefs and fish are the most biologically diverse shallow water marine ecosystems (Hasler & Ott, 2008:1788). Their existence contributes to food security, income, medicinal extracts and tourism.

Still the question that is posed by many is why should we care so much about marine life? It was reported in Hoegh-Guldberg et al. (2015:7) that the annual gross marine product (GMP) is approximately US$2.5 trillion and the aggregate asset base of the ocean is approximately US$24 trillion. Included in these figures are fishing, aquaculture, tourism and education services, trade and transportation and benefits such as carbon sequestration and biotechnology. These estimates, however, do not include yields from offshore oil and gas or wind energy, assets that did not have data at the time, valuable intangibles such as the ocean’s role in climate regulation, the production of oxygen, temperature stabilisation of the earth, or the spiritual and cultural services the ocean provides (Hoegh-Guldberg et al., 2015:7). Therefore, the total value of oceans is much higher than these figures, which means that if people are not concerned about preserving it, then the loss to humankind would be catastrophic.

Since the marine ecosystem is of great value to humankind, the next sections discuss the causes of marine life depletion, particular impact that adverse scuba diving actions have on the ecosystem as well as the consequences of current and future depletion.

2.3.1 Causes of marine life depletion

Pollution, over-fishing and climate change are major factors contributing to the decline in survivorship, reproduction and growth-rates of corals (Camp & Fraser, 2012:30). When compared
to the magnitude of these threats, diving is commonly considered a sustainable use of coral reef ecosystems (Dearden et al., 2007:306).

From a global perspective, contemporary problems can be divided into two categories: (i) actual damage or compromise to marine resources and amenities; and (ii) potential threats of damage (GESAMP, 2001:12; Hughes et al., 2005:380; De’ath et al., 2012:17995; Bozec et al., 2016:4536; Perera-Valderrama et al., 2016:17).

According to GESAMP (2001:12), degradation of ocean resources is caused by eutrophication and related anoxia; destructive algal blooms; consequences of contaminants such as sewage, metals, insistent organic substances, petroleum hydrocarbons and radionuclides; consequences of deforestation; consequences of a change in the mobility of sediments; depletion of coral reefs; loss of wetlands; decrease in mangroves; habitat destruction; the transfer of harmful species into coastal areas; climate change; sea-level rise; inundation as a consequence of physical alteration; increased risks to human health; reduced biodiversity; endocrine disrupting chemicals; overfishing; destructive fishing practices; the effects of the exploitation of coastal mineral resources, particularly sand and gravel; and litter.

Owing to seagrass meadows and mangroves, about 25% of atmospheric carbon dioxide is naturally sequestrated into the oceans as blue carbon (World Bank, 2018). This is an important use of the oceans because this process reduces the amount of greenhouse gases in the atmosphere that is responsible for global warming and its negative multiplier effects. While the sequestration of blue carbon helps in reducing global warming, an unintended consequence is that the increase in carbon dioxide underwater alters the pH level of ocean overtime (Turley & Findlay, 2016:272). This in turn disrupts the chemical composition of the ocean ecosystem and leads to ocean acidification (Chapman, 2017:587).

Over-fishing is another stressor of marine ecosystems. Fish reserves are being depleted through overfishing, that is mostly illegal fishing, which gives a total of 26 million tons of fish catches depleted per year (World Bank, 2018). Furthermore, fish and similar marine life are being compromised because of development along the coast, pollution of the sea, especially marine plastic pollution (Brodie & Waterhouse, 2012:1; Hoegh-Guldberg et al., 2015:12). The World Bank (2018) found that approximately 8 million tons of plastic enter the oceans each year.

To a lesser extent, scuba diving: this is an activity where trained individuals swim deep into the ocean, for recreation or science, using self-contained underwater breathing apparatus (NOAA Ocean Explorer, 2013). Scuba diving largely depends on the quality of the diving experience as well as a healthy sustainable marine ecosystem (quality of dive site) (Hammerton et al., 2012:77).
All these factors affect the marine ecosystem by changing their abundance, diversity and distribution for future generations (GESAMP, 2001:12). For instance, coral reefs are reported to be very fragile, in that human contact can disrupt them and lead to coral loss, which has ripple effects in the ecosystem that result in disruption in the population dynamics of other marine organisms (Thapa et al., 2005:54; Selig & Bruno, 2010:1).

In conclusion, the change in the marine ecosystem composition that is leading to marine life depletion is an amalgamation of human activity, chemical and physical stressors. Therefore, in moving forward, it is important to focus on how all these stressors can be mitigated so as to minimise depletion (Chapman, 2017:587).

However, population pressure, consumption patterns, and increasing demands for space and resources, combined with poor economic performance and the impoverishment of a large part of the global population, undermine the sustainable use of oceans and coastal areas, and of their resources (GESAMP, 2001:1).

An example of population pressure is that of increased popularity of scuba diving and the impact it has on the marine ecosystem. Scuba diving is usually considered relatively gentle and a non-consumptive activity in that divers are often permitted in sensitive protected environments where fishing, collecting and other extractive uses are excluded (Rouphael & Inglis, 2002:427). The next section explores the impact of scuba diving on marine ecosystems.

2.3.2 Impact of scuba diving

The number of scuba divers in the world is increasing at an exponential rate, owing to ease of travel, advances in scuba equipment, increased curiosity in nature and exposure (Barker & Roberts, 2004:481; Lucrezi et al., 2017:385). In addition to this, the increased access to interesting ocean sights through advanced technology, training, education and advanced equipment has led to an increase in scuba diver numbers (Dimmock & Musa, 2015:52). This increase in numbers has led to an increase in concern over the carrying capacity of the oceans as well as its well-being (Davis & Tisdell, 1995:19).

Most analyses of scuba divers’ motivation and satisfaction undertaken over the last decade have revealed that the major reason for diving is to observe and explore the underwater environment and associated marine life, and that underwater nature and marine life are prime determinants of dive enjoyment (Lucrezi et al., 2013:53). However, the increasingly intensive use of some marine protected areas for tourism and recreation has prompted concern about the effects that snorkelling and diving have on marine organisms (Rouphael & Inglis, 2002:427).
The fragile marine life ecosystem is threatened as a result of direct and indirect impacts of irresponsible scuba diving activities (Medio et al., 1996:90). Direct diver contact has been reported in several studies, for example, kicking colonies with fins; trampling, holding and kneeling on benthic organisms; and hitting colonies with loose equipment; most damage involves colony breakage through fin kicks (Hasler & Ott, 2008:1789; Tapsuwan & Asafu-Adjaye, 2008:432; Lucrezi et al., 2013:53). This negatively affects coral growth and sexual reproduction. Furthermore, damaged corals are more susceptible to disease and algal growth (Zakai & Chadwick-Furman 2002:179). Divers may also stir and raise benthic sediment onto the reef, increasing sedimentation stress on oral polyps (Tratalos & Austin, 2001:67). Dive centres’ boat anchors and associated chains can also dislodge, break and pulverise live coral (Dearden et al., 2007:306). This is a particular problem for corals as damage can take decades to repair, due to slow and limited regeneration capabilities (Hunt et al., 2013:35).

Six types of diver behaviour were defined, in terms of contact with or damage to the marine life, these include: hand contact, fin contact, SCUBA tank contact, hose contact, stony coral breakage and raising of sediments (Zakai & Chadwick-Furman 2002:181). Signs of diver damage such as broken coral fragments and dead, re-attached and abraded corals have been reported at heavily used dive sites throughout the Caribbean, Red Sea, Egypt and Australia (Hawkins et al., 1995; Tratalos & Austin, 2001; Hasler & Ott, 2008).

Depletion of marine life, particularly corals, leads to a net decline in fish abundance, indicating increased mortality or relocation of fishes to alternate habitats (Hasler & Ott, 2008:1789). All of which is caused by exceeding the carrying capacity underwater and poor diver behaviour. Diver carrying capacity is usually expressed as a maximum number of dives per site per year and is a measure of the number of dives a site can sustainably support without becoming degraded (Zakai & Chadwick-Furman 2002:179).

Empirical studies have shown that MPAs that have many divers have a significant increase in marine life damage from scuba divers. However, poorer survivorship in areas subject to high disturbance will, to some degree, be offset by the colonisation opportunities made available by diver damage, which may explain why the effect of diving on species numbers appears weaker than it does for hard coral cover (Tratalos & Austin, 2001:73).

One might also expect divers to seek out areas of high species diversity, with the result that these areas may still compare well with less frequently dived sites even after any impact from diving (Tratalos & Austin, 2001:73). This comment also applies to the effect of diving on coral cover, as areas of high coral cover are likely to represent attractive areas for divers. It may also be argued that fish feeding by divers could have had a larger impact on coral communities than direct contact
(touching) or indirect contact (stirring up sediment). Fish feeding may attract predatory fish such as sharks into an area, which in turn damage the reef when seeking prey (Tratalos & Austin, 2001:73).

Previous studies have identified different factors that can influence the impact scuba divers have on a reef. In Rouphael and Inglis (2001:430), gender bias was found to be a contributing factor with male divers being more likely to interact with the reef, although other studies (Camp & Fraser, 2012:31) showed that women made more contact with reefs. The use of photographic equipment by divers was found by Rouphael and Inglis (2001:430) to increase the chance of divers' touching the reef. Additionally, the level of diving experience may or may not affect the number of adverse impacts divers have with the reef, because Camp and Fraser (2012:31) find conflicting evidence of this. Camp and Fraser (2012:31) also find that topography and diving conditions can also affect how often a diver interacts with the reef (Camp & Fraser, 2012:31).

2.3.3 Consequences of marine life depletion

The importance of conserving the ocean’s resources, its disruption and depletion has catastrophic consequences for the human population and its survival. According to Cesar et al. (2003:9) and GESAMP (2001:13), these include:

a. Health concerns due to direct contact with the ocean and marine life, this could be through direct ocean activities such as bathing or boat activities, and indirect activities such as a reduction in ocean food supply and health hazards that come with consumption of polluted seafood.

b. A reduction in employment opportunities that arise from fishing, offering recreational facilities, scientific research and service industry. This reduced employment negatively influences the contribution to the economy, consequently, leading to potential poverty to the community dependent on coastal resources, and more pressure to engage in farming activities. This further exacerbates the situation with, amongst others, the increased use of pesticides and fertilisers, run-off of animal wastes, excessive use of water from coastal aquifers and overgrazing in watershed areas (GESAMP, 2001:10).

c. The ecosystem's health and biodiversity are largely altered as well as the potential for medicinal extracts.

A contemporary solution to this problem is the establishment of MPAs to manage and preserve the ocean ecosystem. The next section discusses marine protected areas.
2.4 Marine Protected Areas

The enormity of the tragedy of the commons in ocean resources was taken seriously through identifying how to manage and protect it in the 1950’s and early 1960’s. The First World Conference on National Parks in 1962 considered the need for protection of coastal and marine areas (Kelleher & Kenchington, 1991:3). These established institutions were MPAs, which were specifically intended to limit human activities at particular locations.

MPAs are aimed at managing oceans for long-term conservation of biodiversity and the marine ecosystem by reducing mortality, which in turn, should generate larger body sizes, increases in abundance and greater fertility (Mora et al., 2006:1750). These designated areas include marine reserves, fully protected marine areas, no-take zones, marine sanctuaries, ocean sanctuaries, marine parks and locally managed marine areas, which vary in terms of protection, permissible and prohibited activities (see Table 2.1) (Mackie et al., 2017:8).

The term Marine Protected Area is defined by Kelleher and Kenchington (1991:3) as:

"Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment."

An MPA provides a pristine, untouched habitat, where divers can admire the fish and reefs (Fabinyi, 2008:899). The hope with MPAs is that while different stakeholders, such as local governments, conservationists, dive operators and fishers may have different motivations for creating MPAs, their end goal should be the same (to repair the MPA to a natural recovery state), and so the interests of all stakeholders will be satisfied. Natural recovery, which is the process where an ecosystem is restored to a former state after the cessation of an impact or alteration, is usually a slow progression that can take decades or centuries (Abelson et al., 2016:156), although previous studies have declared that marine species do not always recover from depletion (Roberts et al., 2005:123).

It should be noted, however, that MPAs are established to meet a variety of different objectives; therefore, the success of each MPA should be judged independently based on their intended goals and objectives (Gallacher et al., 2016:288).

MPAs in the world cover 3.08% of the global ocean, of which 1.47% of global ocean are strongly protected (Marine Conservation Institute, 2017). MPAs vary according to size, location, regulations and enforcements, and this affects the extent of protection and sustainability they provide as well as their success in reaching their goals (Gallacher et al., 2016:280). Most are
small (median size of ~2 km²) and designed primarily for the conservation of a single flagship species (Novaczeck, 2015:1).

Not all MPAs are effective in meeting their goals and meaningful measurement of what constitutes adequate conservation of a species, habitat or ecosystem remains a challenge. While there is no universal formula for ensuring MPA success, size of the protected area is an important factor (Novaczeck, 2015:2). In a global study of 87 MPAs, Edgar et al. (2014:217) identified five characteristics, called “NEOLI”, that are shared by successful MPAs: No take, well Enforced, Old (>10 years), Large (>100km²) and Isolated. The effective management of MPAs is further explained in the next section.
Table 2.1: Types of Marine Protected Areas.

<table>
<thead>
<tr>
<th>MPA Type</th>
<th>Other types</th>
<th>No-Take</th>
<th>Subsistence extraction allowed</th>
<th>Fishing restrictions</th>
<th>Access restrictions</th>
<th>Permanence</th>
<th>Other activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully protected (No-take)</td>
<td>Marine reserves</td>
<td>Fully no-take</td>
<td>Prohibited</td>
<td>Prohibited</td>
<td>May be regulated</td>
<td>Yes (&gt;20 years). Year-round.</td>
<td>No extraction of living or non-living resources – scientific collecting with permit ok.</td>
</tr>
<tr>
<td>Strongly protected</td>
<td>May have some no-take zones with buffer</td>
<td>Restricted, low impact</td>
<td>Commercial: Prohibited. Recreational: Restricted, allowed with permit and quantifiable as very limited take, no bottom trawling.</td>
<td>May be regulated</td>
<td>Yes (&gt;20 years). Year-round.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited take</td>
<td>No</td>
<td>Yes</td>
<td>Restricted. Limited gears, sustainable fishing</td>
<td>No restrictions</td>
<td>Year-round</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other MPA</td>
<td>No</td>
<td>Yes</td>
<td>Any</td>
<td>No restrictions</td>
<td>Year-round</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-MPA</td>
<td>FMAs, marine mammal/shark sanctuaries, OECMs</td>
<td>No</td>
<td>Yes</td>
<td>Any</td>
<td>No restrictions</td>
<td>Seasonal, temporary</td>
<td>No limits on extraction</td>
</tr>
</tbody>
</table>

(Marine Conservation Institute, 2017)
2.4.1 Management of Marine Protected Areas

Effectively managed MPAs can give a variety of benefits, including scientific information on ocean ecosystems, educational opportunities, ecosystem services, protection of cultural and natural resources, preservation of fisheries and increased economic opportunities through tourism (WWF Global, 2017).

Though MPAs have been esteemed as good solutions, they have been criticised for their "one-size-fits-all" methods in marine management, because not all MPAs are the same and a more location-specific approach will be effective (Rossiter & Levine, 2014:196). However, Rudd (2015:2) professes that it seems highly probable that multiple context-dependent pathways to success exist and can be implemented.

Since a location-specific management plan is at the heart of the success or failure of an MPA (Rossiter & Levine, 2014:196), it is encouraged to develop a working plan for what the MPA wants to achieve along with the time frame. Although many MPAs are criticised as only existing on paper, with no evidence of improvement, it is fair to say that all MPAs begin as a piece of paper, and time as well as implementation from all stakeholders is necessary to achieve noticeable results (Rudd, 2015:2).

It is encouraged to follow the anthropological model, and establish a participatory approach that includes the government, business people and the community, in the planning and implementation of the MPA (Hoyt, 2009:702). As with MPA design, management must be both top-down and bottom-up. According to Hoyt (2009:702), the following are the key steps leading to effective management:

a. Engaging stakeholder involvement from the beginning and throughout the process (this is believed to foster a sense of cooperation and unity towards the same goal, among all stakeholders).

b. Formulating clear management objectives for the proposed MPA (this ensures that each player in the MPA understands the goals).

c. Creating a management body (this is important for regulation purposes and authority to supervise the activities).

d. Developing a management plan, subject to periodic re-examination and revision (a plan gives direction of how the goals should be reached, as well as a baseline to measure progress and accountability).

e. Offering management training (this ensures that the appointed management team has the right expertise and knowledge of their duties).
f. Conducting research for baseline numbers, inventory, status and monitoring purposes.
g. Promoting and offering educational programs for the local community and visitors.
h. Developing effective enforcement regimes.
i. Conducting periodic management review and other evaluations to assess whether objectives are met.

2.4.2 How to decide where to have a Marine Protected Area

According to Salm and Price (1995), and Kirkman (2013), MPAs and reserves are selected using natural, cultural, logistical, and/or socioeconomic criteria that may vary with different nations and programs. According to Protect Planet Ocean (2010) and Hoyt (2009:700), some of the most common criteria include:

a. Relative naturalness – selecting areas that are still in good or nearly pristine condition.
b. Representativeness – selecting areas that represent particular habits or include important ecological functions such as spawning, nursery or feeding areas.
c. Biodiversity – selecting areas with high diversity of species and/or areas with high rates of endemism (i.e., having species that are unique to a particular area or region).
d. Vulnerability – selecting areas with biodiversity that is relatively susceptible to disturbance or destruction.
e. Fisheries value – selecting areas that are strategic for enhancing fisheries, such as areas of high productivity or spawning grounds for targeted fish species.
f. Tourism value – selecting areas that could, if protected, enhance appropriate recreational uses and tourism revenues.
g. Social acceptance – selecting areas that are acceptable to all stakeholders to be set aside for protection.
h. Practicality of management – selecting areas that allow for relative ease of management due to a range of factors, such as nearness to shore.

An example of an effectively managed MPA is the Great Barrier Reef. One of the largest protected coral reef systems in the world is the Great Barrier Reef (Abelson et al., 2016:156), covering an area of over 2300 km and incorporating almost 3000 individual reef formations (Knowlton, 2012:17734).

The Great Barrier Reef boasts extraordinary diversity and aesthetic beauty and is reported to having an asset value of $56 billion, funds 64 000 jobs and contributed $6.4 billion dollars to the Australian economy between 2015 and 2016 (Deloitte Access Economics, 2017:5). However, it has seen a decrease of over 50 per cent coral cover in less than 30 years (between 1985 and
This disturbing degradation queries the efficacy of maintenance and preservation efforts that are now in place in MPAs (Abelson et al., 2016:156), since the Great Barrier Reef is considered to be the gold standard of coral reef management (Knowlton, 2012:17734).

This study focuses on the Portofino MPA in Italy, and the next section zooms in to describe and characterise the chosen study site.

### 2.4.3 Description of Portofino Marine Protected Area

The MPA of Portofino (Ligurian Sea, NW Mediterranean) was formally established in 1999 (see Figure 2.2 for the map and Table 2.2 for the description), even though protection was successfully enforced in 2001. The entire MPA covers about 346 ha and includes one small (10 ha) “no entry-no take” area (A zone or integral reserve), two “entry regulated-take regulated” zones (B) and two buffer zones (C).

There are some differences in recreational fishing regulations and restrictions between the B and C zones. Local (i.e. residing in the municipalities of Portofino, S. Margherita and Camogli) professional fishermen operating with traditional fishing gear (trammels, gillnets, traps) are allowed to fish in B and C zones. Local recreational fishermen are allowed to fish in B zone (with license) by long line or trolling and in C zone (without license) by hook and line. The non-resident fishers are allowed to fish only in C zone (with license) from shore, using a hook and line. In 2011, about 193 professional fishermen and 271 licensed recreational fishermen were allowed to operate inside B and C zones, respectively (LaMesa et al., 2011:25).

The MPA of Portofino was established by the decree of the Ministry of 26 April 1999 and includes the municipalities of Camogli, Portofino and Santa Margherita Ligure. The establishment of marine protected areas is provided by two national laws: provisions for the protection of the sea (n. 979 of 31 December 1982) and the Framework Law on Protected Areas (n. 394 of December 6, 1991). The objectives of marine protected areas are the protection of the environment and of marine resources, and to promote and enhance local economic activities, provided they are compatible with the nature and significance of the landscape. The management consortium consists of the Province of Genoa, Municipality of Camogli, Portofino Municipality, Municipality of Santa Margherita Ligure, Genoa University, Province of Genoa, City of Camogli, City of Portofino, City of Santa Margherita Ligure and the Ministry of Environment (Marine Conservation Institute, 2017).

Some of the most popular species for scuba divers in Portofino MPA are the groupers, gorgonians, barracudas, moray eels, dentex, nudibranchs and red corals (Lucrezi et al., 2018:9).
<table>
<thead>
<tr>
<th>Characteristics of the Portofino MPA.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site and Temperature</strong></td>
</tr>
<tr>
<td><strong>Area</strong></td>
</tr>
<tr>
<td><strong>Waters</strong></td>
</tr>
<tr>
<td><strong>Popular marine life</strong></td>
</tr>
<tr>
<td><strong>Types of fishing activities</strong></td>
</tr>
<tr>
<td><strong>Origins of tourism</strong></td>
</tr>
<tr>
<td><strong>Tourism and Recreation types (aside from scuba diving)</strong></td>
</tr>
<tr>
<td><strong>Past and present environmental and ecological issues</strong></td>
</tr>
<tr>
<td><strong>Characteristics of the MPA</strong></td>
</tr>
<tr>
<td><strong>Problems in management of the MPA</strong></td>
</tr>
<tr>
<td><strong>Dives logged annually</strong></td>
</tr>
</tbody>
</table>
The Portofino MPA area also hosts other tourism activities such as shopping, culinary tourism, yachting, snorkelling, swimming, recreational fishing and hiking among other things (Lucrezi et al., 2017:387).

Some of the environmental problems in Portofino include reduced ocean water quality, shoreline erosion caused by coastal enlargement, land pollution and aquatic-pollution, veld fires, littering and construction, anchoring, trawling, fishing nets, landslides, fishing line, recreational fishing, loss from diver actions, introduction of invasive species, increased mortality of marine life (probably associated to climate change) (Lucrezi et al., 2017:387).

Figure 2.2: Maximum sustainable yields.

(Extracted from Zapata-Ramírez et al., 2016:46)
DISI (2017) lists the general prohibitions on the Portofino MPA to include:

- Hunting, catching, harvesting, damaging and, in general, any activity that could be dangerous or disturbed by biocenosis, including the introduction of extraneous species.
- The alteration by any means, direct or indirect, even temporarily, of the marine environment, as well as the landfill of both inert materials, and solid and liquid waste.
- The introduction of weapons, explosives or any means of destruction and capture, and of toxic or polluting substances.
- Activities that can, however, cause damage, obstruction or disruption to the realisation of study programs and scientific research to be carried out in the area.
- Underwater fishing.
- Trawl fishing.

Night scuba divers, subject to specific authorisations issued on the basis of criteria identified by the management authority.

The typical ways of funding an MPA could be by incorporating the following methods: government subsidies, global help offices, establishment stipends, gifts, client charges, keepsake deals, concessions, obligation swaps, trust assets, ecotourism and biodiversity venture stores (Reid-Grant & Bhat, 2008:129). Dependence on one method only is not wise and diversifying the method is advised. For an MPA to be economically sustainable, its management team and government authorities must identify the financial needs of the MPA and divide the funds accordingly. Though this thesis focuses on user fees, it is encouraged that more financing methods are implemented.

The decision of which sources of funding to take advantage of are dependent on the physical, monetary and political circumstances of the area an MPA is in. For instance, government subsidies for MPAs are reported to be an unreliable source of funding especially in developing countries. This occurs because governments in developing countries are faced with the dilemma of inadequate funding to meet the essential needs of the country, and are forced to choose between poverty eradication, clearing international debt and funding environmental initiatives (Reid-Grant & Bhat, 2008:129).

One way of funding MPAs is by employing the user-payer principle, which argues that the users of the ocean should be the ones to pay for entire cost of using the resources and its related
service. For instance, the user should bear at least part of the cost of the losses made for future generations (Sulphey & Safer, 2017:161). Section 2.5 discusses this principle further.

2.5 User-payer principle and willingness to pay

The user-payer principle is described as a principle that requires the user of a resource to pay for the costs of the degradation of that resource (OECD, 1997:1) in the form of a tax or user fee. User fees are a common method used to help generate funds for MPAs (Pascoe et al., 2014:147). User fees can come in a variety of different forms, from a per day access fee to an annual visitor pass (Lindberg, 2001:2). In some cases, user fees are relatively low and insufficient to provide adequate financial resources to effectively manage the reserve; yet another concern is that high user fees could potentially result in tourists going to alternative destinations (Pascoe et al., 2014:147). The main argument of the ‘user pays’ view, however, is that of equity. Benefits accrue to those who use the recreation services (and incur the costs) and therefore, it is only fair and appropriate for them to bear the costs (Reynisdottir et al., 2008:1077).

The user-payer principle is based on four assumptions, according to Basurto and Ostrom (2009:256). The first assumption is that the ocean produces an extremely foreseeable, limited supply of one type of resource unit (one species, for example) in each time period. The second is that the users of the ocean are assumed to have assets, skills, discount rates and cultural views that are all similar (homogenous). The third assumption is that users are short-term profit-maximising with complete information of the market. In essence, it is assumed that any user can enter and exit the ocean and harvest resource units. The last assumption is that users of the ocean are believed to be able to get property rights of what they would have harvested, that they can sell in an open competitive market, acting individually without communicating or coordinating with other users of the ocean, which they then sell in an open competitive market (Basurto & Ostrom, 2009:256).

2.5.1 Successful introduction of user-fees

With the exponential increase in dive tourism in MPAs, user fees have been identified as one way in which MPAs may be financed (Fabinyi, 2008:899). For user fees to be a sustainable source of financing, the fees can either be based on the willingness to pay (WTP), which is the monetary value that an individual is willing to give up to get a desirable change to an environmental good, or a willingness to accept (WTA), which is the amount of money an individual would require as compensation for a negative change in an environmental good, of the targeted users of the MPA (Thur, 2010:68). This ensures that the user fee maximises on potential revenue streams and aids in the fair spreading of costs.
According to economic theory, the difference between WTP and WTA lies in the **income effect** (because willingness to pay is constrained by income whereas willingness to accept is not) and a **substitution effect** (where there is no substitute for the good thus making it difficult to compensate for the removal of the good) (Grutters et al., 2008:1110). According to psychology theory, another reason for the difference between WTP and WTA is the **endowment effect**, where loss aversion kicks in and individuals tend to put more value on the loss of an endowment than the acquirement of something they haven’t possessed yet (Grutters et al., 2008:1110).

According to Harris and Roach (2015:116), theoretically measurements of WTA and WTP should give similar results, however in practice WTA estimates tend to be much larger than WTP because with WTA respondents are inclined to overstate a compensation value than they would for a payment value. This overestimation of compensation is because losses tend to be valued more than gains (Harris & Roach, 2015:116).

Since WTA is used for compensation for a negative change in an environmental good, and WTP is used for paying for a positive change in an environmental good, this study chooses a WTP approach to find out the economic value of a positive change in Portofino MPA. In addition to this, Grutters et al. (2008:1111) encourage that surveys that target potential gainer of an environmental improvement should ask for a WTP and surveys that target potential losers should ask for a WTA. Furthermore, basing fees on users’ WTP also avoids issues that may arise from a miscalculation of fee structures, like overestimation.

This overestimation of visitors’ WTP could result in a sharp decline in expected revenues, ultimately driving tourists to substitute sites that have lower fees or no fees. This reduction in tourists could be beneficial for the MPA because less users will reduce pressure on the environment, help to reduce the recovery period (Peters & Hawkins, 2009:220) and offer improved environmental conditions that the users value and appreciate (Harris & Roach, 2015:112; Pascoe et al., 2014:151). This forms part of the advantages of WTA over WTP. The downside of overestimation is that the reduction in tourists will be damaging for the local economy in terms reduced demand for accommodation, transport and food (Harris & Roach, 2015:112; Peters & Hawkins, 2009:220).

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 (Lindberg, 2007:2). However, a study conducted by Mutsika et al. (2014:484) sought to determine the impact of environmental degradation and increase in local prices on visitor numbers and they found that a significant amount of financial loss could result due to an increase in environmental degradation than due to an increase in local prices.
Introducing scuba diving as a way to finance conservation goals is increasingly being accepted as a sustainable source of self-financing for MPAs. Though user-fees have their limitations, for example the collection of fees and possible conflicts with conservation goals, income from scuba divers through user fees is still important to ensure sustainable administration of MPAs (Reynisdottir et al., 2008:1076). The potential of user-fees as revenue is evidenced through previous WTP studies, which have proven that divers are willing to pay for conservation of marine life in MPAs (Depondt & Green, 2006:189).

Fundamental to the implementation of user-fees, is the predominant sense of equity, where visitors and tourists are charged a fee to cover the costs of using the MPA (Depondt & Green, 2006:190). Considering the wide variety of users of the ocean, different types of user fees exist, to cater for each group of users’ characteristics. These include entrance fees, concession fees, general user fees, royalties and sales revenue, and licenses and permits (Reid-Grant & Bhat, 2008:130).

According to Peters and Hawkins (2009:220), diver user fee has been successfully implemented on the Bonaire National Marine Park that is located north-west of Venezuela (wholly financed through user fees), the Bunaken National Marine Park in Indonesia and on the Namena Marine Reserve in Fiji. Pascoe et al. (2014:151) also lists the Tubbataha World Heritage site in Philippines and Komodo National Park in Indonesia as marine parks that have successfully implemented user fees.

Management fees are also in place in many parts of South East Asia as well (for instance the Gilutongan Marine Sanctuary in the Philippines), particularly in Marine Parks where most (70%) have a diver user fee. However, these user fees are generally substantially lower than willingness to pay estimates, mostly in the order of $1–5 per diver, and hence potential revenues for management could be substantially increased (Pascoe et al., 2014:151). Other studies suggest that divers who pay a relatively high proportion of their willingness to pay in fees are mostly happy to do so, which confirms that the willingness to pay estimates are indeed representative of the divers’ willingness to pay (Pascoe et al., 2014:151).

This study will concentrate on the user payer principle as a source of funding for MPAs. The next section discusses the different methods that can be used when conducting a willingness to pay study.

2.5.2 Methods used to estimate willingness to pay

A willingness to pay approach involves gathering information on selected study sites to find the economic value of a non-market environmental good by putting a price on the utility derived from
the use of the environmental resource. The challenge to this method, as with all experiments, is that such experiments may not give a precise measure of the complexity and diversity of each WTP scenario. Furthermore, assumptions have to be made to enable the quantitative analysis (Basurto & Ostrom, 2009:256).

As a point of departure, people value natural goods differently, yet this value cannot be reflected in a market system. For example, prices of activities such as rock climbing and camping are set administratively and usually lower than the actual value of the activity. The economic value of air cannot be reflected in the market, just as the economic value of the oceans and its resources. Such goods and services are called non-market goods and would need to be simulated in a market-like setting with demand and supply, for their economic value to be estimated (Louviere et al., 2000:329).

In reference to the theory of neoclassical economics, the economic value of goods and services is usually derived from market prices (Morgas et al., 2006:6). When a product is valued, the consumer is willing to pay money to purchase the product or to accept reimbursement for the product’s damage. In a normal market situation, the price that is paid for the product is used to observe the value of the product, however, the value of environmental resources cannot be observed easily because the market imperfections distort their real prices. These environmental resources with market imperfections have been classified into public goods and common pool resources, externalities, and incomplete markets or property rights (Vega & Alpízer, 2011:253).

According to economic theory, the methods to elicit the value of goods and services is broken down into two categories: revealed preference (indirect) methods and stated preference (direct) methods. These two categories are different according to the origin of data and methods of data collection (Tietenberg & Lewis, 2012). Revealed preference methods analyse real consumer behaviour in prevailing markets. This could be directly observed through examining the demand for activities and services in protected areas; or indirectly through observed prices of substitute resources (Morgas et al., 2006:6).

Stated preference methods, on the other hand, analyse the value of non-market resources, which cannot be observed in existing markets. Therefore, this method relies on creating hypothetical settings where individuals make decisions as if they are in a real market (Tietenberg & Lewis, 2012). With stated preference methods, one can estimate non-use and use values of resources. Use values can be described as the economic measure of the satisfaction received from the direct or indirect use of a resource.
Non-use values are described as the non-tangible value that is derived from the need to leave existing resources for future generations to enjoy. A utility can give an intrinsic value on the existence of a specified environmental resource such as an MPA, which can then be measured to give an economic value (Oh et al., 2008:457). All stated preference methods gather data through surveys by asking willing respondents to state their choice in one or more hypothetical scenarios that are formulated to capture a real or potential market situation (Harris & Roach, 2015:112). Nevertheless, there are sizeable differences between stated preference methods.

Literature postulates two types of stated preference methods, namely: contingent valuation and choice experiments (Remoundou et al., 2009:1055). The difference between the two types of stated preference methods lies in the way the economic values are elicited.

Contingent valuation is described as a stated preference method that requires respondents to state maximum willingness to pay for a simulated change in the quality of an environmental resource (Vega & Alpízer, 2011:253). It is the most frequently used stated preference method, and has seen its evolution over the years from refining the open-ended questions (which is problematic in that the respondent may need some reference point or indication to get the bid started, alternatively there are the ‘freerider’ responses, where the respondent offers a low or zero bid in the belief that payment is someone else’s responsibility [Peters & Hawkins, 2009:221]), to close-ended questions (requiring yes or no responses to suggested willingness to pay amounts). Contingent valuation has also gone through extensive criticism for its shortcomings and biases: for instance, the method is reported to have poor implementation and anchoring effects (Vega & Alpízer, 2011:253). This study will use the double-bounded dichotomous choice method of contingent valuation, which involves offering respondents a change in the quality or quantity of a resource at a given price, and the respondent is required to either accept or decline the offer at the suggested cost, and is further asked to accept or decline an offer at a higher or lower cost than the first offer (depending on their answer to the first offer) (Mogas et al., 2006:7).

Choice experiment methods are founded in conjoint analysis and were developed by Louviere and Henscher in 1982 (Mogas, 2006:7). The method involves asking respondents to make a choice among different alternatives in a choice set, and the question involves making a series of choices among different choice sets (Oh et al., 2008:457). Each alternative is described with several attributes or characteristics, with changes of each level of the attribute from one alternative to another. A willingness to pay amount is suggested as one of the attributes in each alternative. Each choice made by a respondent captures the implicit trade-offs between the different levels of the attributes in the different alternatives existing in the choice set (Peters & Hawkins, 2009:221; Vega & Alpízer, 2011:255).
Using the random utility model, both the contingent valuation and discrete choice methods assume that an individual presented with options, will choose the alternative that maximises their utility (Yuki, 2004:9). If the utility of choosing option A is higher than the utility of choosing option B, then the respondent will choose option A. According to Adamowicz et al. (1998:68), for both methods, the willingness to pay response represents a choice from a set of alternatives (a yes or no in the contingent valuation and a choice among the alternative scenarios in the choice experiment), with each alternative corresponding to a utility function that has a deterministic component $V_i$ and a stochastic component $\varepsilon_i$ giving a utility of:

$$ U_i = V_i + \varepsilon_i $$

(2.1)

The respondent will choose alternative $i$ if $U_i > U_j$ for all $j \neq i$. Since both utilities include a random component, the probability of selecting alternative $i$ is

$$ prob(i \text{ chosen}) = (V_i + \varepsilon_i > V_j + \varepsilon_j; \ \forall j \in C) $$

(2.2)

where C represents the set of all possible alternatives. For the choice experiments, $V_i$ includes the different attributes and there are three alternatives (though more than three can be given) to choose from (option 1, option 2, and an opt-out option where respondents have the option to refuse to make a choice). For the contingent valuation, $V_i$ includes the first "bid" and an intercept and there are two options to choose from (option yes and option no) (Adamowicz et al., 1998:68) and a second bid with two options to choose from again (option yes and option no).

Both the contingent valuation method and the choice experiment are used in this study to investigate the willingness to pay user fees in the Portofino MPA. Each method is described and characterised in more detail in the following chapters.

Although willingness to pay user fees has been recommended in past studies as a way to fund the conservation of common pool resources, their implementation is questioned in reality. Gill et al. (2015:57) give the example that when presented with an opt out option or lower priced options, it is possible that respondents may not be willing to pay a user fee at all or will opt for the lowest amount for an increase in the quality of a dive scenario or attribute. It is recommended that user fees should be implemented by considering the conservation budget, the revenue that could be potentially earned and the potential decrease in divers (which could be good for reducing overcrowding in the MPA), rather than just imposing the mean willingness to pay from research (Thur, 2010:68). Another problem arises when respondent divers are presented with dive scenarios and options that they have never experienced at the extreme levels that they are being offered in the questionnaire. This results in respondents answering to anticipated utility rather than real utility or disutility (Gill et al., 2015:57).
Despite these challenges, willingness to pay studies are still relevant for the information they give towards valuing common pool resources and eliciting the specific attributes that the users value the most.

2.6 Conclusion

For many communities around the world, people depend on the sustainable use of the marine ecosystem as a necessity and not a luxury; from employment opportunities that are directly or indirectly linked to coastal and marine activities, to coastal and marine recreational opportunities that sustain the surrounding communities. Because local economies around marine protected areas have a high dependence on tourism, it is essential that marine life is sustainable. In addition, the ocean still has a lot of potential to unlock growth and continued wealth, but human activity is increasingly causing the depletion of the ocean’s ecosystem.

Marine life depletion has domino effects throughout the marine ecosystems resulting in subsequent changes in the population and diversity dynamics of the ocean. Mass mortality of coral reefs and other marine organisms is caused by global climate change, ocean acidification, higher frequency and intensity of hurricanes and cyclones, overfishing, land-based sedimentation, mechanical damage, large amounts of tourists, coral predation by crown-of-thorns starfish, water pollution from terrestrial runoff and dredging, destructive fishing, coastal development and a rapid increase in scuba diving tourism.

Scuba dive tourism, which depends on clean clear water and rich diverse marine life, requires sustainable oceans to ensure its longevity. However, owing to technology bringing more advanced of dive equipment, exposure to the world through globalisation, ease of travel and human curiosity, the oceans have attracted an increasing number of scuba divers.

Emerging theories and new multi-disciplinary approaches point to the importance of assessing and actively managing resilience; that is, the extent to which ecosystems can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly flipping into alternate states. There is the capitalist model, which believes in assigning property rights to individuals, so as to give owners a direct interest in conserving the resource efficiently for future use. In contrast, the socialist model believes in the equal redistribution of resources by nationalising the natural resource so that the regulated rules of sharing reduce the tendency to exhaust resources for personal gain.

The final model is the anthropological model, which motivates for an inclusive management where the key stakeholders are involved, i.e. the government, the business owners and the community. This model fosters social cohesion and acceptance of the regulations and rules for governing the
Marine Protected Area, since all the parties are involved in the planning. The drawback is that it works in small-scale homogenous communities.

Therefore, MPAs are established with the sole purpose of preserving and maintaining selected areas of the oceans that are rich in biodiversity but are prone to depletion. The fishing industry has also made improvements towards controlling by catch and habitat destruction, although there is still so much to be done to diminish the more complicated impacts towards the whole ecosystem.

To value MPAs, the chapter discussed non-use value methods, particularly stated preference methods, which will be used in this study. The two types of stated preference methods: contingent valuation and discrete choice experiments were discussed, each with its valuable contribution to the objectives of this study. In conclusion, willingness to pay, environmental knowledge and attitudes about marine ecosystems among all stakeholders in an MPA are instrumental in minimising impacts and promoting environmentally responsible behaviours.

The main objective of this chapter was to analyse the literature on common pool resources, the marine ecosystem, particularly MPAs, and the potential of user fees as a source of valuing MPA using willingness to pay methods. The next chapter is an article on the willingness to pay user fees in Portofino using the double-bounded choice contingent valuation method.
CHAPTER 3 ASSESSING DIVERS’ WILLINGNESS TO PAY FOR USER FEES IN THE PORTOFINO MARINE PROTECTED AREA

Abstract

The need to move towards sustainable Marine Protected Areas (MPAs) has long been dominated by efforts to minimise current consumption behaviour, which renders ocean resources depleting to unsustainable levels. The efforts of MPAs are often limited by a lack of funds. Since MPAs can be classified as common pool resources, they also face the consequence associated with the tragedy of the commons (the tendency of non-excludable rival goods to be consumed until their marginal benefit falls to zero). Scuba diving is an example of a consumption activity where the fragile marine ecosystem is prone to destruction from uncontrolled or overcrowded user activity. This paper aims to evaluate the divers’ willingness to pay user fees towards marine conservation in the Portofino MPA. A contingent Valuation (CV) survey is conducted using the upper and lower bounded dichotomous choice questionnaire. This type of CV method is chosen mainly because it is more efficient and less biased than other CV methods. Results show that scuba divers in Portofino are willing to pay €6.79, and the protest vote respondents mostly stated that the government should be responsible for conservation.

Keywords: Contingent valuation; willingness to pay; scuba diving

3.1 Introduction

Effective protection of the ocean and its biodiversity requires correct knowledge of perceptions and motivations of the resource (ocean) users. This can enable policy makers to derive appropriate strategies for conservation policies. Since conservation of natural resources, like the world’s oceans and seas, is paramount for maintaining a functional ecosystem and sustaining biodiversity, what better way to push for sustainability practices than to start with the users of the oceans? One such group of resource users are scuba divers diving in MPAs for recreation and professional purposes.

Scuba diving has become increasingly important over the years, especially in biodiversity rich coastal countries. Therefore, such countries attract a large number of divers every year, an activity that is economically beneficial in terms of employment and income. The main source of attraction for scuba divers is the marine species. Apart from providing aesthetic beauty and a habitat for numerous marine species, coral reefs also provide very important and valuable ecosystem services such as coastal protection from waves and storms, provision of genetic resources, and pharmaceuticals research (Asafu-Adjaye & Tapsuwan, 2008:1122).
Traditionally, scuba diving was regarded as having low levels of environmental degradation; however, various studies including Harriot et al. (1997:174); Tratalos and Austin (2001:67) and Hasler and Ott (2008:1789) showed that the popular diving sites, which attract many divers, are not limitless in terms of carrying capacity and should be regulated to mitigate the damage on the fragile marine ecosystem.

Divers’ presence and their feeding of marine life threaten marine ecosystems and species. According to Graver (2010:110), scuba divers harm marine ecosystems, particularly coral reefs, in different ways, including smashing and therefore killing sea organisms while moving about underwater, stirring up clouds of silt (which can choke and destroy living things) from the bottom, and handling, feeding and touching sea animals. The idea of sustainable diving tries to resolve the problems of intergenerational equity so as to encourage economic growth, environmental protection and social justice (Akama & Kieti, 2007:735). This need to move towards sustainable diving comes from the previous and current consumption patterns that are posing a threat to the fragile marine ecosystem.

Fragile marine ecosystems are regulated and protected through MPAs. MPAs are aimed at managing oceans for long-term conservation of biodiversity and the marine ecosystem. These designated areas include marine reserves, fully protected marine areas, no-take zones, marine sanctuaries, ocean sanctuaries, marine parks and locally managed marine areas, which vary in terms of protection, permissible and prohibited activities (Mackie et al., 2017:8). The term Marine Protected Area is defined by the IUCN (2016:4) as:

“Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment”.

However, these MPAs are subject to what Hardin (1968) termed the tragedy of the commons. In this scenario, all users of an MPA benefit from conservation efforts of other users irrespective of making a contribution or not (Sell & Son, 1997:122). This is called the free-rider problem, where the MPA gives access to all and cannot finance its running costs and environmental costs. The end result is an MPA with inadequate funding to pay its staff and implement its conservation strategies. One of the ways to ensure sustainable use of marine resources by all types of users is in applying the user-payer principle, which is a neoclassical economic instrument for environmental conservation (Peters & Hawkins 2009:220).

The user-payer principle advocates that the user pays for the environmental cost of using a certain resource, and this ensures that the environmental externalities are included in the costs for private
use of the resource (Santilli, 2013:110). By paying for conservation, scuba divers, as users of the MPA, will help to fund the MPA’s strategies towards marine life diversity and preservation. Furthermore, the idea of sustainable diving is funded in order to resolve the problems of intergenerational equity so as to encourage economic growth, environmental protection and social justice (Akama & Kieti, 2007:735).

Given that MPAs are common pool resources, the willingness to pay for conserving this common pool resource forms a central aspect in sustainable resource management and to this study. This paper investigates the user-payer principle for the use of an MPA by scuba divers, which maximises the benefits associated with diving and mitigating the depletion of marine life and other oceanic resources on which the diving experience depends. This is an area that is vital in pushing for sustainable marine life and oceanic resources, and yet so poorly studied in the European context, with revenues generated from fees that could be used to improve conservation efforts. In addition, a user fee may also serve as a tool to control the number of visitors so as to minimise marine life and oceanic damage. Therefore, this can aid in the environmental, economic and social sustainability of the European diving systems. According to McClanahan et al. (2006:1408), successful conservation of marine life improving and sustaining the marine ecosystem, for instance fish biomass and marine life cover, and sustaining ecosystem resilience to outside pressures.

This paper analyses Portofino MPA in Italy. This site was chosen because it offers an abundance of red corals, and one of the most diverse groupers, barracudas and moray eels. Portofino MPA is highly representative of diving systems in a European context and a coral-reefs context, thus paving the way for future translation to other locations (Green Bubbles, 2015:6). Besides these reasons, the research at this dive site can shed light on the differences in willingness to pay for marine conservation by scuba divers in Europe and their reasons for not being willing to pay. To achieve the main goal of sustainable scuba diving in Europe, this article provides insight into the economic viability of imposing a levy for conserving marine life in Portofino MPA.

This article is organised as follows: Section 3.2 gives a brief background of the marine life degradation and the tragedy of the commons; Section 3.3 discusses the data and the contingent valuation method; Section 3.4 presents and discusses the results and Section 3.5 gives the conclusion and recommendations.

3.2 Background

Diving destinations attract scuba divers for different reasons, depending on the quality of the diving experience and dive site (Hammerton et al., 2012:77). A good quality dive site relies on a
healthy sustainable marine environment. Coral ecosystems around the world sustain roughly 850 million people living within 100 km of coral reefs, who derive benefit from reef productivity such as food, employment, coastal protection and tourism (Burke et al., 2011:11). Because local economies around marine protected areas have a high dependence on tourism, it is essential that reefs and marine life are sustainable.

Since marine protected areas are common pool resources, they are plagued by the tragedy of the commons. Theory shows that open access in MPAs results in overconsumption and underinvestment (Tornell & Verlasco, 1992:1209). This is because, with unrestricted access to the MPA, each user is locked in a system that encourages them to maximise their utility without limit in a finite MPA (Hardin, 1968:1244). In the analogy postulated by Hardin (1968), he gave an example of a piece of land accessible to every farmer, but with a finite source of grass for grazing so that every rational farmer becomes a self-interest seeker to maximise their own cattle’s grazing before the pasture is depleted (Holden, 2005:340).

Some literature challenges Hardin’s tragedy of the commons, advocating that common pool resources are not always open to all but rather restricted to a defined group of users, and that a rational user can foresee the long-term distraction of overuse and therefore regulate their behaviour to ensure sustainable resource use (Kagi, 2001:10). Contrary to this view, recent statistics show that mass mortality of marine life, including coral reefs, is caused by overfishing, land based sedimentation, physical damage, mass tourism, global climate change, ocean acidification, an increase in the frequency and intensity of hurricanes (Perera-Valderrama et al., 2016:17), coral predation by crown-of-thorns starfish, water pollution from terrestrial runoff and dredging, destructive fishing, coastal development and cyclones (De’ath et al., 2012:17995).

The fragile marine life ecosystem is also threatened as a result of direct and indirect impacts of irresponsible scuba diving activities (Medio et al., 1996:90). Depletion of marine life leads to a net decline in fish abundance, indicating increased mortality or relocation of fishes to alternate habitats (Hasler & Ott, 2008:1789). Direct diver contact has been reported in several studies, for example, kicking colonies with fins, trampling, holding, kneeling on benthic organisms and by hitting colonies with loose equipment; most damage involves colony breakage through fin kicks (Hasler & Ott, 2008:1789; Tapsuwan & Asafu-Adjaye, 2008:432; Camp & Fraser, 2012:30; Lucrezi et al., 2013:53).

Therefore, since the principle problem with common pool resource management revolves around exploitation and degradation of the resource, it is imperative to encourage all stakeholders, including businesses, the community, the users of the resource and the government, to cooperate to sustain a marine protected area. This involves creating economic incentives for stakeholders
as well as encouraging cooperative resource management to reduce the risk of resource depletion (Yabuta et al., 2014:5).

Many MPAs are reported to only exist on paper, because their management plan is not being actively implemented (Hoyt, 2009:696). Empirical studies have shown that this can be avoided by making the management of the MPA a participatory process for the community (Chiriko et al., 2017:2), the government and local businesses (Chao, 2018:123). This will help to avoid it being a top-down, outside influence regulation (because it can foster conflict and resistance), and rather promote an adherence to the management plan through co-management (Hoyt, 2009:702; 2018:123, Huang & Huang, 2015:88).

Since MPAs are specifically intended to limit human activities at particular locations, one of the main impacts of MPAs on marine ecosystems is the reduction of harvesting, which reduces mortality and which, in turn, should generate larger body sizes, increases in abundance and greater fecundity (More et al., 2006:1750). This reduction of harvesting translates to a reduction in household income for the subsistence local fishers around the MPA. Therefore, developing co-management encourages mutual coercion as a tool that is necessary in inspiring sustainable behaviour in common pool resource users (Holden, 2005:342). Co-management of the MPA is thus believed to establish a sense of responsibility, increase compliance with conservation measures and reduce conflicts among MPA users (Rosendo, 2011:55). Therefore, the success of an MPA not only depends on environmental improvement but also local support (Camp & Fraser, 2012:30).

Although implementation is key to the success of an MPA, without proper funds to hire staff to monitor the area, nothing can be accomplished (Gilburg, 2013). In this way, inadequate funding of MPAs is the main cause of their failure. Without sustainable funding, it is difficult to effectively control and impose rules and regulations within an MPA. This problem is even worse in developing countries where daily subsistence fishing or farming take priority over sustainability of the ecosystem (Daly, 2013:1)

MPAs are reported to often be difficult to justify on financial grounds, especially when compared to other funding needs in a country such as health care and infrastructure (Depondt & Green, 2006:189). MPAs traditionally rely on several sources of funding, including central government subversions, and donor funding and trust funds, but all are subject to unpredictable fluctuations and are therefore unsustainable (Depondt & Green, 2006:189).

Thur (2010:64) confirms that the establishment of a MPA does not necessarily imply sufficient funding. From insufficient government funding for conservation in developing countries, to
promised donor support that never ceases to follow through with years and legislative appropriations and uncertainties for government funded MPAs, it is important to look towards self-financing mechanisms. Using dive tourism as a source of funding, in the form of diver user fees, is now widely recognised by MPA managers as an excellent way to enable self-financing (Pascoe et al., 2014:147).

The user-payer principle advocates that the user pays for the environmental cost of using a certain resource, and this ensures that the environmental externalities are included in the costs for private use of the resource (Santilli, 2013:110). User fees can come in a variety of different forms, ranging from a per-day access fee to an annual visitors pass (Lindberg, 2007:2). One disadvantage is that in some cases, collected user fees can be relatively low and insufficient to provide adequate financial resources to effectively manage the reserve; yet another concern is that high user fees could potentially result in tourists going to alternative destinations (Pascoe et al., 2014:147).

For user fees to be a sustainable source of financing, the fees must be based on the willingness to pay (WTP), as chosen in this study, (see section 2.5.1 for WTA) of the targeted users of the MPA (Thur, 2010:63). This allows the user fee to maximise on a potential revenue source that will spread the environmental costs among this user group aids in the fair spreading of costs (Peters & Hawkins, 2009:220). 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, ultimately driving tourists to substitute sites that have lower fees or no fee at all. Though this could reduce park visits, overestimation can be advantageous if the extra revenue is channelled towards improving the MPA (Peters & Hawkins, 2009:220). Without the data provided by a WTP study, MPAs could stand to lose the very users needed to help economically sustain the MPA, especially if there are close substitutes, such as another nearby park or recreational site (Lindberg, 2007:2).

Although the system of user fees presents disadvantages, notably with regard to fee collection and possible conflicts with conservation goals, revenues from diver user fees remains critical for the sustainable management of many MPAs. The important potential for this source of funding has been revealed by many WTP studies, which show that divers are prepared to accept significant charges to use resources within protected areas and in so doing, contribute to the conservation of marine habitats (Depondt & Green, 2006:189; Peters & Hawkins, 2009:220; Thur, 2010:63).

For example, Mutsika et al. (2016:484) investigated the impact of environmental degradation and increase in local prices on visitor numbers. They found that the financial loss due to an increase in environmental degradation exceeds that of an increase in local prices. Therefore, they conclude
that increasing prices to reduce environmental degradation is a viable source of future funding for MPAs that do not already have it in place.

User fees have been implemented in many parts of South East Asia, although it is reported that these user fees are mostly significantly lower than willingness to pay approximations (ranging from $1 to $5 per diver), and therefore, there is room to increase user fees in these areas (Pascoe et al., 2014:151). Other empirical findings suggest that some divers who pay user fees that are higher than their willingness to pay, have no problem paying such an amount and this proves the effectiveness of the willingness to pay method in representing the divers’ true willingness to pay (Pascoe et al., 2014:151).

This paper investigates imposing a levy that scuba divers can pay to maximise the benefits associated with diving and mitigating the depletion of reefs and ocean life, based on their willingness to pay. The current generation of divers have different perceptions and attitudes towards marine life and the consequences of their actions towards it. It was observed by Ojea and Loureiro (2007:807) that these different perceptions are also influenced by the divers’ background and level of knowledge about the environment. Therefore, it is important to understand that divers’ willingness to pay will not only be influenced by their level of economic affordability but also by their characteristics and attitudes.

3.3 Methodology

3.3.1 Study area

The area under analysis for this research is the Portofino Marine Protected Area. The neck of Portofino is characterised by a rough coastline, steep seabed and high indices of rich biodiversity, according to LaMesa et al. (2011:25). It is situated on the north-western coast of Italy (see Figure 3.1) and was established in 1998 by the Italian government (Salmona & Verardi, 2001:39). The town is mainly an affluent tourist resort area attracting the rich, and the present economy is almost entirely based on onshore and offshore tourism (Salmona & Verardi, 2001:41). Its establishment was controversial, as the local community feared that the strict controls that come with a marine park would reduce tourism in the area – the main source of income for locals.
Figure 3.1: Map of Portofino MPA.
Credits: Marco Palma

The area hosts activities such as yachting, snorkelling, recreational fishing, sunbathing, shopping and culinary tourism to name a few (Lucrezi et al., 2017:387). The MPA includes a “no entry-no take” area that is referred to as zone A or integral reserve, two “entry regulated-take regulated” zones (B) and two buffer zones (C) as shown in Figure 3.1 (Salmona & Verardi, 2001:41; Venturini et al., 2017:383).

This site was chosen because the Portofino MPA is known for its diverse groupers, barracudas and moray eels, and it is representative of diving systems in a European context and a marine life context, thus paving the way for future translation to other locations (Green Bubbles, 2015:6).

3.3.2 Survey and data collection

The empirical study consists of data collection from the Portofino MPA (Italy) using the contingent valuation method (CV). The survey (see Appendix B for the full questionnaire) was in the form of a willingness to pay questionnaire (upper and lower bounded dichotomous choice questionnaire), also known as the double-bounded dichotomous choice contingent valuation method (DDCCVM), designed according to the NOAA (National Oceanic and Atmospheric Administration) regulation written in Arrow et al. (1993:4604). The different choice questions were well described and clearly understood by the respondents as motivated by Laarman & Gregersen, 1996:247.

The survey included three questionnaires distributed using random sampling, each consisting of a different starting bid. This was designed to eliminate starting point bias, which is one of the
problems of CVM, and to increase the efficiency of the statistical results when estimating the willingness to pay amount as explained in Chilton (2007:664). The part of the survey containing questions on the contingent evaluation method, was phrased as follows:

MPAs are falling short in achieving their conservation targets because of inadequate funds. The Portofino MPA Authority is responsible for safeguarding its extraordinary marine biodiversity and ensuring a sustainable use of its natural resources at the local scale. In light of the threats facing the MPA (listed above), an option is to introduce a diving user fee, which will go towards the Portofino MPA Authority, to maintain and improve your diving experience. Would you be willing to pay €5 (or other bid amounts, see Figure 3.2) per dive to the Portofino MPA Authority? This bid amount would be an additional amount paid per dive.

![Diagram of Questionnaire Logic](image)

**Figure 3.2:** Questionnaire logic.
(Source: Own compilation)

The starting bids were based on research by Asafu-Adjaye and Tapsuwan (2008) on the Mu Ko Similan Marine National Park in Thailand. According to Hanley and Wright (2005:234), researchers can compile questionnaires by either following insights from past studies or through pilot studies. The questions used in the survey were extracted from past surveys of similar willingness to pay studies, therefore the questionnaire was not a new design, simply a new application. Four expert divers who dive in Portofino were asked to review the questionnaire to ensure that the statements and questions are clear. When the respondent accepted the starting bid, the next question would offer a higher amount, but when the respondent had rejected the starting bid, the next question would offer a lower amount as shown in Figure 3.2.

In the case that the respondent had rejected both the starting and the lower bid, the next set of questions required that the respondent ranks the reasons for not accepting it, from most important to least important:
1. I already pay tax and conservation must be funded by the government;

2. Why should I pay when other users of the MPA don’t;

3. It’s too expensive and;

4. Other reasons (which the respondent was asked to write down).

These questions were asked as a control to make sure that the reasons for not accepting the bids were not because of protest behaviour. These reasons were based on research from Meyerhoff and Liebe (2006:585).

Apart from the questions of willingness to pay, the questionnaire included questions regarding the respondents’ demographic and socio-economic characteristics, such as gender, age, language, level of education, marital status and country of origin (which was controlled for by using a foreigner dummy, though the majority of divers in Portofino are Itaians). The questionnaire also had questions on the level of diving certification, number of dives logged and years the respondent has been diving, as well as the respondents’ views on the possibility of user fees. The inclusion of these control variables are based on work by Oh et al. (2005), Togridou et al. (2006) and Asafu-Adjaye and Tapsuwan (2008). Oh et al. (2005:263) especially found satisfaction with the diving experience and education to be significant predictors of WTP, while Asafu-Adjaye and Tapsuwan (2008) show that income, country of origin, age and the number of dives play a significant role in predicting WTP. Togridou et al. (2006) also found income to positively influence WTP and the estimated yearly revenue that could be collected from user fees in the National Marine Park of Zakynthos being enough to cover the operating costs of the park.

Table 3.1: Variable description.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidi</td>
<td>Starting bid amount in euros proposed to each respondent</td>
</tr>
<tr>
<td>Male</td>
<td>Dummy variable equal to 1 if respondent is a male; 0 if female</td>
</tr>
<tr>
<td>age_range</td>
<td>Age in years grouped into 5 categories: 1 if &lt;30, 2 if 30-39, 3 if 40-49, 4 if 50-59 and 5 if &gt;59.</td>
</tr>
<tr>
<td>education</td>
<td>Level of education: (1) high school, (2) diploma, (3) degree, (4) post-graduate degree and (5) other.</td>
</tr>
<tr>
<td>dive experience</td>
<td>Rating of their diving experience (i.e. level of satisfaction with diving at Portofino MPA) using the scale (1) poor, (2) fair, (3) good, (4) very good and (5) excellent.</td>
</tr>
</tbody>
</table>
The variables shown in Table 3.1 were included in order to control the influence that socio-economic factors of the scuba divers may have on willingness to pay. Gender and age were included to capture the demographics and how they affect the divers’ willingness to pay; education is included as a proxy for income that affects ability to pay; and dive experience at Portofino, also to control for satisfaction with the MPA. Dive experience measured the level of satisfaction the divers realised after diving at Portofino MPA, and this required divers to rate on a five point Likert scale from excellent to poor. Dummy variables were coded to control for the nationality of the divers and gender.

Additional variables tested for inclusion include those relating to the proficiency of the diver. The number of years that the respondent has been diving and the number of dives logged were tested for inclusion, but were not statistically significant and therefore disregarded. To control for possible non-linearities in the age and education variables, a squared age and education variable were coded and included in the estimations.

The peak dive seasons for Portofino are from June to September every year. Therefore, the survey was carried out in between June and July 2016, over a period of thirty days. The questionnaires were distributed randomly (to ensure that each diver has an equal chance of participating) to divers who were willing to participate in the survey. To ensure a representative sample, the questionnaire was administered to divers across eight different dive operators in each area from morning to evening during the high season months. A total of 442 completed surveys were received. Considering the population of divers in Portofino as estimated in Lucrezi et al. (2018:90) and Cerrano et al. (2017:303) of 10 000 scuba divers, a sample of 442 divers gives a 4.56% margin of error using a 95% confidence level.

### 3.3.3 Contingent valuation

Over the years, economists have established and advanced a series of techniques for calculating the value of the non-market goods and services. Such non-market valuation methods are divided into revealed and stated preference methods, subject to whether they are based on existing markets or constructed hypothetical markets (Morgas et al., 2006:6). Contingent Valuation Methods (CVM) are found under the stated preference family of methods, as shown in Figure 3.3.

In a contingent valuation method, respondents are asked their maximum willingness to pay (WTP) for a predetermined increase in the quality of a good or resource (Morgas et al., 2006:7). In this...
case, scuba divers where asked for their willingness to pay for conservation of coral reefs in a MPA. CVM has been used to estimate the value of a wide variety of environmental resources and this type of CV method is chosen mainly because it is more efficient and less biased than other CV methods, for instance, it increases accuracy through a tighter confidence interval to the statistics (Peters & Hawkins, 2009:221).

**Figure 3.3:** Non-use value methods.
(Source: Own compilation)

However, the application and use of this method has been subject to criticism when it comes to producing accurate and reliable estimates of willingness to pay. For instance, Diamond and Hausman (1994:46) argued that there is a tendency of not being able to deliver reliable and accurate responses from the respondents because of what they called the “embedding effect.” This is described as the tendency of willingness to pay responses to be highly similar across different surveys, even where theory suggests that the responses be very different.

Critics have also debated about the use of mean or median measures as efficient estimators of willingness to pay (Duffield & Patterson, 1991:227), and the advantages and disadvantages of using the single, double or triple bounded dichotomous contingent methods (Hanneman et al, 1991:1256) among other things. Nevertheless, this study makes use of the double bounded dichotomous design because of its efficient estimation of willingness to pay under the assumption that there is a single valuation function behind both answers. This is because the follow-up bid amount of a double bounded dichotomous questionnaire avoids inefficiencies from increased observations of initial bid values that are not relevant (Kanninen, 1993:145), and gives an upper
and lower bound interval of the respondent’s unobserved true WTP (Hanemann et al., 1991:1257).

Using the double dichotomous questionnaire, given a predetermined bid amount ($t_i$ that varies randomly across the different respondents), the respondent’s answer $i$ is captured as either $y_i = 0$ if the answer is no and $y_i = 1$ if the answer is yes. According to Lopez-Feldman (2012:3) the linear equation assumed to estimate the willingness to pay is:

$$WTP_i(Z_i, u_i) = Z_i \beta + u_i$$  \hspace{1cm} (3.1)

In equation 3.1, $Z_i$ is a vector of explanatory variables, $\beta$ is a vector of parameters and $u_i$ is the error term. Asking a willingness to pay for a second bid makes the second bid endogenous because the amount depends on the answer from the first bid question.

### 3.3.3.1 Econometric model

If only one bid is presented to a respondent, the WTP is estimated using the probit model. The dependent variable ($y_i^*$) is not observed and is defined by a dummy variable ($y_i^*$) which is equal to 1 if $y_i^* > 0$, and 0 otherwise. If the regression model is specified as (Maddala & Lahiri, 2009):

$$y_i^* = \beta_0 + \sum_{j=1}^{k} \beta_j z_{ij} + u_i$$  \hspace{1cm} (3.2)

and if we observe $y_i^*$, the $\beta$’s can be estimated, assuming that the variance of the error term is equal to 1. Defining $F$ as the cumulative distribution function of the error term, this implies that:

$$Prob(y_i = 1) = F[\beta_0 + \sum_{j=1}^{k} \beta_j z_{ij}] = F(Z)$$  \hspace{1cm} (3.3)

The probit model is estimated by maximising the likelihood function of $F(Z)$. The WTP is given by $-z_i^\prime \hat{\beta}$. Lopez-Feldman (2012) shows that the same principles can be applied when more than one bid is offered to respondents.

Assuming that $y_i^1$ and $y_i^2$ are the dichotomous variables that capture the divers’ responses to the first and second bid, the probability that a diver responds with a yes or no can be shown as:

$$Pr(y_i^1 = 1, y_i^2 = 0|x_i) = Pr(s, n)$$  \hspace{1cm} (3.4)

The right hand omits that the probability is conditional on the values of the explanatory variables. Assuming that $WTP_i(x_i, u_i) = z_i^\prime \beta + u_i$ and $u_i \sim N(0, \sigma^2)$, the following four possible cases is a possibility (Lopez-Feldman, 2012):

- $y_i^1 = 1$ and $y_i^2 = 0$ (i.e. yes-no).
- $y_i^1 = 1$ and $y_i^2 = 1$ (i.e. yes-yes).
- $y_i^1 = 0$ and $y_i^2 = 1$ (i.e. no-yes).
• \( y_1^i = 0 \) and \( y_2^i = 0 \) (i.e. no-no).

Lopez-Feldman (2012:12) shows how to construct a likelihood function that will allow the estimates of \( \beta \) and \( \sigma \) using maximum likelihood, which will allow for an estimation of WTP. The results from the survey will be used to estimate the mean amounts that scuba divers are willing to pay for marine protection. The \( \hat{\beta} \) estimate is the WTP amount. With the inclusion of control variables, the WTP is given by \( z' \hat{\beta} \). The \( z' \) is the vector with the values of interest for the explanatory variables (Lopez-Feldman, 2012:5). Several studies have used a dichotomous or double-bounded choice contingent valuation method for willingness to pay, including:

**Asafu-Adjaye and Tapsuwan (2008:1129)** surveyed 421 respondents in Mu Ko Similan Marine National Park in Thailand 2004, to find out scuba divers’ willingness to pay for efficient park management. Their analysis used a logit model to estimate a DDCCVM and found that there is bid amount sensitivity and the greater the dive experience, the less the willingness to pay.

**Brouwer et al. (2016:202)** conducted a public willingness to pay study for improved MPA management in the Netherlands for the North Sea using a sample of 1190 from a mail survey and 390 from a beach survey in 2006. The logit model was used to estimate a DDCCVM, and the results showed willingness to pay and bid amount sensitivity.

**Lee and Yoo (2016:123)** surveyed 1000 people in 2012 at Gogunsan Marina Port in Korea to find out the public economic value of the port. The study used the maximum likelihood estimation technique and the Monte Carlo simulation technique to analyse the DDCCVM questions and the results showed bid amount sensitivity and a high protest vote because respondents felt that they already pay too much in taxes.

**Hall et al. (2002:335)** surveyed 220 visitors in Orange County, Southern California USA, on their willingness to pay for officers to patrol for protection of non-commercial rocky inter-tidal resources. Using a double-bounded logit model to analyse the DDCCVM, the results showed that regional visitors had a higher willingness to pay.

**Walpole et al. (2001:218)** surveyed 465 visitors in Komodo National Park in Indonesia in 1995 to find out the willingness to pay for an increase in entrance fees. The logit model results that analysed the DDCCVM showed bid sensitivity and a general willingness to pay.

### 3.4 Results

#### 3.4.1 Descriptive results

The data was first analysed using SPSS to get the characteristics of the sample. These are shown in Table 3.2. From Table 3.2 it is evident that most respondents in Portofino were residents (89%).
It also shows that scuba diving is still a male dominated activity, with 70.0% in Portofino. The sample demographics in this sample of Portofino divers correspond with that of Lucrezi et al. (2017:399) and since the sample of 442 divers gives a margin of error of less than 5%, using 95% confidence interval, this sample be deemed adequate for the analysis.

The largest categories of divers in Portofino were between the age of 40 to 49 (36%). Table 3.2 indicates that the largest groups of the respondents had obtained a diploma or a degree (35% and 30% respectively%), followed by a post-graduate qualification (17.0%).

**Table 3.2: Descriptive statistics.**

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian</td>
<td>89%</td>
<td>354</td>
</tr>
<tr>
<td>Foreigners</td>
<td>11%</td>
<td>41</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>30%</td>
<td>128</td>
</tr>
<tr>
<td>Male</td>
<td>70%</td>
<td>301</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>17%</td>
<td>71</td>
</tr>
<tr>
<td>30-39</td>
<td>21%</td>
<td>88</td>
</tr>
<tr>
<td>40-49</td>
<td>36%</td>
<td>151</td>
</tr>
<tr>
<td>50-59</td>
<td>22%</td>
<td>90</td>
</tr>
<tr>
<td>60+</td>
<td>5%</td>
<td>19</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>15%</td>
<td>63</td>
</tr>
<tr>
<td>Diploma</td>
<td>35%</td>
<td>149</td>
</tr>
<tr>
<td>Degree</td>
<td>30%</td>
<td>129</td>
</tr>
<tr>
<td>Post-graduate degree</td>
<td>17%</td>
<td>73</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>15</td>
</tr>
<tr>
<td><strong>MPA awareness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>99%</td>
<td>413</td>
</tr>
<tr>
<td>No</td>
<td>1%</td>
<td>5</td>
</tr>
<tr>
<td><strong>Diving experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1%</td>
<td>4</td>
</tr>
<tr>
<td>Fair</td>
<td>1%</td>
<td>6</td>
</tr>
<tr>
<td>Good</td>
<td>20%</td>
<td>82</td>
</tr>
<tr>
<td>Very Good</td>
<td>45%</td>
<td>194</td>
</tr>
<tr>
<td>Excellent</td>
<td>32%</td>
<td>138</td>
</tr>
<tr>
<td><strong>Average dives logged</strong></td>
<td>485.7 per year</td>
<td></td>
</tr>
<tr>
<td><strong>Average years diving</strong></td>
<td>7.2 years</td>
<td></td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td>442 respondents</td>
<td></td>
</tr>
<tr>
<td><strong>Response scale</strong></td>
<td>5-point Likert</td>
<td></td>
</tr>
</tbody>
</table>

When asked whether they were aware that they were diving in a MPA, most of the divers said yes (99%). In terms of how they rated their diving experience measured as the level of satisfaction
they received from diving at Portofino MPA on a five-point scale from poor to excellent, most divers rated it as very good to excellent. This shows that diving in Portofino is generally a very good experience.

3.4.2 Willingness to pay results

The next step involved the data being extracted from excel and imported into STATA. STATA is a data analysis and integrated statistics modelling software that was used to model a probit model in order to estimate the willingness to pay based on the initial bid. Table 3.3 gives a description of the respondents who indicated they are willing to pay the first amount shown to them. The 442 observations in the model are divided into four groups. Approximately 47.3% divers answered positively for the first bid at €5. Of those who were asked for €10 as the first bid, 20.41% answered yes and 10.20% answered yes to the first bid at €15. These results show that the divers are sensible to the bid amounts, because as the bid amount increased the proportion of divers who responded positively decreased. As expected, acceptance of the bid is higher for lower amounts (i.e. compare €5 to €15). These results confirm that the divers are generally sensitive to the bid amounts, because as the bid amount increased the proportion of divers who responded positively decreased. The results also show that when asked the first bid, on average, most of the divers in Portofino are not willing to pay (73.98%) and this echoes the literature that says divers often believe that access should be free, according to Peters and Hawkins (2009:220). Though most divers are not willing to pay, it is still relevant to find out if the unwillingness to pay is because the bid is too expensive or if it is a protest vote and the reasons behind the protest.

Table 3.3: Answers to first bid question

<table>
<thead>
<tr>
<th></th>
<th>€5</th>
<th>€10</th>
<th>€15</th>
<th>Average percentage willing to pay first bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>52.70%</td>
<td>79.59%</td>
<td>89.80%</td>
<td>73.98%</td>
</tr>
<tr>
<td>Yes</td>
<td>47.30%</td>
<td>20.41%</td>
<td>10.20%</td>
<td>26.02%</td>
</tr>
<tr>
<td>Total</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

When using the probit model, the amount scuba divers are willing to pay is €4.13. However, to account for the second amount shown to the divers (either higher if he/she accepted the first bid or lower if he/she rejected the first bid), the doubleb command, which is a modified ordered probit model (Lopez-Feldman, 2012:12) was used in STATA. This captures the second bid for a double-bound dichotomous contingent model. Table 3.3 also shows how respondents reacted to the second bid and again, lower amounts were more readily accepted by divers than higher amounts, thus showing bid sensitivity. This corresponds with the findings in Lee and Yoo (2016:123).
The next step is to calculate the willingness to pay with and without the explanatory variables, first using a normal probit model. The result is shown in Table 3.5 (second column), where the bidi variable is statistically significant, reflecting that as the bid (i.e. price) goes up the probability of a positive answer goes down. The willingness to pay was also calculated for the first bid model with no explanatory variables, and the result was €4.13. The third column shows the first double-bounded result, where both bids were taken into consideration, but also with no control variables. The constant of the beta equation indicates the WTP and this is €6.63. Therefore, without controlling for factors that may affect the willingness to pay, the respondents were willing to pay €6.63 on average (see Table 3.5) when presented with the first and follow-up bid.

To look at how the willingness to pay is altered by introducing explanatory variables to the first bid model, the variables gender (in the form of a male dummy), age, education, diving experience, nationality (in the form of a foreign dummy) were used. These explanatory variables were chosen based on the survey and the recommendations as possible control variables that are likely to affect willingness to pay, based on Togridou et al. (2006:309). The results are shown below in Table 3.5. Beta is the constant measuring the vector of coefficients related to each explanatory variable and sigma is the coefficient for the variable capturing the amount of the bid.
However, when the explanatory variables were included, the model showed mixed results in terms of their significance. None of the control variables are significant at 5% level, thus the results cannot be generalised.

Though none of the variables in Figure 3.5 are statistically significant, some comments will be made about the relationship. Gender is not significant; males are willing to pay less than females. The results show that younger divers are more willing to pay than older divers are, although the relationship is non-linear and therefore reaches a minimum point. Arin and Kramer (2002:180), and Asafu-Adjaye and Tapsuwan (2008:1127) also found that age had a negative relationship with willingness to pay, because the probability of willingness to pay was decreasing with age. Younger divers were more willing to pay conservation, and the resistance from older divers could be because they were used to not paying user fees. Furthermore, education also shows a non-linear relationship, with increased levels of education associated with higher WTP amounts, but also reaching a maximum before declining again. The study by Arin and Kramer (2002:180) in the Philippines also showed a positive relationship between education and willingness to pay.

Dive experience is positive, indicating that a better experience is associated with positive willingness to pay amounts. This does not correspond with the results in the Asafu-Adjaye and Tapsuwan (2008:1127) study in Thailand where a higher dive experience is associated with a lower willingness to pay, which could be a reflection of diminishing marginal returns as scuba divers experience reduced utility with increased dive experience. However, in the Oh et al. (2005:263) study, dive experience also showed to have a positive relationship with willingness to pay.

Table 3.6 compares the WTP estimates. The first WTP amount is the amount where only the initial bid is considered; the second is the WTP using both bids but with no added control variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>education_squared</td>
<td>0.0717</td>
<td>(0.264)</td>
</tr>
<tr>
<td>dive experience</td>
<td>0.0771</td>
<td>(0.423)</td>
</tr>
<tr>
<td>Foreign</td>
<td>-0.138</td>
<td>(1.140)</td>
</tr>
<tr>
<td>Sigma_cons</td>
<td>5.874***</td>
<td>0.308</td>
</tr>
<tr>
<td></td>
<td>5.769***</td>
<td>(0.324)</td>
</tr>
<tr>
<td>Pseudo R² (for probit)</td>
<td>0.109</td>
<td></td>
</tr>
<tr>
<td>Wald chi² (LR chi² for probit)</td>
<td>55.18</td>
<td></td>
</tr>
<tr>
<td>Prob&gt; chi²</td>
<td>&lt;0.0001</td>
<td>0.9874</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-225.7853</td>
<td>-545.3292</td>
</tr>
<tr>
<td></td>
<td>-471.0464</td>
<td>386</td>
</tr>
</tbody>
</table>

N 442

Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001
The third amount is the mean calculated from the model with control variables. It is evident that it does not differ much from the third WTP amount and, since none of the control variables were significant, this result was not surprising.

**Table 3.6: Willingness to pay results.**

<table>
<thead>
<tr>
<th></th>
<th>WTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>First bid only WTP</td>
<td>4.13***</td>
</tr>
<tr>
<td>Without control variables</td>
<td>6.635***</td>
</tr>
<tr>
<td>Mean WTP</td>
<td>6.777***</td>
</tr>
</tbody>
</table>

* p<0.05; ** p<0.01; *** p<0.001

Using the mean values, the results show that with control variables, the divers’ mean willingness to pay is €6.78. Assuming that the dive population in Portofino is 10,000 divers who dive an average of 2 or 3 dives, according to Lucrezi et al. (2018:90) and Cerrano et al. (2017:303), then (20,000 to 30,000 dives x €6.78 would give an annual revenue of €135,600 - €203,400 to the Portofino MPA. It is interesting to note that in Portofino, Italians are a bit more willing to pay for conservation than the non-Italians who dive there. Though the difference is little, this contradicts the results in the study by Yeo (2005:116) in Malaysia where foreign visitors were more willing to pay than the local visitors were. This could perhaps be because Portofino is located in an affluent town in a developed country and so foreigners are less obliged to pay more.

A similar study by Asafu-Adjaye and Tapsuwan (2008:1129) at the Mu Ko Similan Islands in Thailand, using the double dichotomous contingent method resulted in a willingness to pay $27.07 per dive, which translates to €23.25 (using €1 = $1.16). Walpole et al. (2001:218), using the double-bounded dichotomous method, found $11.70 to be the visitors’ mean willingness to pay in Komodo National Park in Indonesia, which translates to €10.08 (using €1 = $1.16). Lee and Yoo (2016:123) at Gogunsan Marina Port in Korea, also used the double-bounded dichotomous method and found that visitors were willing to pay $1.60 per year, which translates to €1.38 (using €1 = $1.16). Another similar analysis of Brouwer et al. (2016:202) found €87.50 to €109.90 as an acceptable annual public mean willingness to pay amount for improved MPA management in the North Sea, in the Netherlands.

In studies that used other valuation methods, Uyarra et al. (2010:521) used an open-ended contingent valuation method at the Bonaire National Marine Park (famous for its successful implementation of user fees to finance the MPA), and found a mean willingness to pay per year amount of $33.50, which translates to €28.79 (using €1 = $1.16). In Philippines at the Tubbataha Reef National Marine Park conducted in 1999, the mean willingness to pay (using close-ended CV method) per live-aboard dive trip for access to scuba dive was $41.11, which translates to €35.33 (using €1 = $1.16) (Tongson & Dygico, 2004:17). The average dive trip includes three
days of scuba diving. In the Bays of Hualtulco in Mexico, the mean willingness to pay for conservation was $48.40, which translates to €41.60 (Robles-Zavala, 2016:135).

It is probable that the differences in the willingness to pay amounts across these studies may be because of differences in the contingent valuation scenarios and the bid elicitation mechanisms (Asafu-Adjaye and Tapsuwan, 2008:1129), and perhaps because the other study sites are located in developing countries and foreigners have a high willingness to pay for conservation in developing countries. For example, Peters and Hawkins (2009:220) acknowledge the WTP differences that can exist between local residents and foreigners, such that two-tier pricing fees are implemented where foreigners pay a higher user fee than locals in developing countries. Another reason for the difference in WTP amounts is that some of the studies calculated an annual amount, while others for a 3 days (±6 dives) amount. These studies show that scuba divers are willing to pay for conservation, although the methods, amount differs with each dive site, and this is echoed in the findings of Peters and Hawkins (2009:225), which compares willingness to pay in different dive sites around the world.

3.4.3 Protest vote

The responses to the willingness to pay included some who did not reflect an answer to the bids; this is known as the protest vote. The model above removed the protest vote from the analysis, however, for a robust check we then assumed that if the respondent did not indicate an answer then their answer is a no to the willingness to pay (i.e. \( y_i^1 = 0 \) and \( y_i^2 = 0 \)).

Those who answered no to both the proposed bids were asked to rank their reasons from a list of pre-determined reasons for protesting, from most important to least important. The reasons included:

- I already pay tax and conservation must be funded by the government;
- Why should I pay when the other users of the MPA don’t?
- It is too expensive;
- They were asked to state other reasons.

Figure 3.4 compares the reasons for divers’ unwillingness to pay for conservation
Figure 3.4: Protest vote results.

Approximately 146 divers in Portofino indicated that they are not willing to pay (“nn” option) at all. The results are shown in Figure 3.4 as percentages, and the percentage is calculated as the summation of a ranking of 1 (indicating most important reason) for each reason of protest divided by the total number of 1s allocated for all reasons. Most divers (45%) in Portofino do not want to pay because they believe it is the government’s responsibility to pay for conservation of the MPA, 27% because they think the bid amounts are too expensive, 13% because they feel that since users of the MPA do not pay, neither should they, and 15% for other reasons.

Literature on the protest vote explains that this vote is common in willingness to pay for environmental resource studies, mostly because some respondents feel they do not need to pay for a resource that was otherwise free for use, and not necessarily because they regard the environmental upgrade as valueless (Alban et al., 2008:19; Meyerhoff & Liebe, 2006:583). This problem of the protest vote can be offset by using WTA method, where respondents will show value because of the endowment effect explained in section 2.5.1.

3.5 Conclusion

This paper investigated the user-payer principle for the use of an MPA by scuba divers, which maximises the benefits associated with diving and mitigating the depletion of reefs and other oceanic resources on which the diving experience depends, using estimates of WTP. The paper furthermore investigated the divers’ WTP and the factors that influence it in Portofino, Italy, in order to contribute to the broader debate of the sustainable use of resources. Sustainability has been topical over the years because of the high levels of destruction caused by different factors, including human activity.
Data were collected from the Portofino MPA in the Liguria province, north-west of Italy. A double dichotomous contingent method was chosen because of the relatively efficient results it produces in stated preference contingent scenarios. The initial bid estimated a mean willingness to pay of €4.13 in Portofino, amounts which increased with the inclusion of the second bid and control variables. The estimated mean willingness to pay for Portofino is €6.78. This estimate can be viewed as a maximum amount that the MPA can charge divers for contribution towards conservation. This estimate is a positive contribution that gives MPA management a guideline as to the value of conserving the MPA and the potential revenue that can be collected towards the conservation of Portofino MPA.

Results of this study have shown similar and contrasting characteristics compared to other studies. In Portofino, scuba diving is a male dominated activity that is mostly engaged by divers who are between the age of 40 and 49. The results also showed that most divers in Portofino are locals. Willingness to pay has a positive relationship with age and education, although the relationship is not linear.

Our most compelling result is that these divers, however, generally have a low willingness to pay for user fees and this can be attributed to the fact that they do not consider their actions whilst diving as having a damaging effect on sea mortality and marine life.

The study also found that willingness to pay is amount-dependent and increasing the size of the bid resulted in a decrease in willingness to pay, therefore showing that fees for conservation have an inverse relationship with WTP, with an increase in price leading to a decline in WTP.

These findings provide new insights into the biographical profile of scuba divers and how scuba divers view marine life conservation, which features they think are important and their opinions on who should pay for conservation. Most of the divers diving in the marine park are aware that it is a protected area that exercises conservation efficient practices and most of them rate their diving experience as very good to excellent.

In conclusion, charging user fees can go a long way in providing an income that marine protected areas can use to fund their initiatives towards sustainable marine life and reduce the financial constraints of managing a marine protected area. This decision should be taken with precaution considering the high protest vote and the possibility that results from a hypothetical WTP survey do not always translate into actual behaviour. Introducing a user fee could lead to the substitution effect where divers will opt to dive in other dive sites that do not have user fees, and the resulting decrease in divers will have a detrimental economic effect to the Portofino economy. The user fees could also be used to control the number of divers so as to reduce their effects of marine life.
While this study was beneficial in providing insight into the divers’ willingness to pay in Portofino, future research could expand this research into other diving sites in Italy to more fully analyse the willingness to pay for user fees in the region and the determinants thereof. Future research should also focus on divers’ environmental awareness and whether that influences their WTP.
CHAPTER 4 VALUING DIFFERENT ATTRIBUTES OF THE SCUBA DIVING EXPERIENCE AT PORTOFINO USING CHOICE MODELLING

Abstract

This article reports on the findings of a discrete choice modelling study to value environmental attributes for scuba divers in Portofino. The environmental attributes were divided into five different qualities that divers value including water visibility, diver crowding, species diversity, species number and the willingness to pay price. A d-efficiency design was used to calculate a practical number of choice sets. Using a self-administered choice questionnaire, divers were asked to state their choice over different choice sets with different combination of environmental attributes and a price representing the cost of having that combination of attributes. A sample of 556 completed questionnaires was collected. A multinomial logit model, conditional logit, nested multinomial logit and a multinomial probit model were estimated in STATA, to estimate scuba divers’ valuation of the environmental attributes at the Portofino MPA.

Keywords: Choice modelling; common pool resources; willingness to pay; scuba diving; Portofino

4.1 Introduction

Decision-making involves a choice between two or more alternatives. A choice is a result of a sequential decision-making process where an individual or group of people define the choice problem, identify the alternatives, assess the characteristics of the alternatives, make a choice and then finally implement it (Ben-Akiva & Lerman, 1985:21). In a willingness to pay study, choice experiments are another type of a stated preference method that measures the value of the attributes of a good or service by asking their preference among different hypothetical alternatives (Langham, 2009:151).

Choice experiments derive their reasoning from utility theory, where an individual seeks to maximise their utility by choosing the best discrete choice alternative with respect to their beliefs and desires (Abley, 2000:1; Wittink, 2011:10). By making a choice, an individual is assumed to be stating a preference that yields their highest individual benefit, known as utility (Mangham et al., 2009:152).

Done in an open access resource scenario, such individualistic choices tend to result in the tragedy of the commons, a situation where many individuals share a limited open access resource, to an extent that each person’s profitable use leads to the depletion of the resource for everyone else (Hardin, 1968). MPAs are an example of an open access resource that suffers from the tragedy of the commons as more pressure is exerted on its limited resources. MPAs are also categorised as a non-market good because of its free access characteristic, which does not
allow it to be traded in a typical market setting with private firms and market prices (Reynisdottir et al., 2008:1078).

Recent statistics from the World Bank (2018) report that the ocean and its resources contribute approximately US$1.5 trillion yearly in terms of value-added towards the global economy and more than 275 million people live within 30km of coral reefs (World Resources Institute, 2011:1). Estimates from UNEP (2018) report that 200 million people are directly and indirectly employed by the fisheries industry alone. However, the world’s coral reefs have been depleted by 25% to 50% in the last 30 years, an alarming occurrence that needs immediate solutions, especially in MPAs.

MPAs are designated areas that are established to regulate and manage oceans for the long-term conservation of marine biodiversity, marine ecosystem and its scarce resources. They are an important tool for maintaining the health of the oceans, and for avoiding further degradation (UNEP, 2018) that comes with the tragedy of the commons. This tragedy of the commons gives rise to the need for valuing these non-market goods so as to identify the investment/funding them for their conservation. One way of valuing non-market goods is through a willingness to pay study that values the environmental attributes of the ocean. Tisdell (2006) reports that willingness to pay for natural resources has been the most widely used indicator for estimating economic value of a resource. This study will employ a willingness to pay analysis using a discrete choice experiment to value the environmental attributes that are most important to divers at the Portofino MPA.

Identifying the attributes that divers value the most in the MPA, gives policy-makers detailed knowledge that can be used for policy and pricing. Schlereth et al. (2012:762) describe two views of willingness to pay: firstly, as a point estimate that reflects the optimal price that makes individuals indifferent between choosing and not choosing a product; secondly, as an interval because individuals rarely know with certainty the amount they are willing to pay and they conclude from a range of willingness to pay.

Using the user-payer principle, this paper aims to estimate a willingness to pay for changes in the attributes that are important for scuba divers in Portofino. This is paramount in pushing for sustainable marine life and yet so poorly studied in the Italian context. By doing this research, it is believed that the environmental, economic and social sustainability of the European diving systems can be achieved. This will be done by way of a stated preference method called choice modelling, where divers are presented with different sets of diving conditions (scenarios) from which to choose, each with a stated willingness to pay amount. With this method, the effect of
divers’ choices as the levels of the five different attributes change, will reflect which attributes the divers value the most.

This paper can contribute by informing policy about the environmental attributes that are valued the most by divers and recommend a selection of environmental restoration strategies in the MPA. The important attributes can be used to attract a higher user fee. Scuba dive operators could use the information to concentrate on improving the important attributes as a selling strategy in their marketing plan. Furthermore, revenues generated from the fees could be used to improve coral reef and marine conservation efforts.

The article is organised as follows: Section 4.1 is an introduction to the study and its objectives; Section 4.2 gives a brief background by discussing the choice modelling method and why it was chosen; Section 4.3 describes the study site and types of choice models used; Section 4.4 presents and discusses the results and Section 4.5 gives the conclusion and recommendations.

4.2 Background to choice modelling of non-market goods

People value goods and services differently according to their own beliefs and intentions. The theory of economic choice is rooted in the assumption that individuals’ market behaviour can be observed and analysed by maximising their preferences (McFadden, 1986:279). These preferences are subject to random components such as fluctuations in perceptions, attitudes and beliefs (Schlereth et al., 2012:762). However, demographic, socio-economic factors such as age, gender and income, can influence choices (Reynisdottir et al., 2008:1078), confirming that choices reflect the option that provides their maximum utility.

“An object can have no value unless it has utility. No one will give anything for an article unless it yields him satisfaction. Doubtless, people are sometimes foolish, and buy things, as children do, to please a moment’s fancy; but at least they think at the moment that there is a wish to be gratified.” These are the words of F.M Taussig (1912) as quoted in McFadden (1986:278).

Economic theory has formulated a series of techniques for calculating the value of the non-market goods and services. Such non-market valuation methods are divided into revealed and stated preference methods depending on whether they are based on existing markets or constructed hypothetical markets (Morgas et al., 2006:6). Stated preferences employ the following assumptions: (i) rationality in making choices, which means that respondents give each attribute a utility weight and then choose the option that has the highest total utility; (ii) all the important factors to the respondent about the resource are exhausted in the attributes and the attribute levels and; (iii) they rely on the concept of utility (Abley, 2000:14).
Stated preference methods include contingent valuation, attribute-based models, conjoint analysis, choice experiments and contingent ranking. Revealed preference methods include market price, travel cost, hedonic property price values and hedonic wage values (Tietenberg & Lewis, 2012). Discrete choice experiment is found under the stated preference family of methods and is one of the most widely used methods for valuing non-market goods, such as MPAs.

In a choice experiment, the survey requires individuals to make a choice among hypothetical scenarios (alternatives). The principle hypothesis in a choice experiment method is evaluating the impact of the probability of selecting an alternative over the other for all choice sets. For instance, measuring the probability of selecting alternative one of 7-12 divers, given the attribute “diver crowding”, or 19-24 divers as alternative two. By using a random utility framework, the probability is measured as a result of a diver’s inner evaluation of their satisfaction resulting from the given options in the choice set (with the assumption that it is contingent on the chosen levels and environmental attributes) (Vega & Alpízer, 2011:257).

To fit within a discrete choice context, these choice sets need to exhibit three characteristics: (i) they must be mutually exclusive, (ii) the alternatives need to be exhaustive, and (iii) the number of alternatives must be finite (Goodwin et al., 2018).

According to economic theory, discrete choice modelling corresponds with Lancaster’s (1966) new approach to the individual utility maximisation problem in consumer theory and with random utility theory (McFadden, 1974). In Lancaster’s method to consumer theory, individuals gain their utility not from the product as such, but rather from the resource’s environmental attributes. Following the random utility theorem, utility is considered an underlying concept that exists in the individual’s mind and cannot be observed directly (Vega & Alpízer, 2011:254).

Additionally, random utility theory assumes that this latent utility can be apportioned into two parts, that is, a systematic component and a random component. The latter part emerges as a result of the randomness in the respondents’ preferences in light of the fact that the attributes don’t cover the majority of the people's preferences (Vojáček & Pecáková, 2010:37).

Accordingly, the advantages of using discrete choice experiment are that they evaluate the value of a product as well as estimate the marginal contribution that each attribute adds to a person’s utility. This feeds extra information for the future design of multidimensional policies and allows for cost-benefit analysis of these policies (Figini et al., 2007:7; Takatsuka et al., 2009:281). This cost-benefit analysis depends on the Kaldor-Hicks principle, which assumes that when the aggregate net value, determined using a willingness to pay, increases, then the social welfare increases too as gainers compensate losers for the losses incurred (Tisdell, 2003:2).
4.3 Methodology

4.3.1 Study site

Primary data for this case study was collected at eight different dive operators around the Portofino MPA. This site was chosen because it is one of the top diving sites on the Mediterranean Sea and in Italy, with an all year-round diving location (characterised by a rough coastline, steep sea bed and high indices of rich biodiversity), according to LaMesa et al. (2011:25). It is a unique dive site as well, because it hosts one of the famous underwater statues: Christ of Abyss, which represents a monument for those lost in the ocean (Venturini et al., 2018:49). See section 2.4.3 for the full description of Portofino MPA.

4.3.2 Questionnaire design

The choice questionnaire was designed to maximise the efficiency of the survey by extracting the relevant information from the divers. In this way, with each answer given or not given, a choice set will be captured by the model, and then all choices for each of the attribute levels can be individually identified (Vega & Alpízer, 2011:255). The questionnaire design included several different combination scenarios varying in different levels of five chosen attributes. The combination of attributes was called a choice set. This questionnaire has two choice sets, each choice set with two alternatives to choose from, i.e. option A and option B. The five attributes were: level of water visibility, extent of diver crowding, quantity of groupers, diversity of species and the willingness to pay price (see Table 4.1).

These attributes were chosen based on the following: firstly, the characteristics of the main species attraction in Portofino as described in a paper done by Lucrezi et al. (2017:383). This paper described scuba divers in Portofino, and that they are most interested in groupers, gorgonians, barracudas, moray eels, dentex, nudibranchs and red corals (Lucrezi et al., 2018:93). Secondly, according to Szuster et al (2011:158), the carrying capacity of scuba divers under water at a time is also a cause for concern for many divers, and therefore diver crowding was included as an attribute. Thirdly, literature shows that scuba divers consider the abundance and diversity of marine life, together with visibility as the fourth most important attribute (Fitzsimmons, 2009; Uyarra et al., 2009). The visibility options were according to the averages in the research of Beharry-Borg and Scarpa (2010:1128), and Peng and Oleson (2017:41), and diver crowding was according to the averages in the research of Rudd and Tupper (2002:139).

The willingness to pay price is added to act as a measure of the value of each scenario, and the different price levels were chosen according to a willingness to pay study by Asafu-Adjaye and Tapsuwan (2008) on the Mu Ko Similan Marine National Park in Thailand. The opt-out option was
not added; as an extra choice, a “no choice” in a choice set is treated as an opt-out answer. Including a no answer as an opt-out choice has the advantage of avoiding a “forced choice” where respondents do not have an option to select (Ruby et al., 1998:1).

Forced choices reduce the statistical efficiency of the choice parameters because they eliminate the demand effect that is present in a typical market setting (Kontoleon & Yabe, 2003:1). To control for this, no choice was forced in this research with respondents not pressed to indicate an option. Since the respondents were not pushed to exercise a choice and could move to the next question without choosing, no choice was taken as being indifferent and therefore the opt-out option. The assumption made was that those who did not make an option were choosing neither of the offered possibilities, and this gave the opt-out option.

**Table 4.1:** Descriptive of the five attributes.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Level of attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility</td>
<td>20 metres, 15 metres, 10 metres, 1 metre</td>
</tr>
<tr>
<td>Crowding</td>
<td>1 to 6 divers, 7 to 12 divers, 13 to 18 divers, 19 to 24 divers</td>
</tr>
<tr>
<td>Groupers</td>
<td>Large number of small (&lt;50cm) groupers,</td>
</tr>
<tr>
<td></td>
<td>Small number of large groupers (&gt;50cm),</td>
</tr>
<tr>
<td></td>
<td>Moderate number of both small (&lt;50cm) and large (&gt;50cm) groupers</td>
</tr>
<tr>
<td>Species</td>
<td>Plenty of barracudas and dentex,</td>
</tr>
<tr>
<td></td>
<td>Plenty of lobsters and octopus,</td>
</tr>
<tr>
<td></td>
<td>Plenty of moray eels and nudibranchs,</td>
</tr>
<tr>
<td></td>
<td>Plenty of fish in large bait balls</td>
</tr>
<tr>
<td>Price</td>
<td>€ 5, € 10, € 15, € 20</td>
</tr>
</tbody>
</table>

The choice sets are described by attributes that vary in terms of level. The combination of the different levels of attributes was developed using a full factorial design, where every combination of the attribute level is used (Sanko, 2001:15). The full factorial design of our model would give:

\[ 4 \times 4 \times 3 \times 4 \times 4 = 768 \text{ alternatives} \]

\[ \frac{(768 \times 767)}{2} = 294,598 \text{ pairs} \]

These 768 alternatives would then give 294,598 possible combinations of two alternative choice questions from which respondents could choose. These pairs of combinations were estimated using the full factorial design method in STATA. However, since it is time consuming and
cumbersome for respondents to make a choice for all these combinations (Johnson et al., 2013:6), a D-efficiency design was conducted as explained by Hole (2016:11). With a d-efficiency design, the minimum number of choice sets is calculated by minimising the d-error and “maximising the determinant of the inverse of the variance-covariance matrix in maximum-likelihood estimation” (Johnson et al., 2013:8).

Besides reducing the combinations to a practical size, the d-efficiency design guarantees that the attributes are varied independently from one another to isolate the effect of each level of attribute on the responses, thus avoiding multicollinearity (Hoyos, 2010:1596; Sanko, 2001:15). Using the D-efficiency design, the minimum number of choice sets for this model was 14, and the study chose 32 choice sets. Therefore, the analysis decreased the possible combinations efficiently to maintain the reliability of results to 64 alternatives (which gives 32 choice sets) from the 768 scenarios. The software STATA was used to extract the options using d-efficiency random design, with a d-efficiency optimal design coefficient of 3.477 (p<0.001). The 3.477 coefficient is the relative number of runs (expressed as a percent) required by a hypothetical orthogonal design to achieve the same determinant value – the determinant is maximized.

Figure 4.1: Choice games.
These 32 choice sets were organised into 16 different questionnaires, each with 2 sets of choice sets from which to choose. Figure 4.1 shows an example of two choice sets that a respondent was presented with. Each of these two choice sets had two different alternatives (option A and

---

\(^1\) D-error measures how effective the d-efficiency method is in capturing a respondent’s answer in a choice experiment, and the lower the d-error, the more efficient the d-efficiency design is.
option B), from which the respondent had to choose. The same choice sets were swapped in some questionnaires with option B presented first and option A presented second, to minimise bias. The question for each choice set was:

“The Portofino MPA management has to allocate funds to improve certain attributes at the MPA. Therefore, it is important to know which attributes will improve your diving experience. Therefore, you are presented with two choices between a set of attributes. You have to choose the most appealing option in each of the following sets, given that each option comes with an additional premium on the current price per dive”

This required the respondents to make a “trade-off” between two different options twice (first for choice set 1 then second for choice set 2).

This data was collected during the peak dive season in Portofino, which is during the summer months of June and July 2017. A choice modelling questionnaire was administered using random sampling of scuba divers from eight different dive operators. After their dive, respondent divers were approached randomly throughout the day at each dive operator and presented with two discrete choice sets to complete. On average, the questionnaire took 10 minutes to complete. In total, the survey collected 556 completed questionnaires, leading to 1112 different choice sets that were completed. Assuming the population of divers in Portofino as reported in Lucrezi et al. (2018:90) and Cerrano et al. (2017:) of 10 000 scuba divers, a sample of 556 divers represents a 4.04% margin of error with a 95% confidence level.

The questionnaire also asked the respondents their gender, age, country of residence, level of education, marital status, occupation, number of years diving and the number of dives logged. These variables were asked because willingness to pay can be influenced by different demographic and characteristic factors and these were chosen based on the demographic factors tested in similar studies (see Aanesen et al. 2015:54; Grafeld et al., 2016:208; Parsons and Thur 2008:593; Reynisdottir et al., 2008:1078; Rudd & Tupper, 2002:140; Beharry-Borg and Scarpa 2010:1138; Peng and Oleson 2017:41; Schuhmann et al., 2013:32 and Sorice et al., 2006:316).

4.3.3 Modelling approach

The modelling approach used in this analysis is adapted from Castellani et al. (2015:92), who used multinomial or conditional logit, nested logit and multinomial probit model in estimating museum visitor preferences. Sanko (2001:11) motivates four types of analytical methods of estimating stated preference methods, and these include naïve or graphical methods; non-metric scaling, linear regression and; logit and probit models. Pearmain et al. (1991) concludes that the
logit and probit models are the most efficient methods of estimating stated preference experiments.

The multinomial logit model is a discrete choice model that is used when the data has more than two alternatives in a choice set (Wittink, 2011:20), and has been one of the most used methods in choice modelling. The advantages of using the multinomial logit model include that it returns sigmoid probabilities that sum to one over all alternatives, and the model is consistent, efficient and follows a normal distribution (Dow & Endersby, 2004:110).

The multinomial logit model is criticised because of its assumption that choices are independent across alternatives (Kropko, 2008:3; Fiebig et al., 2010:397). The logit model assumes the errors are independent and identically distributed (IID) with type I extreme value distribution (Dow & Endersby, 2004:110). The reasoning for this assumption is that when a respondent compares two or more options, the subtraction or addition of the other options should not have an impact on the ordinal grading of the two options being compared (Kropko, 2008:3). Therefore, the odds ratio of selecting any two options should be independent of the addition or subtraction of other alternatives from the choice set (Dow & Endersby, 2004:110). The IID assumption is the other reason for including more than one estimating method in this paper.

From such data, the econometric analysis can only make assumptions based on the observations from the choice made, and not on the decision process. The limitation is that individual decisions come with irrational mistakes, inconsistencies, strange preferences etc., all of which contribute to the final decision but are not observed (Vega & Alpízer, 2011:257).

Several studies have used discrete choice modelling in valuing ocean resources including:

**Sorice et al. (2006:316)** used logit models and found that scuba divers opted for a decrease in site use, an increase in restrictive management and conservation education. The divers, however, were not willing to pay user-fees.

**Parsons and Thur (2008:593)** surveyed 211 divers in 2002 with three attributes of visibility, species diversity, and percentage of coral cover. The study used mixed logit models to analyse the choice questions at Bonaire National Marine Park and the results showed little heterogeneity in individual preferences.

**Beharry-Borg and Scarpa (2010:1138)** surveyed 284 snorkelers and non-snorkelers on their willingness to pay for an increase in coastal water quality in Tobago. Six attributes were used to categorise different improvements in coastal water for non-snorkelers and nine attributes for snorkelers, and the results of the latent class and mixed multinomial logit models showed that
both groups have high willingness to pay for MPAs that have a greater level of environmental quality.

**Schuhmann et al. (2013:32)** surveyed 165 scuba divers in Barbados between 2007 and 2009 with the attributes price, crowding, fish diversity, encounters with sea turtles, and coral cover. The multinomial logit results showed homogenous preferences for attributes among the divers and a high willingness to pay with increases in the quality of the attributes.

**Aanesen et al. (2015:54)** conducted a willingness to pay study in a valuation workshop (workshop of sampled respondents who answer choice questions after getting knowledge about the product to be valued) for cold water corals in Norway using a sample of 397 respondents. The multinomial logit and mixed logit model results show preference heterogeneity and a willingness to pay for protection of cold water corals.

**Grafeld et al. (2016:208)** surveyed 220 scuba divers in Gaum in 2013 to investigate their willingness to pay for six ecological attributes, and using various logit models the results showed that divers have a positive and significant willingness to pay.

**Peng and Oleson (2017:41)** conducted a survey on willingness to pay for coastal water clarity in Hawaii of 263 beach recreationalists with the attributes of water quality, water clarity, coral cover and fish diversity. The conditional logit model results showed homogenous preferences across individuals and a positive willingness to pay.

**Shideler and Pierce (2016:36)** surveyed 1537 scuba divers in Eastern Florida, USA about their willingness to pay for an encounter with a goliath grouper using four attributes. Higher willingness to pay came more from divers outside Florida, than local divers.

These studies and others have successfully used discrete choice experiments in valuing ocean resources and identifying which attributes the respondents value the most. A more detailed discussion of the methods follows.

### 4.3.3.1 Multinomial logit model

Multinomial models compute continuous latent variables for each choice, which work to evaluate scores of each respondent for each choice selected so that the greater the score, the greater the chance that the respondent chooses that option (Kropko, 2008:5). Assume that scuba diver $i$’s utility for an alternative $j$ is $U_{ij}$, $i = 1, \ldots, n; j = 1, \ldots, p$. Then $U_{ij}$ is a function of the characteristics of the individuals as well as the environmental attributes and a stochastic error term (Rodriguez, 2007:8). The typical multinomial regression model is usually written as:
\[ U_{ij} = \beta'X_{ij} + \alpha_j'Z_i + \varepsilon_{ij} \]  

(4.1)

where \( X_{ij} \) represents a vector of characteristics or attributes which differ in intensity or level of the scuba divers that remain constant across choices, and \( z_i \) represents a vector of levels of environmental attributes that vary across choices (Dow & Endersby, 2004:109; Rodriguez, 2007:8). From this the standard error of \( \beta \) and \( \alpha_j \) are calculated. If each respondent seeks to maximise their utility, the odds that respondent \( i \) chooses option 1 is:

\[ P_{ii} = P[U_{i1} > U_{i2}, U_{i1} > U_{i3}, ..., U_{i1} > U_{ip}] \]  

(4.2)

The coefficients also describe the comparative odd of a choice to a base-choice. Therefore, if there are \( m \) choices, the model will provide \( m - 1 \) sets of coefficients, and therefore setting the coefficients for the base-choice all equal to zero (Kropko, 2008:7).

For any “\( m \)” in the set of 1, ..., \( p \) alternatives:

\[ P(m) = P[\varepsilon_{im} - \varepsilon_{ij} < (\beta'X_{ij} + \alpha_j'Z_i) - (\beta'X_{im} + \alpha_m'Z_i), j \neq m] \]  

(4.3)

The error terms \( \varepsilon_{ij} \) are assumed to be independent, identically distributed (iid), with type 1 extreme value distribution. This means that the value of a variable, that is age, gender and education remain constant across choices, but the coefficients vary (Kropko, 2008:6). Gensch and Recker (1979:125) motivate that the importance of the assumptions in the error term of the model is to account for the complexity of the choice process by recognising that the choice process cannot be fully identified, with all the influencing attributes to give a more precise measure.

According to Dow & Endersby (2004:110) the probability that a respondent chooses alternative \( j \) is given by:

\[ P(\text{choice} = j | \beta, \alpha_j, X_{ij}, Z_i) = \frac{\exp(\beta'X_{ij} + \alpha_j'Z_i)}{\sum_{k=1}^{w} \exp(\beta'X_{ik} + \alpha_k'Z_i)} \]  

(4.4)

This multinomial model assumes that the estimators are consistent, follow a normal distribution and efficient; properties that are described in Dow & Endersby (2004:110) as asymptotic. The Independence of Irrelevant Alternatives (IIA) assumption mostly appears restrictive, but it can alternatively be translated as the expected outcome of an appropriately-specified utility equation that captures all causes of correlation explicitly and leaves the unobserved part as a ‘white noise’ (Hoyos, 2010:1598). Nevertheless, though the multinomial logit (MNL) is mostly used in discrete choice experiments, it is limited by its inability to detect random taste heterogeneity across
individuals, the panel nature of repeated choices and the assumption of independence of irrelevant alternatives (Beharry-Borg & Scarpa, 2010:1029). Therefore, alternative modelling techniques are also used to ensure robust estimates, and these include the conditional logit, nested multinomial logit and the multinomial probit model.

4.3.3.2 Conditional logit model

The conditional logit model is an extension of the basic multinomial logit model with the exception that the utility function is modelled in terms of the attributes of the alternatives, instead of the characteristics of the individuals like in the multinomial logit (Hauber et al., 2016:305). This addition of socio-economic factors characterising individuals generates a "hybrid" model, which allows for heterogeneity by including interaction terms (Mazzanti, 2003:587). Therefore, each estimated coefficient becomes a preference weight, which denotes the relative influence of the attribute level to the utility that respondents assign to an alternative (Hauber et al., 2016:305). Unfortunately, conditional logit models have the limitations of assuming homogenous preferences across individuals, which can lead to biased results of the preference weights, and it also assumes that choice responses measure utility equally well across respondents (Rodríguez, 2007:8).

4.3.3.3 Nested Multinomial Logit model

The nested multinomial logit model assumes a hierarchy of choices where the choice among alternatives is decomposed into two or more sequential choices called nests. The IIA hypothesis is assumed to hold within nests but not across nests (Castellani et al., 2015:92). According to Train (2002:88), these models are commonly used when choice sets presented to a respondent can be divided into subsets called nests so that:

1. From any two alternatives in the same nest (IIA within each nest), there is independence of the ratio of probability from other alternatives.

2. Dependence of the ratio of probabilities on the attributes of other alternatives

To illustrate the utility function for nested logit models, assume the \( j \) alternative to be divided into \( K \) non-overlapping subsets represented by \( B_1, B_2, \ldots, B_K \) and called nests. The utility that person \( i \) obtains from alternative \( j \) in nest \( B_k \) is denoted, as

\[
U_{ij} = V_{ij} + \varepsilon_{ij}, \quad (4.5)
\]

where \( V_{ij} \) is observed and \( \varepsilon_{ij} \) is a random variable whose value is unobservable. The nested logit model is therefore obtained by assuming that the vector of unobserved utility is \( \varepsilon_i = \varepsilon_{i1}, \ldots, \varepsilon_{ij} \) (Hoyos, 2010:1598; Train, 2002:88). This study followed the procedure used in Castellani et al.
(2015:92), where the model starts by assuming a hierarchy in the choice, the choices are then split into two or more sequential choices (nests) whilst holding the IIA assumption within the nests and not across the nests.

### 4.3.3.4 Multinomial probit model

This model modifies the error term of the utility functions so that they are jointly normally distributed with random variances and covariances (Castellani et al., 2015:92; Rodriguez, 2007:10). The multinomial probit model is mostly used when the IIA hypotheses does not hold (Castellani et al., 2015:92). According to Dow and Endersby (2004:110) the multinomial probit model therefore assumes that the error is distributed multivariate normal with mean 0 and a covariance matrix of:

\[
\Sigma = \begin{bmatrix}
\sigma_1^2 & -\sigma_{12} & - & -
-\sigma_{12} & \sigma_2^2 & - & -
- & - & \sigma_i^2 & -
\end{bmatrix}
\]

(4.6)

The probabilities are written:

\[
P(\text{choice} = j | \beta, \alpha_j, X_{ij}, Z, \Sigma^*)
= \int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} \cdots f(\epsilon_1^*, \ldots, \epsilon_{j-1}^*) \partial \epsilon_1^*, \ldots, \partial \epsilon_{j-1}^*
\]

(4.7)

where \(f(\cdot)\) is the probability density function of the multivariate normal distribution.

This model is beneficial because it enables the respondent’s utility for each alternative to be correlated between each other, and according to Rodriguez (2007:11), the drawback is that "fitting" the model requires evaluating probabilities given by multidimensional normal integrals, a limitation that effectively restricts routine practical application of the model to problems involving no more than three or four alternatives."

### 4.4 Results

#### 4.4.1 Descriptive results

A total of 600 questionnaires were printed and handed out using a random sampling design, and 556 of these were completed and returned to the fieldworkers, resulting in 93% participation and 2224 observations (since each participant answered four choice options divided into two choice
sets). Altogether, no choice was made in 133 choice sets, therefore this is treated as an opt out response. This leaves 1958 observations, in which a choice was made (i.e. 979 choice sets).

Table 4.2: Descriptive statistics.

<table>
<thead>
<tr>
<th></th>
<th>Portofino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td></td>
</tr>
<tr>
<td>Residents</td>
<td>94%</td>
</tr>
<tr>
<td>Non-Residents</td>
<td>6%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>27%</td>
</tr>
<tr>
<td>Male</td>
<td>73%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>23%</td>
</tr>
<tr>
<td>30-39</td>
<td>24%</td>
</tr>
<tr>
<td>40-49</td>
<td>28%</td>
</tr>
<tr>
<td>50-59</td>
<td>19%</td>
</tr>
<tr>
<td>60+</td>
<td>6%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>23%</td>
</tr>
<tr>
<td>Diploma</td>
<td>34%</td>
</tr>
<tr>
<td>Degree</td>
<td>29%</td>
</tr>
<tr>
<td>Post-graduate degree</td>
<td>12%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
<tr>
<td>MPA awareness</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>99%</td>
</tr>
<tr>
<td>No</td>
<td>1%</td>
</tr>
<tr>
<td>Diving experience</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1%</td>
</tr>
<tr>
<td>Fair</td>
<td>4%</td>
</tr>
<tr>
<td>Good</td>
<td>24%</td>
</tr>
<tr>
<td>Very Good</td>
<td>46%</td>
</tr>
<tr>
<td>Excellent</td>
<td>25%</td>
</tr>
<tr>
<td>Average dives logged</td>
<td>372</td>
</tr>
<tr>
<td>Average years diving</td>
<td>9</td>
</tr>
</tbody>
</table>

The descriptive statistics (Table 4.2) show that most respondents in Portofino were Italians and only 6% were foreigners, confirming that Portofino MPA’s main dive market is Italians. Scuba diving is still a male dominated activity with 73% males from the sample and 27% females. The largest categories of divers in Portofino are between the age of 40 and 49. Previous research among scuba divers at the Portofino MPA was conducted by Lucrezi et al. (2018:91) and their sample shows similar characteristics than the sample used in this study. In their sample of 279 respondents, 80% of the divers were male and 20% were females, most were middle-aged (in their 40s) and of Italian decent. Since our sample corresponds with the sample characteristics of
the study by Lucrezi et al. (2018:91) on scuba divers in Portofino, we have confidence that our sample is not biased, but rather representative of the diving population in Portofino.

In terms of education, the largest groups of the respondents had obtained a diploma or a degree (34% and 29%, respectively). When asked whether they were aware that they were diving in a MPA, the majority (99%) of divers said yes. In terms of how they rated their diving experience in Portofino on a five-point scale from poor to excellent: most divers rated it as very good to excellent. This shows that diving in Portofino is generally a very good experience. The divers also showed that they were on average very experienced, with the average diver having an average of 372 dives logged in total. The average diver also had at least 9 years diving experience.

4.4.2 Econometric results

Since theory postulates that the willingness to pay for changes in environmental attributes should vary systematically, it is assumed that a lack of responsiveness to the change in level of attributes would suggest that the estimates are either invalid or biased (Johnston et al., 2006:3). Following the modelling process in the museum visitor preference paper by Castellani et al. (2015:92), the data were exported from excel and into STATA for analysis. STATA is a data analysis and integrated statistics modelling software that was used in this paper to estimate a multinomial logit model to estimate the probability of a diver to choose an alternative and their willingness to pay for it.

To begin the estimation, dummy variables for each of the options included in the choice questionnaire are coded, as in Table 4.3 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
</table>
| Price    | Bid amount in euros proposed to each respondent  
    Randomly assigned using €5; €10; €15; €20 |
| Choice   | Choice_no (dummy variable equal to 1 when diver chooses no, 0 if otherwise), which was the base outcome  
    Choice_yes (dummy variable equal to 1 when diver chooses yes, 0 if otherwise)  
    Choice_not (dummy variable equal to 1 when diver chooses opt-out, 0 if otherwise) |
| Vis      | vis20 (dummy variable equal to 1 when diver chooses 20 metres visibility, 0 if otherwise)  
    vis15 (dummy variable equal to 1 when diver chooses 15 metres visibility, 0 if otherwise) |
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vis10</td>
<td>(dummy variable equal to 1 when diver chooses 10 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td>vis1</td>
<td>(dummy variable equal to 1 when diver chooses 1 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td>Crowd</td>
<td></td>
</tr>
<tr>
<td>crowd1</td>
<td>(dummy variable equal to 1 when diver chooses 1-6 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td>crowd2</td>
<td>(dummy variable equal to 1 when diver chooses 7-12 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td>crowd3</td>
<td>(dummy variable equal to 1 when diver chooses 13-18 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td>crowd4</td>
<td>(dummy variable equal to 1 when diver chooses 19-24 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td>Groupers</td>
<td></td>
</tr>
<tr>
<td>lgrouper</td>
<td>(dummy variable equal to 1 when diver chooses large number of small (&lt;50cm) groupers, 0 if otherwise)</td>
</tr>
<tr>
<td>sgrouper</td>
<td>(dummy variable equal to 1 when diver chooses small number of large groupers (&gt;50cm), 0 if otherwise)</td>
</tr>
<tr>
<td>mgrouper</td>
<td>divers (dummy variable equal to , when diver chooses moderate number of both small (&lt;50cm) and large (&gt;50cm) groupers, 0 if otherwise)</td>
</tr>
<tr>
<td>Species</td>
<td></td>
</tr>
<tr>
<td>barracuda</td>
<td>(dummy variable equal to 1 when diver chooses plenty of barracudas and dentex, 0 if otherwise)</td>
</tr>
<tr>
<td>lobster</td>
<td>(dummy variable equal to 1 when diver chooses plenty of lobsters and octopus, 0 if otherwise)</td>
</tr>
<tr>
<td>eels</td>
<td>(dummy variable equal to 1 when diver chooses plenty of moray eels and nudibranchs, 0 if otherwise)</td>
</tr>
<tr>
<td>baitball</td>
<td>(dummy variable equal to 1 when diver chooses plenty of fish in large bait balls, 0 if otherwise)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>(dummy variable equal to 1 if diver is a female; 0 if male)</td>
</tr>
<tr>
<td>Age_range</td>
<td></td>
</tr>
<tr>
<td>age1</td>
<td>dummy variable equal to 1 when diver chooses age 29 or less, 0 if otherwise</td>
</tr>
<tr>
<td>age2</td>
<td>(dummy variable equal to 1 when diver chooses age_range is 30-39), 0 if otherwise</td>
</tr>
<tr>
<td>age3</td>
<td>(dummy variable equal to 1 when diver chooses age_range is 40-49), 0 if otherwise</td>
</tr>
<tr>
<td>age4</td>
<td>(dummy variable equal to 1 when diver chooses age_range is 50-59), 0 if otherwise</td>
</tr>
<tr>
<td>age5</td>
<td>(dummy variable equal to 1 when diver chooses age_range is 60 and above), 0 if otherwise</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>edu1</td>
<td>dummy variable equal to 1 when diver chooses high school, 0 if otherwise</td>
</tr>
<tr>
<td>edu2</td>
<td>(dummy variable equal to 1 when diver chooses diploma), 0 if otherwise</td>
</tr>
</tbody>
</table>
Table 4.4 shows the results of the Hausman test of IIA assumption. The no option is not significant, and the yes option and opt-out option’s chi² are both also insignificant. Therefore, the null hypothesis of Independence of Irrelevant Alternatives cannot be rejected.

<table>
<thead>
<tr>
<th></th>
<th>chi²</th>
<th>df</th>
<th>P&gt;chi²</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>8.779</td>
<td>13</td>
<td>0.789</td>
</tr>
<tr>
<td>Yes</td>
<td>10.537</td>
<td>13</td>
<td>0.650</td>
</tr>
<tr>
<td>Opt-out</td>
<td>5.828</td>
<td>13</td>
<td>0.952</td>
</tr>
</tbody>
</table>

H₀: Odds (Outcome-J vs Outcome-K) are independent of other alternatives

Using the commands mlogit for the basic multinomial logistic, clogit for the conditional logit model, nlogit for the nested logit model, mprobit for the multinomial probit model, the regressions that control for respondents’ characteristics are estimated. The coefficient resulting from these models will be used to evaluate the importance of each attribute according to its statistical significance, the direction of this importance as indicated by the positive or negative sign of the coefficients, as well as the relative importance of each attribute as indicated by the magnitude of the estimated parameter (WHO, 2010:36).

4.4.2.1 Multinomial model results

Table 4.5 shows the results of the multinomial logit regression, one with the control variables and the other without the control variables. The Wald $\chi^2(42)$ of 1292.51 with a p-value of 0.000 shows that the multinomial logit model is a good fit with 1% significance level, better than the model with no predictors. The significant attribute coefficients are price (in the base multinomial logit model and age3 model), visibility, crowd1 and crowd 2, and lgrouper.

From Table 4.5, the multinomial model without control variables (column 2) is preferred for this analysis since the control variables in the multinomial model (first column) are not all statistically significant. This shows that the sample is homogenous, since none of the demographic and socio-economic variables are statistically significant. In other words, there is no difference between the probability of choosing an option based on age or gender. Therefore, divers in Portofino generally have homogenous preferences.
Looking at the magnitude of the different attribute coefficients, the base multinomial model (column 2) shows greater preference for the higher visibility levels (20 metres visibility than 15 metres visibility) and lower levels of diver crowding (1-6 divers then 7-12 divers), with apparent diminishing marginal utility between the different levels. This corresponds with the results from Schuhmann et al. (2013:34) who also found high water visibility and reduced diver crowding to be preferred the most.

Table 4.5: Multinomial results.

<table>
<thead>
<tr>
<th>Choice_yes</th>
<th>MNL</th>
<th>MNL without control variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.020*</td>
<td>-0.029***</td>
</tr>
<tr>
<td></td>
<td>0.012</td>
<td>0.009</td>
</tr>
<tr>
<td>vis20 vs vis1</td>
<td>1.321***</td>
<td>1.431***</td>
</tr>
<tr>
<td></td>
<td>0.198</td>
<td>0.145</td>
</tr>
<tr>
<td>vis15 vs vis1</td>
<td>1.054***</td>
<td>1.187***</td>
</tr>
<tr>
<td></td>
<td>0.192</td>
<td>0.144</td>
</tr>
<tr>
<td>vis10 vs vis1</td>
<td>0.775***</td>
<td>0.873***</td>
</tr>
<tr>
<td></td>
<td>0.191</td>
<td>0.141</td>
</tr>
<tr>
<td>crowd1 vs crowd4</td>
<td>0.855***</td>
<td>0.885***</td>
</tr>
<tr>
<td></td>
<td>0.188</td>
<td>0.140</td>
</tr>
<tr>
<td>crowd2 vs crowd4</td>
<td>0.502**</td>
<td>0.378**</td>
</tr>
<tr>
<td></td>
<td>0.195</td>
<td>0.139</td>
</tr>
<tr>
<td>crowd3 vs crowd4</td>
<td>-0.003</td>
<td>-0.196</td>
</tr>
<tr>
<td></td>
<td>0.189</td>
<td>0.140</td>
</tr>
<tr>
<td>lgrouper vs mgrouper</td>
<td>-0.420**</td>
<td>-0.392***</td>
</tr>
<tr>
<td></td>
<td>0.170</td>
<td>0.119</td>
</tr>
<tr>
<td>sgrouper vs mgrouper</td>
<td>-0.025</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>0.155</td>
<td>0.115</td>
</tr>
<tr>
<td>barracuda vs eels</td>
<td>-0.262</td>
<td>-0.192</td>
</tr>
<tr>
<td></td>
<td>0.175</td>
<td>0.137</td>
</tr>
<tr>
<td>lobster vs eels</td>
<td>-0.024</td>
<td>-0.174</td>
</tr>
<tr>
<td></td>
<td>0.177</td>
<td>0.138</td>
</tr>
<tr>
<td>baitball vs eels</td>
<td>-0.139</td>
<td>-0.103</td>
</tr>
<tr>
<td></td>
<td>0.190</td>
<td>0.141</td>
</tr>
<tr>
<td>female vs males</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.125</td>
<td></td>
</tr>
<tr>
<td>age2 vs age1</td>
<td>-0.017</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.157</td>
<td></td>
</tr>
<tr>
<td>age3 vs age1</td>
<td>-0.040</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.150</td>
<td></td>
</tr>
<tr>
<td>age4 vs age1</td>
<td>-0.089</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.169</td>
<td></td>
</tr>
<tr>
<td>age5 vs age1</td>
<td>-0.093</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.241</td>
<td></td>
</tr>
<tr>
<td>edu2 vs edu1</td>
<td>-0.011</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.145</td>
<td></td>
</tr>
<tr>
<td>edu3 vs edu1</td>
<td>-0.017</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.148</td>
<td></td>
</tr>
<tr>
<td>edu4 vs edu1</td>
<td>-0.069</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.190</td>
<td></td>
</tr>
<tr>
<td>edu5 vs edu1</td>
<td>0.034</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.449</td>
<td></td>
</tr>
</tbody>
</table>
Levels of access significantly affect choice, and this is shown by the decrease in coefficient as the number of divers at a time increases (from 1-6 divers to 7-12 divers to 13-18 divers). Thus, as congestion in the sea increases from 1-6 divers to 13-18, utility declines and becomes a negative. Crowding also has a positive coefficient at 1-6 divers, meaning that divers are more willing to pay for a controlled (less divers) access to the MPA.

There is a significant disutility when it comes to preferring a large number of small groupers versus a moderate number of both small and large groupers in the MNL model with control variables (-0.42), and also in the MNL model without control variables (-0.392). This could be because there are widespread groupers in the Portofino MPA, as mentioned from an informal discussion with one of the dive operators, as such that divers could be experiencing diminishing marginal returns. This echoes the demand theory that when a product is abundant it becomes relatively worthless.

The analysis further tested the model using 6 sub-samples according to gender (female) and age (age1, age2, age3, age4 and age5), but since none of the control variables were significant in the specification above, it is not surprising that the results could not be improved (see Appendix A for these results).

### 4.4.2.2 Conditional logit, multinomial probit and multinomial logit results

Taking into consideration the limitations of the multinomial logit model, the data was further estimated using the conditional logit model, nested logit model and the multinomial probit model. The nested logit model’s results showed that there is no evidence of nests in the model, which may be attributed to the fact that only two choice sets were presented to each respondent. The nested model is therefore similar to the conditional logit model.

Table 4.6 presents the results for the conditional logit, multinomial probit and the multinomial logit model without control variables, and it is evident that the coefficients of the three models are very comparable, which means that the models are quite robust, giving confident results.

### Table 4.6: Conditional logit and multinomial probit estimations.

<table>
<thead>
<tr>
<th>Choice</th>
<th>CL</th>
<th>MNP</th>
<th>MNL without control variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>price</td>
<td>-0.018**</td>
<td>-0.023**</td>
<td>-0.029***</td>
</tr>
<tr>
<td></td>
<td>0.008</td>
<td>0.009</td>
<td>0.009</td>
</tr>
<tr>
<td>vis20 vs vis1</td>
<td>1.168***</td>
<td>1.199***</td>
<td>1.431***</td>
</tr>
</tbody>
</table>
The results indicate that the coefficients in the conditional logit model are significant (price, visibility, crowd1, crowd2 and lgrouper) and have the same sign as those of the multinomial probit and logit model, though the coefficients are slightly different in magnitude. Lobster is also significant for the conditional logit model.

4.4.2.3 Willingness to pay results

The willingness to pay estimates were computed according to Schuhmann et al. (2013:31):

$$-\frac{\beta_A}{\beta_P}$$  \hspace{1cm} (4.8)

where $\beta_A$ is the coefficient of an attribute level and $\beta_P$ is the coefficient of the alternative price.

Table 4.7 gives the results of the willingness to pay estimations using equation (4.8).

<table>
<thead>
<tr>
<th>Attribute level</th>
<th>MNL</th>
<th>CL</th>
<th>MNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 metres</td>
<td>49,34***</td>
<td>64,89**</td>
<td>52,13**</td>
</tr>
<tr>
<td>15 metres</td>
<td>40,93***</td>
<td>49,50***</td>
<td>42,87***</td>
</tr>
<tr>
<td>10 metres</td>
<td>30,10***</td>
<td>38,11***</td>
<td>31,61***</td>
</tr>
</tbody>
</table>

Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
The following variables were statistically different from zero: price, visibility, 1-6 crowding, 7-12 crowding and large number of small groupers. The price affects choice, and as expected, there is a negative relationship with the price; in the regression, when the price increased, it decreased the probability to choose this alternative.

Visibility has a positive relationship with willingness to pay, the greater the level of visibility, the more the divers are willing to pay. Divers hold significant economic value from high underwater visibility of 20 metres, since they are willing to pay a range from €49.34 to €64.89 to improve visibility. This is in line with the high willingness to pay in Peng and Oleson (2017:17), where divers were willing to pay $35.71 for increased visibility from 15ft to 30ft. This willingness to pay amount decreases with the decrease in visibility level, as echoed in the literature (Beharry-Borg & Scarpa, 2010:1136).

Diver crowding of 6 divers has the highest willingness to pay for the least number of divers at a time. Results show that divers are willing to pay at least a range from €23.62 to €38.56 for 1-6 divers and avoid overcrowding, and a range of €13.03 to €26.72 for 7-12 divers, and a negative range of -€6.76 to €4.83 for 13-18 divers at a time. From 13 divers and more, divers experience disutility and expect to be compensated for the crowding in the MPA, which corresponds with the finding of Sorice et al. (2007:320), and Beharry-Borg and Scarpa (2010:1136).

In terms of species diversity and abundance, willingness to pay is generally not statistically significant. However, the attribute with a statistically significant willingness to pay for abundance and diversity is the small number of large groupers, where estimates show that divers are willing to pay a range of -€15.11 to -€14.39 and -€13.39 for plenty of lobsters and octopus. This negative willingness to pay estimate convey disutility for small numbers of large groupers. This contradicts the willingness to pay literature on fish abundance and diversity, where in most studies

<table>
<thead>
<tr>
<th></th>
<th>6 divers</th>
<th>7-12 divers</th>
<th>13-18 divers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23,62***</td>
<td>38,56***</td>
<td>24,61***</td>
</tr>
<tr>
<td></td>
<td>13,03***</td>
<td>26,72***</td>
<td>13,96***</td>
</tr>
<tr>
<td></td>
<td>-6,76**</td>
<td>4,83**</td>
<td>-6,91**</td>
</tr>
<tr>
<td>large number of small groupers</td>
<td>-13,52</td>
<td>-15,11</td>
<td>-14,39</td>
</tr>
<tr>
<td>small number of large groupers</td>
<td>1,10***</td>
<td>1,22**</td>
<td>1,09***</td>
</tr>
<tr>
<td>plenty of barracudas and dentex</td>
<td>-6,62</td>
<td>-3,50</td>
<td>-6,78</td>
</tr>
<tr>
<td>plenty of lobsters and octopus</td>
<td>-6,00</td>
<td>-13,39**</td>
<td>-6,26</td>
</tr>
<tr>
<td>plenty of fish in large bait balls</td>
<td>-3,55</td>
<td>-6,11</td>
<td>-3,57</td>
</tr>
</tbody>
</table>

* p<0.1; ** p<0.05; *** p<0.01
respondents had a high willingness to pay for marine life abundance and diversity: Gill et al. (2015:54) found divers’ willingness to pay $82.64 for fish abundance in three Caribbean countries; Peng & Olesen (2017:49) found that beach recreationalists were willing to pay $15.33 to improve coral reef cover in Hawaii; Shideler & Pierce (2016:36) found that divers in Eastern Florida were willing to pay up to $202 for increased goliath grouper encounters; and Grafield et al. (2016:210) found that divers were willing to pay $35.14 for more sharks and turtles in Guam. This could be attributed to the widespread abundance of groupers in the Portofino MPA, as such that divers are experiencing diminishing marginal returns.

Considering the base multinomial results, significant willingness to pay point estimates range between €30 to €49 for water visibility, between -€6 to €23 for diver crowding and €1.10 for small number of large groupers. These results have established that water visibility followed by diver crowding are the most important environmental attributes in Portofino MPA. The base multinomial results for 6 divers at a time showed a willingness to pay of €23.62, €24.61 in the multinomial probit results, but €38.56 in the conditional logit results. This corresponds with the willingness to pay $75 for 5 divers in Schuhmann et al. (2013:2) in Barbados. The range of values is not too different across the 3 models, with the multinomial logit giving the most conservative estimates, which are close to the estimates of the multinomial probit model, and the conditional logit giving the highest estimates.

### 4.5 Conclusions and recommendations

The basis for identifying economic value comes from individuals’ choice among alternatives. The objective of this paper was to understand the environmental attributes that are important and valuable to scuba divers, as well as measure the economic value of these attributes. In other words, this study was estimating scuba divers’ willingness to pay for environmental improvements in Portofino Marine Protected Area using discrete choice models. A discrete choice model is a model where individuals make a choice among a set of different alternatives, which are called choice sets.

The choice sets presented to the respondents did not include an opt-out or status quo option, which is added to avoid forcing the respondents to choose. This is motivated by many scholars as being important because it simulates a market system where respondents do not just choose between two alternatives but are also able to choose not to pay at all. However, this study treated the questionnaires with no responses as the opt-out responses. This allowed for an actual willingness to pay to be estimated.
There is also the drawback of respondents getting fatigued as they are faced with many choices and attributes from which to choose. If there are too many attributes, it is possible that the respondents will only focus on the few that they are interested in, whilst ignoring some other important ones. For example, it is impossible to test all possible combinations of the five attributes chosen, therefore, by using a fractional factorial design, a practical combination and choice sets were put together. The result is that some attributes and combinations ended up being omitted from the survey; therefore, their impact will not be captured (Scarpa & Willis, 2007:453).

The findings of this study are that the most valued attribute in Portofino MPA is underwater visibility followed by a less crowded dive site. The estimated willingness to pay price for 20 meters of visibility is a range from €49.34 to €64.89, more than the baseline 1 metre visibility; for the whole sample, which corresponds with the results from Peng and Oleson (2017:41) who found a willingness to pay amount of $35 for increase in water visibility in Hawaii. The age group 40-49 year olds are the sub-sample that has a significant willing to pay of up to €23 for the best level of visibility, which could be explained by probable higher levels of income than other ages.

It was also found that there is a unanimous aversion for willingness to pay for diver crowding of 13 and above, and species abundance and diversity, with willingness to pay values ranging from -€6.76 to €4.83, and an aversion for small number of large groups with €1.09 to €1.22, which shows a great magnitude of disutility. The aversion to diver crowding is strongly supported by past studies of Schuhmann et al. (2013:2) and Sorice et al. (2007:320), among others. However, the aversion for species abundance and diversity is contradictory to the previous studies of Shideler and Pierce, (2016:26), who found a willingness to pay amount of between $34 to $75 for an abundance of goliath groupers; and Peng and Oleson, 2017:41) who found a willingness to pay amount of $7.14 for an increased abundance of fish species. The main reason for this aversion was explained by a dive operator to be because of the widespread abundance of groupers in the Portofino MPA, as such that divers are experiencing diminishing marginal returns. Therefore, divers are not willing to pay a fee for an increase abundance of groupers.

4.5.1 Policy Implications

Although most MPAs are financed through government funding, public subsidies and donors, common pool resource literature agrees that looking for alternative sources of direct revenue for MPAs is advisable so as to move away from dependency on changing government and donor budgets and priorities. Therefore, the most important implication of these results is the possible financing opportunity that willingness to pay provides for the MPA. This potential financing strategy can fund current management initiatives, conservation, research and education programs, as is a concern for most MPAs (Thur, 2010:67). Therefore, these figures help to inform
policy makers on how much the users of the MPA, in this case scuba divers, are willing to pay towards conservation, and most importantly, which environmental attributes they value the most and that are important to them.

These user fees capture consumer surplus and collected funds can go a long way in financing the limited budget of the MPA, just as they have successfully been implemented in Bonaire National Marine Park (Asafu-Adjaye & Tapsuwan, 2008:1122; Thur, 2010:63). Policy makers can definitely use these results to establish and implement user fees as a revenue maximising option, by restricting diver crowding and conservation efforts to improve water visibility. This is strongly supported by Schuhmann et al. (2013:2) through establishing policies that benefit the divers as well as other stakeholder of the MPA so as to maximise returns from diving while reducing adverse consequences associated with using the MPA.

The economic value of each attribute can be used to justify conservation budgets in the Portofino MPA through a social benefit angle. By identifying the magnitude of willingness to pay, the social benefits of improving the MPA for the community are revealed, because preserving the Portofino MPA ecosystem would be beneficial for continued economic and cultural generating activities that locals survive on. Therefore, a social benefit to the Portofino community is indirectly estimated with this willingness to pay value as the spillover effect of improving the MPA positively affects the community.

To compensate for the losses due to increased restrictions on diver crowding and strict conservation to improve water quality, the revenue from the user fees could cover these costs. Beharry-Borg and Scarpa (2010:1133) motivate that if policymakers want to increase the number of divers or increase the quality of the dive experience, then it is important to focus on improving the water visibility since it is the most valued attribute according to divers. This can be done by investing in intensive research on ways of improving water visibility, bearing in mind that water visibility is a function of several different factors. This research will go a long way in directing funds towards reducing ocean water pollution activities.

The results from the sub-samples are useful in understanding how preferences vary among sub-groups of divers depending on gender and age group. This is strongly echoed in the findings of Grafield et al. (2016:211) where willingness to pay differs according to diver characteristics. This information can allow policy makers to come up with a strategy for the diver package, where these differences are taken into account.

These results are also useful because they show the predicted impact on scuba divers in Portofino of alternative levels of environmental attributes that are most valuable to them. Therefore, this
information can be used to forecast changes that are needed in the MPA from a user's perspective as well as the possibility of imposing a tax to help fund the MPA’s conservation goals.

With this in mind, it is important that the MPA authorities use the directed funds for the improvement of the MPA and be accountable. This works to instil confidence and support from all the stakeholders, especially the resource users who contribute towards change.
CHAPTER 5 THE INFLUENCE OF ENVIRONMENTAL CONCERN ON WILLINGNESS TO PAY

Abstract

Environmental degradation that comes from the tragedy of the commons, (the tendency of non-excludable rival goods to be consumed until their marginal benefit falls to zero) has given rise to Marine Protected Areas (MPAs) in many parts of the world today. To ensure efficient MPAs, they need a continuous stable flow of income and insight into which environmental attributes are important to the users of the ocean. In support of the growing need to understand pro-environmental behaviour, scuba divers are investigated to understand their value orientations (egoistic, altruistic, or biospheric) and how much it influences their willingness to pay. Following the value belief norm model, this paper assumes that scuba divers base their beliefs on environmental degradation according to their biospheric, egoistic and social-altruistic values. This paper aims to test the hypothesis that egoistic, biospheric and altruistic value orientations influence different environmental behaviour and willingness to pay for conservation. The study area used was the Portofino MPA, where a sample of scuba divers was surveyed in June and July 2016 and then 2017, using the General Awareness of Consequences (GAC) scale. Data collected from two samples of 442 scuba divers in 2016 and 556 scuba divers in 2017 was analysed using a logistic regression model. Mediator and moderator effects are tested. Results show that though there are no moderating and mediating effects, high egoistic oriented divers are willing to pay the most, followed by low biospheric and neutral altruistic oriented divers.

Keywords: Egoistic, altruistic, biospheric, Contingent valuation; willingness to pay; scuba diving

5.1 Introduction

Modern day environmental problems are a result of various forms of unregulated human behaviour, from pollution of land, degradation of MPAs to climate change and loss of biodiversity (De Groot & Steg, 2007:318). MPAs are examples of common pool resources whose existence is threatened for current and future generations. It is believed that knowledge about the environment and marine ecosystems is important in reducing the degradation impacts and promoting eco-friendly behaviour (Rickels et al., 2016:37). This knowledge is often acquired through experience and level of skill and then transferred into eco-friendly behaviour (Thapa et al., 2005:54).

Ryan and Spash (2012:2505) support the notion that mitigating environmental damage requires altering individual human behaviour as well as organisational and government behaviour, to ensure moving towards sustainable behaviours that are practised by everyone. An important cause for action is regulating scuba diver behaviour in a bid to reduce the potential damage that
scuba diving tourism could have in the long-run, regardless of the current levels of conservation (Peters & Hawkins, 2009:219). One point of departure in this regulation has been to identify and characterise scuba diver behaviour in terms of their personality, attitude, motivations, preferences, satisfaction, knowledge, perceptions and norms (Lucrezi et al., 2013:52).

In accordance with the work of Kahneman and Tversky (1979:263), when individuals make decisions under risk and uncertainty, they often deviate and contradict normal rational thought in terms of risk seeking or risk averse behaviour, depending on the individual’s beliefs, personal experience, attitudes and demographic factors. Individuals’ behaviour differs in situations where there are risks with gains, from situations where there are risks with losses, as such that asymmetry in their choices is evident (Lanz et al., 2010:517).

The study of consumers’ willingness to pay is characterised by their heterogeneous attitudes, ethical beliefs and perception of the environment, the knowledge they have as well as the different demographic and socio-economic factors peculiar to them (Obeng & Aguilar, 2018:459; Olofsson & Öhman, 2006:768; Stern et al., 1995:1611). When these heterogeneous characteristics are under-estimated or not taken into account in utility studies, they lead to inaccurate estimates (Choi & Fielding, 2013:24).

Theory on environmentalism originally focused on these socio-demographic and economic factors that affect the different levels of individuals’ willingness to pay, and less on the attitudinal characteristics (Dietz et al., 1998:450; Holden, 2005:344). The rationale for individual environmental attitudes in willingness to pay estimates comes from the premise that stated preferences reveal a behavioural intention (Choi & Fielding, 2013:24). These environmental attitudes are measured according to what is known as value orientation. Value orientation is defined in Schwartz (1994:21) as:

“a desirable trans situational goal varying in importance, which serves as a guiding principle in the life of a person or other social entity.”

These value orientations come from acknowledging that there are environmental consequences coupled with accepting responsibility for these consequences (Ryan & Spash, 2012:2508). Considering the different impacts that the scuba diving industry has on the ocean and its resources (Harriot et al., 1997:174); Hasler & Ott 2008:1789; Tratalos & Austin 2001:67), it is important to understand the behavioural concern of scuba divers. This would assist in establishing and executing effective environmental management plans and education programs to reduce current and future damage to the environment (Thapa et al., 2005:54).
Though many studies on value orientations and how they influence pro-environmental behaviour have been conducted (Aprile & Fiorillo, 2017:120; Bouscasse et al., 2018:206; Eom et al., 2016:1332; Stern et al., 1995:1611), very little has been done on the influence of these value orientations on willingness to pay of scuba divers in an Italian MPA.

This paper aims to study the value orientations and environmental perceptions, in addition to selected socio-demographic factors, of scuba divers in the Portofino MPA and how these act as mediating and moderating effects on the diver’s willingness to pay for conservation of the MPA. In other words, this study investigates which of these value orientations have a significant influence on willingness to pay.

This article is organised as follows: Section 5.2 provides background literature on the awareness of environmental consequences and resulting value orientations; Section 5.3 describes the study cite and data collection; Section 5.4 discusses the method and why it was chosen; Section 5.5 presents and discusses the results and Section 5.6 gives the conclusion and recommendations.

5.2 Literature

Ethics of the marine environment can be described by the collective action of humans towards the natural ecosystem (Holden, 2005:344; Palau-Saumell et al., 2014:423). Questions that follow are: to what degree are scuba divers morally responsible for the environment; and what conservation right does nature have in the eyes of scuba divers? The answer lies in the continuous environmental degradation, caused by human behaviour that is leading to adverse consequences to scuba divers themselves, other users of the ocean and nature as a whole; therefore, environmental concern is important (Ryan & Spash, 2012:2505).

Environmental concern is the degree to which people acknowledge that there is environmental damage and their concern about reducing the consequences (Eom et al., 2016:1332; Helm et al., 2018:158). There are two main theories that give foundation to environmental concern behaviour: the theory of planned behaviour and the value belief norm theory (Bouscasse et al., 2018:206). Besides these two theories, environmental behaviour literature has motivated that environmental values are influenced by post-materialism (Dutcher et al., 2007:475), cultural bias (Douglas & Wildavsky, 1982), social psychology and inclusion with nature (Schwartz, 1994:19; Stern et al., 1993:233). Post-materialism defines a situation where economic prosperity brings a movement in value from the pursuit of material possessions to the pursuit of non-monetary things like pro-environmental behaviour, political freedom, etc. (Combes et al., 2018:286; Dutcher et al., 2007:475). Cultural bias determines the degree to which an individual is incorporated into a group and the rules that they are bound to follow (Dutcher et al., 2007:476).
Based on the assumption that pro-environmental behaviour is a result of intentional thought process rather than external conditions, the two main theories are discussed in the next sections.

5.2.1 Theory of planned behaviour

According to the theory of reasoned action, postulated by Ajzen and Fishbein (1980), which was later modified into the theory of planned action (Ajzen, 1991:77), people have different opinions based on their personal values, and these personal values are held with varying ranks of importance (Kotchen & Reiling, 2000:95).

These personal values enable individuals to engage in behaviours that will result in their self-desired outcomes. For instance, a scuba diver who believes that fishermen are abusing the ocean is most likely to encourage conservation initiatives in contrast to a scuba diver who strongly disagrees with the statement, ceteris paribus. Therefore, the extent of agreement or disagreement acts as a weighting of value orientation strength, which is assumed to explain human behaviour (Kotchen & Reiling, 2000:95).

The theory of planned behaviour assumes that observed behaviour is a function of attitudinal dimensions (the extent the action is positively valued), subjective norms (which are the social pressures from people that are of influence in one’s life) and perceived behavioural control (which explains that individuals are prone to an action that is easy to execute), all of which translates to an intended behaviour that progresses to observed behaviour (Bouscasse et al., 2018:206).

5.2.2 Value belief norm model

According to Stern et al.’s (1993:233) value belief norm (VBN) model, there are three different, though correlated, environmental attitudes that come from people’s value orientations: egoism, altruism and biospheric nature (Deng et al., 2006:23; Ryan & Spash, 2012:2506). These three value orientations are assumed to directly influence an individual’s belief about the environment and be more concerned about the effects of their actions on the environment (Obeng & Aguilar, 2018:459). Value orientations are described as guiding principles, which serve as a foundation for shaping an individual’s beliefs and attitudes towards behaviour (Dutcher et al., 2007:475).

Altruistic value orientations are motivated by the need to reduce environmental consequences because they affect other people, and these can be divided into selfish-altruism and social altruism (Fehr & Fischbacher, 2003:785). Selfish-altruism describes a situation where an individual’s direct benefits allow others to benefit as well, whereas social-altruism describes a situation where others’ direct benefit, gives an individual satisfaction (Ryan & Spash, 2012:2508).
Individuals with the biospheric value orientation have a tendency to view their own and other’s actions, by considering the benefits and disadvantages for nature (Martin & Czellar, 2017:57). Biospheric value orientation is motivated by the need to protect nature and other living animals, therefore, individuals engage in pro-environmental behaviour so as to mitigate damage to nature; egoistic value orientations are motivated by the need to reduce adverse impacts towards oneself; and altruistic values engage in pro-environmental behaviour to avoid environmental consequences that will affect other individuals (Martin & Czellar, 2017:57; Ojea & Loureiro, 2007:809; Fehr & Fischbacher, 2003:785).

All these value orientations compel individuals to take responsibility for conservation. Therefore, in this case, a scuba diver is assumed to be more receptive to pro-environmental behaviour depending on their specific value orientation, which in turn influences their behaviour and also their willingness to pay for marine resources (Ryan and Spash, 2010:2508).

The assumption is that having a specific value orientation influences people to choose a behaviour that is congruent with that value orientation and deny value incongruent information (Hansa et al., 2008:3). Therefore, it is probable that people with egoistic value orientations (self-interest) are more likely to participate in pro-environmental behaviour when offered with a self-enhancing message rather than a self-transcendent message (De Dominicis et al., 2017:1). In the same way, people with biospheric value orientations are more likely to participate in pro-environmental behaviour when they are offered self-enhancing and self-transcendent messages. De Dominicis et al. (2017:1) motivates that in order to get more pro-environmental behaviour, it is advisable to make self-enhancing motivators more prominent because self-transcendent messages only appeal to individual with altruistic value orientations. Nevertheless, it is believed that individuals hold all three value orientations to a certain extent (de Groot & Steg, 2009:62), and it may be difficult to determine which value orientation has influenced a behaviour since they may be contradicting (Luzar & Cossé, 1998:429).

Therefore, this paper carries its foundation from the theory of planned behaviour and the value belief norm, which collectively suggests that individuals are concerned about the environment because damage to it would result in negative consequences to oneself, other people or other natural living things (Aprile & Fiorillo, 2017:120).

To measure the value orientations, a variety of scales have been proposed, for example the two attitudinal scales, which are based on the concern for the environment and the consequences of damage to oneself, others and nature (Obeng & Aguilar, 2018:459), as shown in Table 5.1.
Table 5.1: Example of EC and AC scale items.

<table>
<thead>
<tr>
<th>Items</th>
<th>Awareness of Consequences scale (AC)</th>
<th>Environmental Concern Scale (EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egoistic</td>
<td>Environmental protection will provide a better world for me and my children. Protecting the environment will threaten jobs for people like me.</td>
<td>I am concerned about environmental problems because of the consequences for: - My lifestyle - My health</td>
</tr>
<tr>
<td>Altruistic</td>
<td>Environmental protection will help people have a better quality of life. The effects of pollution on public health are worse than we realise.</td>
<td>I am concerned about environmental problems because of the consequences for: - All people - People in the community</td>
</tr>
<tr>
<td>Biospheric</td>
<td>Over the next several decades, thousands of species will become extinct. Claims that current levels of pollution are changing earth’s climate are exaggerated.</td>
<td>I am concerned about environmental problems because of the consequences for: - Birds - Plants</td>
</tr>
</tbody>
</table>

(Adapted from Ryan & Spash, 2010:4)

The AC scale assumes that when people value an environmental resource, they will be ready to do whatever it takes to conserve it, for instance, by being willing to pay a user fee towards conservation (Obeng & Aguilar, 2018:459). The EC scale assumes feelings of interconnectedness and empathy in relation to others or nature (Ryan & Spash, 2010:4). This study will employ a General Awareness of Consequences (GAC) scale, since the focus is on diver behaviour and values, and how it influences willingness to pay.

Several studies have investigated the influence of the three value orientations on willingness to pay, and their main findings are subsequently summarised:

Kotchen and Reiling (2000:93) investigated the willingness to pay for conservation of endangered species in Augusta, Maine. The sample involved 635 residents sampled using a stated contingent valuation and New Ecological Paradigm (NEP) scale, and results showed that environmental attitudes significantly influence willingness to pay.

Lopez-Mosquera and Sanchez (2012) investigated whether the value belief norm and theory of planned behaviour explain willingness to pay for conservation of a suburban park. A sample of 194 respondents was drawn in 2010 at Monte San Pedro Park in Spain. Using a confirmatory factor analysis and logit regression, the results show that respondents with biospheric and
altruistic value orientations influence willing to pay for conservation, while egoistic value-oriented respondents do not have a significant influence.

Obeng and Aguilar (2018:458) investigated the three value orientations and their influence on willingness to pay for conservation of a forest watershed in the USA. A sample of 1002 respondent was drawn in 2016 from a web-based survey using the GAC scale. Data was analysed using an exploratory factor analysis and ordered logit model and the results showed egoistic value orientations to have a negative relationship with willingness to pay, while biospheric value orientations had a positive relationship with willingness to pay;

Ojea and Loureiro (2007:807) investigated the influence of the three value orientations on the willingness to pay for conservation of a marine bird. Data was collected in 2005 in Galicia (Spain) using a sample of 660 respondents of willingness to pay and GAC scale questionnaires. The estimation included a factor analysis and logit regression and the results showed that the three value orientations are important in explaining willingness to pay for the marine bird.

Spash (2006:602) conducted open-ended willingness to pay interviews with GAC scales in the UK to find out if the three value orientations explain willingness to pay for environmental improvements. A sample of 713 respondents was surveyed; a confirmatory factor analysis and a multinomial logit model found that altruism should be divided into selfish altruism (which can be related to egoism) and social altruism (which can be related to biospherism).

Some of these studies and others have successfully used the three value orientations and their effect on willingness to pay.

5.3 Data

Data is retrieved from the two different sets of questionnaires (from Chapter 3 and Chapter 4), collected in the Portofino MPA. The first one was a stated preference double bounded dichotomous questionnaire collected in June and July 2016 (see Appendix C). The questionnaire consisted of three sections: section A captured views of conservation questions, section B determined the demographic factors of the sample and section C investigated the spending behaviour of the sample. This paper made use of Section A, for opinions on selected detrimental human behaviour and the willingness to pay questions using an upper and lower bounded dichotomous choice method, and section B for the demographic control questions. Three questionnaires with three different starting bids were randomly administered to divers using random sampling strategy after their dive. This was designed to eliminate the problem of starting point bias and to increase the efficiency of the statistical results when deriving the willingness to pay amount as explained in Chilton (2007:664). The questionnaire was well described and clearly
understood by the respondents as motivated by Laarman & Gregersen (1996:247). This is true because the questions used in the survey were extracted from past surveys of similar willingness to pay studies, therefore the questionnaire was not a new design. The questionnaire was also given to a small number of expert divers who dive in Portofino to ensure that the questions are clearly formulated before distribution.

The second set of data was retrieved from the stated preference choice experiment questionnaire collected in June and July 2017 (see Appendix C). The questionnaire also consisted of three sections: section A, which captured views on conservation; section B, which captured demographic questions and section C, which investigated spending behaviour. This paper made use of section A for the GAC questions as well as the choice sets question (different combination scenarios varying in different levels of six chosen attributes), and section B for the demographics. The questionnaire was randomly administered to divers after their dive.

5.3.1 Study setting

The study was conducted at the Portofino Marine Protected Area in Italy. See section 2.4.1 for a full description of Portofino MPA.

5.3.2 Double bounded dichotomous questionnaire

The data used in this paper was extracted from the first willingness to pay survey conducted in 2016 (see Appendix C for complete questionnaire) included nine different actions that respondent divers were required to rate how much of an effect each of these nine actions had on the marine ecosystem. Following the list of fourteen hazards in coastal wetlands caused by human behaviour from the study by Elliot et al. (2014:89) and Lucrezi et al. (2018:91), this study chose the following human behaviour: climate change; water pollution; introduction of invasive species; fishing; coastal development and boat traffic activities. In addition to these actions, scuba divers’ actions underwater were found to cause some damage to marine life (Lucrezi et al., 2018:91).

These nine different actions were rated on a five-point likert scale from no effect to major effect as shown in Table 5.2. The question for these statements was: “In your opinion, what effect does the following human behaviour have on sea bottom?”

<table>
<thead>
<tr>
<th>Table 5.2: Adverse behaviour questions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Water pollution</td>
</tr>
<tr>
<td>b. Diver impact on coral reef mortality</td>
</tr>
<tr>
<td>c. Diver impact on marine life e.g. sea turtle</td>
</tr>
<tr>
<td>d. Diver impact on dolphins</td>
</tr>
</tbody>
</table>
Willingness to pay questions were asked by means of a double-bounded dichotomous method, where respondents were asked whether they are willing to pay a certain amount. These amounts were varied among three different starting bids, that is, €5, €10 and €15 to different divers. This was done to reduce the starting point bias as motivated by Chilton (2007:664). On accepting the starting bid, the next question would offer a higher bid amount. On rejecting the starting bid, the respondent would be offered a lower bid amount as shown in Figure 5.1.

![Figure 5.1: Willingness to pay bids.](image)

### 5.3.3 Choice experiment questionnaire

Data retrieved from the choice experiment survey (see full questionnaire in Appendix C) included questions aimed at identifying scuba divers’ opinions about nine environmental statements. These statements required the divers to tick an answer from a five-point likert scale, rating their degree of agreement or disagreement with each statement, as shown in Table 5.3. The question for these statements was: “What is your opinion on the following statements?”

| Table 5.3: GAC scale questions. |
|---------------------------------|------------------|-----------------|-----------------|-----------------|
| **a. Environmental protection benefits everyone** | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
| **b. Over the next decade, thousands of marine species will become extinct** | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
c. Claims that we are changing the environment are greatly exaggerated
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
---|----------------|-------|---------|----------|------------------|

d. While some local species may have been harmed by environmental degradation, over the whole earth there has been little effect
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

e. We do not need to worry much about the environment because future generations will be able to deal with these problems than us
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

f. Marine biodiversity is essential to maintain a healthy planet earth
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

g. Environmental protection will provide a better world for me and my children
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

h. Modern development threatens marine biodiversity
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

i. Laws to protect the ocean limit my choices and freedom
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

j. Protected environment provides me with better opportunities for recreation
   | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |

These GAC scale statements were extracted from the study by Ojea and Loureira (2007:108) and modified to suit Portofino MPA and its characteristics extracted from the study by Lucrezi et al. (2018:91). This scale was chosen because it incorporates the three underlying value factors of egoistic, biospheric and altruistic by capturing an individual’s attitude towards environmental issues. The three value orientations were divided among the nine-item statements as shown in Table 5.4.

**Table 5-4: Characterisation of the value orientations.**

<table>
<thead>
<tr>
<th>Value Orientation</th>
<th>GAC Number</th>
<th>GAC Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altruistic</td>
<td>1</td>
<td>Environmental protection benefits everyone.</td>
</tr>
<tr>
<td>Biospheric</td>
<td>2</td>
<td>Over the next decade, thousands of marine species will become extinct.</td>
</tr>
<tr>
<td>Biospheric</td>
<td>3</td>
<td>Claims that we, the divers, are changing the environment are greatly exaggerated.</td>
</tr>
<tr>
<td>Biospheric</td>
<td>4</td>
<td>While some local marine species may have been harmed by environmental degradation, there has been little effect over the whole earth.</td>
</tr>
<tr>
<td>Altruistic</td>
<td>5</td>
<td>Environmental threats to public health have been exaggerated.</td>
</tr>
<tr>
<td>Egoistic</td>
<td>6</td>
<td>Environmental protection is beneficial to my health.</td>
</tr>
<tr>
<td>Egoistic</td>
<td>7</td>
<td>Environmental protection will provide a better world for me and my children.</td>
</tr>
<tr>
<td>Egoistic</td>
<td>8</td>
<td>Environmental protection will help me to have a better quality of life.</td>
</tr>
<tr>
<td>Altruistic</td>
<td>9</td>
<td>Environmental damage generated here harms people all over the world.</td>
</tr>
</tbody>
</table>
This scale was followed by willingness to pay for conservation questions in the form of a stated preference discrete choice experiment. This was done by presenting each diver with two choice set questions, each with two options, A and B, from which to choose (see Figure 5.2). Each option had a diving environmental scenario involving one level of the five attributes. These environmental attributes were water visibility, diver crowding, abundance of groupers, diversity of species and a user fee price (see 4.3.2 for a detailed discussion of the construction of the choice sets).

![Choice set example](image)

**Figure 5.2:** Choice games.

Both questionnaires also gathered information on the respondents’ demographics, that is, gender, age, level of education, marital status, country of origin and dive experience.

### 5.4 Method for mediator and moderator effects

The first analysis conducted is that of testing the presence of mediating and moderating effects in the double-bounded dichotomous data. Following the method in Ong and Musa (2012:1523) and Thapa *et al.* (2005:57), this paper tests whether environmental concern, through diver specialisation, will predict pro-environmental behaviour (willingness to pay). Environmental concern is described here as the opinion divers have about how the nine different human actions (described in Figure 5.2) affect marine life. Diver specialisation is measured through the dive certification level (described in Table 5.7); the higher the dive certification, the more specialised a diver is. Diver specialisation is split into 6 different dive certification levels: open water, advanced open water, rescue, deep advanced open water, dive master and instructor.
This idea of specialisation as a mediating or moderating effect comes from the theory of recreational specialisation, where individuals are believed to be influenced, through participating in social groups, into pro-environmental behaviour (Van Liere & Noe, 1981:512). Recreational specialisation is defined by Thapa et al. (2005:57) as a linear hierarchical progression starting at entry level and advancing to expert level in a specified activity based on, skill, use of equipment, experience, value orientations and commitment.

Therefore, this analysis investigates whether diver specialisation levels moderate or mediate pro-environmental behaviour via environmental knowledge. Environmental knowledge is defined as the diver’s knowledge and education about the marine environment and human impact on it (Thapa et al., 2005:54). The hypothesis becomes: divers who dive more and are more specialised, will have more concern towards the negative impact on the environment, and be more willing to support conservation. The data was used to model the effect on each respondent’s willingness to pay, using the mediator and moderator methods. Environmental concern will be measured through the divers’ rating of the environmental actions. Pro-environmental behaviour will be established from divers’ willingness to pay user fees towards conservation efforts. As a point of departure, the next section will define the meaning of mediator and moderator effects.

5.4.1 Characterisation of mediator moderator method

Mediator effects occur when one variable is responsible for part of, or all of, the connection between two other variables in a function (Thapa et al., 2005:58). To test for mediator effects, there are three steps to follow:

(a) the mediator should be regressed on the predictor variable: \[ M = B_0 + B_1X + e \]

(b) followed by regressing the criterion variable on the mediator: \[ Y = B_0 + B_1M + e \] and then

(c) the criterion is regressed on both the predictor alone, and the predictor together with the mediator: \[ Y = B_0 + B_1X + B_2M + e \]

A predictor variable \( X \) is an independent variable and a criterion variable \( Y \) is a dependent variable in a function (Baron & Kenny, 1986:1174). For a mediation conclusion, the impact of the predictor variable on the criterion variable should be less when the mediator \( M \) is included than when it is not included (Thapa et al., 2005:58; Baron & Kenny, 1986:1176).

On the other hand, a moderator effect occurs when the connection between two variables differs, and to establish moderation, the interaction between the predictor and the moderator must be significant as a function of another variable (Thapa et al., 2005:58). Therefore, when analysing a
correlation, Baron and Kenny (1986:1174) explain that a moderator becomes “a third variable that affects the zero-order correlations between two other variables”. It is preferred that the moderator variable not be correlated with the predictor variable or the criterion variable (Thapa et al., 2005:58).

5.4.2 Descriptive results of the double-bounded dichotomous sample

Table 5.5 presents the descriptive statistics of the 2016 double dichotomous sample. The majority of divers in the sample were Italians, 89% in 2016. Scuba diving in Portofino is still a male dominated activity with 70% males, and the highest percentage of respondents were between the age of 40 and 49 (middle-aged).

Table 5.5: Descriptive statistics.

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian</td>
<td>89%</td>
<td>354</td>
</tr>
<tr>
<td>Foreigners</td>
<td>11%</td>
<td>41</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>30%</td>
<td>128</td>
</tr>
<tr>
<td>Male</td>
<td>70%</td>
<td>301</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>17%</td>
<td>71</td>
</tr>
<tr>
<td>30-39</td>
<td>21%</td>
<td>88</td>
</tr>
<tr>
<td>40-49</td>
<td>36%</td>
<td>151</td>
</tr>
<tr>
<td>50-59</td>
<td>22%</td>
<td>90</td>
</tr>
<tr>
<td>60+</td>
<td>5%</td>
<td>19</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>15%</td>
<td>63</td>
</tr>
<tr>
<td>Diploma</td>
<td>35%</td>
<td>149</td>
</tr>
<tr>
<td>Degree</td>
<td>30%</td>
<td>129</td>
</tr>
<tr>
<td>Post-graduate degree</td>
<td>17%</td>
<td>73</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>15</td>
</tr>
<tr>
<td><strong>MPA awareness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>99%</td>
<td>413</td>
</tr>
<tr>
<td>No</td>
<td>1%</td>
<td>5</td>
</tr>
<tr>
<td><strong>Diving experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1%</td>
<td>4</td>
</tr>
<tr>
<td>Fair</td>
<td>1%</td>
<td>6</td>
</tr>
<tr>
<td>Good</td>
<td>20%</td>
<td>82</td>
</tr>
<tr>
<td>Very Good</td>
<td>45%</td>
<td>194</td>
</tr>
<tr>
<td>Excellent</td>
<td>32%</td>
<td>138</td>
</tr>
<tr>
<td><strong>Average dives logged</strong></td>
<td></td>
<td>485.7 per year</td>
</tr>
<tr>
<td><strong>Average years diving</strong></td>
<td></td>
<td>7.2 years</td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td></td>
<td>442 respondents</td>
</tr>
<tr>
<td><strong>Response scale</strong></td>
<td></td>
<td>5-point likert</td>
</tr>
</tbody>
</table>
The respondents were generally well educated, with most of them having at least a diploma. Most divers were aware that they were diving in an MPA (99%), and a high percentage of divers rated their diving experience in Portofino as very good (45% in 2016). It is worth highlighting that the average diver in this sample was experienced, having logged 485 dives for the 2016 sample. These characteristics correspond with the sample of the study by Lucrezi et al. (2018:91) done in Portofino MPA.

5.4.3 Probit model

A probit model is used for the double-bounded dichotomous sample. According to Thapa et al. (2005:58), the mediating and moderating effects are tested using the following hypothesis:

\( H_1 \): Environmental knowledge is positively related to pro-environmental behaviour among scuba divers.

\( H_2 \): The relationship between environmental knowledge and pro-environmental behaviour among scuba divers is mediated by level of diver specialisation.

\( H_3 \): The relationship between environmental knowledge and pro-environmental behaviour among scuba divers is moderated by level of diver specialisation.

This paper follows the same steps and method used in Thapa et al. (2005:58). To test for mediation, the steps used are as described in Section 5.4.1, where M (diver level specialisation) is assumed to be the mediator that mediates between predictor X (environmental knowledge/concern) and an outcome Y (willingness to pay).

Using the method in Thapa et al. (2005:58) and Newsom (2015:1) as a guideline, the data was modelled and adapted to the present study’s hypothesis to follow the following four steps:

1. estimating a simple regression analysis where specialisation predicts environmental knowledge;
2. estimating a simple regression analysis where environmental knowledge predicts diver level specialisation;
3. estimating a simple regression analysis where environmental knowledge predicts willingness to pay;
4. and then finally, estimating a multinomial regression where environmental knowledge and diver level specialisation predict willingness to pay.
According to Newsom (2015:1), if one of the first three steps shows results that are not significant, then there is no mediating effect. If the results are significant then the final step 4 is estimated and evaluated for partial or full mediation.

To test for moderation, Kean University (2013:1) assumes again that M (diver level specialisation) is the mediator that mediates between predictor X (environmental knowledge/concern) and an outcome Y (willingness to pay), and the following steps are conducted:

1. variables are standardised for easy interpretation;
2. dummy variables are created for the categorical variables;
3. a hierarchical multiple regression analysis is estimated where willingness to pay is predicted from both environmental knowledge and diver specialisation level.

If the third step results are significant, then interaction effects are added to the model and checked again for significance. Moderation is concluded if there is significance in the results.

5.5 Results of the mediating and moderating effects

The double-bounded dichotomous sample collected a total of 442 divers in 2016. The response rate to the two sections used for this paper was 100%. The statistical packages used for the analysis were: Microsoft Excel for data capturing; IBM SPSS 25.0 (Statistical Package for Social Science) for the descriptive statistics and StataMP 14 to model the probit models for the willingness to pay. The data were coded following the method in Thapa et al. (2005:59). The results for the double-bounded dichotomous mediating and moderating effects are presented in this section.

Table 5.6 shows the percentage of responses corresponding with each of the nine environmental actions that the divers were asked. Divers believe that human behaviour has a major effect causing water pollution (83.1%), a major effect through commercial fishing (77.8%), a major effect through climate change (62.8%) and introduction of invasive species (67.7%), and a major effect through boat traffic activities (58.2%) and coastal development (58.6%). What is interesting is that divers believe that their actions have a lesser effect on the ocean and marine life. The distribution of the two diver impact actions is close to each other, with most of the divers voting for moderate effect on sea bottom (34.6%) and marine life (28.9%).

Table 5.6: Action percentage results.

<table>
<thead>
<tr>
<th>Actions</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>
5.5.1 Probit results for double dichotomous sample

The dependent and independent variables to be used are shown in Table 5.7.

Table 5.7: Description of variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidi</td>
<td>Starting bid amount in euros proposed to each respondent</td>
</tr>
<tr>
<td>Male</td>
<td>Dummy variable that equals to 1 if respondent is a male; 0 if female</td>
</tr>
<tr>
<td>age_range</td>
<td>Age in years grouped into 5 categories: 1 if &lt;30, 2 if 30-39, 3 if 40-49, 4 if 50-59 and 5 if &gt;59.</td>
</tr>
<tr>
<td>age_squared</td>
<td>The square of the age range variable to test for non-linearities</td>
</tr>
<tr>
<td>Education</td>
<td>Level of education: (1) high school, (2) diploma, (3) degree, (4) post-graduate degree and (5) other.</td>
</tr>
<tr>
<td>Edu_squared</td>
<td>The square of the education variable to test for non-linearities</td>
</tr>
<tr>
<td>dive experience</td>
<td>Rating of their diving experience using the scale (1) poor, (2) fair, (3) good, (4) very good and (5) excellent.</td>
</tr>
<tr>
<td>Italy</td>
<td>Dummy variable equal to 1 when respondent is from Italy</td>
</tr>
<tr>
<td>Dive Specialisation</td>
<td>Dive levels grouped: 1= open water, 2= advanced open water, 3= rescue, 4= deep advanced open water, 5= dive master and 6= instructor</td>
</tr>
<tr>
<td>environ</td>
<td>Average environmental scores for each respondent based on the average score of items in Figure 5.2, representing environmental knowledge.</td>
</tr>
</tbody>
</table>

The probit model was estimated in STATA to investigate moderating and mediating effect in the model through the value orientations. Results are shown in Table 5.8. Table 5.8 presents three columns of results, first two showing the moderating effects model results, and the last showing the mediating effects model results. In the first column, moderation shows the environ variable is statistically significant at 5% level. In the second column, the moderation model regresses the
interaction terms (lev2*en, lev3*en, lev4*en, lev5*en) and all the variables become insignificant (that is, the levels, environ and interaction variables). Therefore, the conclusion is that dive specialisation is not a moderator.

The variable environ has a 5% level of significance; therefore, H₁ is accepted and the conclusion is that knowledge about the environment is positively related to pro-environmental behaviour. This means that divers who are more aware and informed about the MPA are more likely to be willing to pay user fees.

When testing mediation effects, the results show a direct effect where environmental knowledge predicts willingness to pay, shown in Table 5.8. However, there is no mediation via dive level specialisation, because dive level of specialisation never becomes significant. This could be because the level of specialisation used in this study is one dimensional, compared to the specialisation used in Thapa et al. (2005:58). Therefore, since the study’s level of dive specialisation is not as comprehensive, moderating and mediating effects have not been detected.

The hypotheses H₂ and H₃ are rejected, and the conclusion is that there are no mediating or moderating effects in this sample. The control variables: gender; age; education and dive experience, were also not significant, and the intermediate steps in the process showed that there is no relationship between diving levels and environmental sensitivity of divers. This is in contrast with the results found in Thapa et al. (2005:58), where scuba diving specialisation level showed partial mediation, but not moderation.

Table 5.8: Mediating and moderating effects results.

<table>
<thead>
<tr>
<th></th>
<th>Moderating effects 1</th>
<th>Moderating effects 2</th>
<th>Mediating effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidi</td>
<td>-0.131*** (0.020)</td>
<td>-0.131*** (0.021)</td>
<td>-0.130*** (0.020)</td>
</tr>
<tr>
<td>Level</td>
<td>-0.059 (0.060)</td>
<td>-0.363 (0.567)</td>
<td>-0.059 (0.060)</td>
</tr>
<tr>
<td>Environ</td>
<td>0.347** (0.172)</td>
<td>0.250 (0.301)</td>
<td>0.347** (0.172)</td>
</tr>
<tr>
<td>lev2*en</td>
<td>-0.011 (0.149)</td>
<td>0.011 (0.149)</td>
<td></td>
</tr>
<tr>
<td>lev3*en</td>
<td>-0.098 (0.274)</td>
<td>-0.098 (0.274)</td>
<td></td>
</tr>
<tr>
<td>lev4*en</td>
<td>-0.195 (0.408)</td>
<td>-0.195 (0.408)</td>
<td></td>
</tr>
<tr>
<td>lev5*en</td>
<td>0.266 (0.535)</td>
<td>0.266 (0.535)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-0.107 (0.182)</td>
<td>-0.026 (0.185)</td>
<td>-0.017 (0.182)</td>
</tr>
</tbody>
</table>
Since the environmental variable (Environ) was found to be significant and positive, it confirms that environmental concern is a high predictor for pro-environmental behaviour, such as willingness to pay for conservation.

### 5.5.2 Willingness to pay results

The willingness to pay result reflects intentions in monetary terms. Willingness to pay estimates were calculated by dividing the coefficients of the attributes levels by the coefficient of the price variables (Obeng & Agular, 2018:461).

The estimates for willingness to pay were calculated using the probit model in Lopez-Feldman (2012:3), the linear equation is assumed to estimate the willingness to pay is:

\[
WTP_i(Z_i, u_i) = Z_i \beta + u_i
\]  

(5.1)

In the specification in equation 5.3, \(Z_i\) is a vector of explanatory variables, \(\beta\) is a vector of parameters and \(u_i\) is the error term (see section 3.3.3).

The probit model with no control variables shows €6.64 per dive and €6.80 when the control variables are added. It is interesting to note that Italians’ willingness to pay are slightly more (€6.80) per dive than non-Italians (€6.63). This may be because locals have more understanding and greater concern for the environment they live in, but it may also be because there are more Italian divers in Portofino than there are foreigners.
5.6 Method for the GAC value orientations

The data collected from the discrete choice questionnaire was used to measure how the value orientations reflect environmental concern through the divers’ rating of the environmental actions and GAC scale. Pro-environmental behaviour is examined from the divers’ willingness to pay user fees towards conservation efforts. This paper followed the method used in Ojea and Loureiro (2007:811), except that instead of estimating a single willingness to pay, this paper determines how and if the divers’ value orientations affect their valuation of the different attributes of the environment.

5.6.1 Descriptive results of the discrete choice sample

Table 5.9 presents the descriptive statistics of the 2017 sample. The majority of divers in the sample were Italians (80%). Scuba diving in Portofino is still a male dominated activity with 73% of the divers being male (almost similar to the 70% males in the 2016 sample), and the highest percentage of respondents were between the age of 40 and 49 (middle-aged).

Table 5.9: Descriptive results.

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residents</td>
<td>94%</td>
<td>446</td>
</tr>
<tr>
<td>Non-Residents</td>
<td>6%</td>
<td>27</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>27%</td>
<td>138</td>
</tr>
<tr>
<td>Male</td>
<td>73%</td>
<td>366</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>23%</td>
<td>110</td>
</tr>
<tr>
<td>30-39</td>
<td>24%</td>
<td>117</td>
</tr>
<tr>
<td>40-49</td>
<td>28%</td>
<td>139</td>
</tr>
<tr>
<td>50-59</td>
<td>19%</td>
<td>94</td>
</tr>
<tr>
<td>60+</td>
<td>6%</td>
<td>28</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>23%</td>
<td>115</td>
</tr>
<tr>
<td>Diploma</td>
<td>34%</td>
<td>165</td>
</tr>
<tr>
<td>Degree</td>
<td>29%</td>
<td>145</td>
</tr>
<tr>
<td>Post-graduate degree</td>
<td>12%</td>
<td>59</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
<td>8</td>
</tr>
<tr>
<td>MPA awareness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>98%</td>
<td>533</td>
</tr>
<tr>
<td>No</td>
<td>2%</td>
<td>9</td>
</tr>
<tr>
<td>Diving experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1%</td>
<td>8</td>
</tr>
<tr>
<td>Fair</td>
<td>4%</td>
<td>23</td>
</tr>
<tr>
<td>Good</td>
<td>24%</td>
<td>131</td>
</tr>
<tr>
<td>Very Good</td>
<td>46%</td>
<td>250</td>
</tr>
<tr>
<td>Excellent</td>
<td>25%</td>
<td>134</td>
</tr>
</tbody>
</table>
The respondents were well educated, with most of them also having at least a diploma. Most divers (98%) were aware that they were diving in an MPA, and most (46%) rated their diving experience in Portofino as very good. It is worth highlighting that the average diver in the sample was an experienced diver, having logged 372 dives for the 2017 sample. These characteristics also correspond with the sample of the study by Lucrezi et al. (2018:91) done at Portofino MPA.

5.6.2 Logit model

Following the method used in Stern (1994:69), and Ojea and Loureiro (2007:809), willingness to pay, which is described as the behavioural intention, is a function of:

\[ Y = V_{ego}AC_{ego} + V_{alt}AC_{alt} + V_{bio}AC_{bio} + \varepsilon \]  (5.2)

where \( Y \) is the willingness to pay a user fee, \( V_{ego} \) represents the egoistic value orientation weight, \( V_{alt} \) is the altruistic value orientation weight and \( V_{bio} \) represents the biospheric orientation weight. \( AC_{ego} \) is the belief related to the consequences of egoistic values, \( AC_{bio} \) is the belief related to the consequences of biospheric values, \( AC_{alt} \) is the belief related to the consequences of altruistic values and \( \varepsilon \) is the residual term.

A multinomial logit (refer to section 4.3.3.1) is used for this sample. The dependent variable is the choice response to the willingness to pay question. The explanatory variables are the three value orientations specified in Table 5.14. The nine GAC questions were characterised into the three value orientations of interest: egoistic, altruistic and biospheric. The average diver score for each of the value orientations was determined, and each diver’s value orientation was subsequently classified as low (if the score was below 3), neutral (if the score was between 3 and 3.99), and high (if the score was above 4). This resulted in the following scores: ego_low, ego_neutral, ego_high, alt_low, alt_neutral, alt_high, bio_low, bio_neutral, and bio_high. Dummy variables were coded for each of the options included in the choice questionnaire. This allowed for measurement of the joint effect of the value orientations and the socio-demographic factors on willingness to pay, and further catered for preference heterogeneity among divers, as in Obeng and Aguilar (2018:461).
5.7 Results of the GAC value orientations

The discrete choice sample collected a total of 556 divers in 2017. The response rate to the two sections of the questionnaire that was used in this paper was 100%. The statistical packages used for the analysis were: Microsoft Excel for data capturing; IBM SPSS Statistics 25 for the factor analysis and StataMP 14 to model the multinomial logit model for willingness to pay. The data were coded following the method in Ojea and Loureiro (2007:89). The results for the value orientation effects are presented in this section.

Table 5.10 shows the percentage of responses corresponding with each of the nine GAC statements with which the divers were presented. Divers strongly agree that “environmental protection benefits everyone” (76.2%), most strongly agree that “over the next decade, thousands of marine species will become extinct” (53.9%), most strongly agree that “environmental protection is beneficial to my health” (64.4%).

Most of the divers also strongly agree that “environmental protection will provide a better world for me and my children” (69.1%), another strong agreement for “environmental protection will help me to have a better quality of life” (65.2%) and also for “environmental damage generated here harms people all over the world” (60.6%). What is interesting is that divers seemed to have mixed feelings about GAC 3, 4 and 5, which measure biospheric and altruistic value orientations. The distribution of these three statements was close to each other, with most of the divers voting for agreement to strong agreement with the three statements.

Table 5.10: GAC percentage results.

<table>
<thead>
<tr>
<th>GAC Statements</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAC 1: Environmental protection benefits everyone.</td>
<td>76.2</td>
<td>11.9</td>
<td>1.8</td>
<td>3.1</td>
<td>7.0</td>
</tr>
<tr>
<td>GAC 2: Over the next decade, thousands of marine species will become extinct.</td>
<td>53.9</td>
<td>2.7</td>
<td>8.6</td>
<td>5.9</td>
<td>4.6</td>
</tr>
<tr>
<td>GAC 3: Claims that we divers are changing the environment are greatly exaggerated.</td>
<td>18.2</td>
<td>27.8</td>
<td>26.3</td>
<td>18.6</td>
<td>9.1</td>
</tr>
<tr>
<td>GAC 4: While some local marine species may have been harmed by environmental degradation, over the whole earth there has been little effect.</td>
<td>25.4</td>
<td>25.9</td>
<td>22.2</td>
<td>17.7</td>
<td>8.8</td>
</tr>
<tr>
<td>GAC 5: Environmental threats to public health have been exaggerated.</td>
<td>29.8</td>
<td>25.9</td>
<td>16.6</td>
<td>17.4</td>
<td>10.4</td>
</tr>
<tr>
<td>GAC 6: Environmental protection is beneficial to my health.</td>
<td>64.4</td>
<td>20.7</td>
<td>5.5</td>
<td>3.3</td>
<td>6.1</td>
</tr>
</tbody>
</table>
GAC 7: Environmental protection will provide a better world for me and my children.  
|       | 69.1 | 17.0 | 3.8 | 3.3 | 6.8 |

GAC 8: Environmental protection will help me to have a better quality of life.  
|       | 65.2 | 19.2 | 4.9 | 4.2 | 6.4 |

GAC 9: Environmental damage generated here harms people all over the world.  
|       | 60.6 | 20.7 | 8.6 | 4.9 | 5.1 |

5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree.

The next section describes the reliability tests for the factor analyses.

### 5.7.1 KMO and Bartlett's test

An exploratory factor analysis was conducted to investigate the suitability of the data for factor analysis, the Kaiser-Meyer-Olkin (KMO) test and the Bartlett's Test were estimated (see Table 5.11). The KMO test measures dimensionality of the scale and sampling adequacy for factor analysis, and a result of 0.5 or more is measured as suitable (Williams et al., 2010:5) since the results range from 0 to 1. The Bartlett's Test measures sphericity for factor analysis, and a statistically significant result is considered suitable (Williams et al., 2010:5).

**Table 5.11: KMO and Bartlett's test for discrete choice sample.**

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>0.901</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>3889.132</td>
</tr>
<tr>
<td>df</td>
<td>36</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
</tr>
</tbody>
</table>

The KMO (Table 5.11) shows a result of 0.9, which is higher than the minimum value for suitability, and the Bartlett test is significant at 1% level of significance.

### 5.7.2 Principle component analysis

The method used to extract the factors is principle component analysis. The varimax factor rotation, as in Ryan and Spash (2012), is used because it produces uncorrelated components. A factor rotation is used to maximise high item loadings and minimise low item loadings, to simplify the solution and make it more interpretable (Williams et al., 2010:5). Since 3 value orientations are postulated, 3 factors were extracted, explaining 83.4% of the variance in the dataset.
Considering the three value orientations described in Table 5.12, egoistic values are recorded in scale items 6, 7 and 8; altruistic values are recorded in scale items 1, 5 and 9 and; biospheric values are recorded in scale items 2, 3 and 4. The negative scale items were recoded, and the value orientations were as the average of items, as in Ojea & Loureiro (2007:811).

Table 5.12: Rotated factor loadings (pattern matrix).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>0.911</td>
<td>0.030</td>
<td>-0.029</td>
</tr>
<tr>
<td>2</td>
<td>0.851</td>
<td>-0.071</td>
<td>0.036</td>
</tr>
<tr>
<td>3</td>
<td>0.931</td>
<td>0.010</td>
<td>-0.007</td>
</tr>
<tr>
<td>4</td>
<td>0.949</td>
<td>0.023</td>
<td>-0.006</td>
</tr>
<tr>
<td>5</td>
<td>0.942</td>
<td>0.008</td>
<td>0.021</td>
</tr>
<tr>
<td>6</td>
<td>0.871</td>
<td>-0.005</td>
<td>-0.015</td>
</tr>
<tr>
<td>7</td>
<td>0.000</td>
<td>0.003</td>
<td>0.999</td>
</tr>
<tr>
<td>8</td>
<td>-0.061</td>
<td>0.866</td>
<td>-0.006</td>
</tr>
<tr>
<td>9</td>
<td>0.054</td>
<td>0.879</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Boldface numbers represent the most important relationships <0.40

In this data set, the first six GAC statements fall on one factor. The last two (GAC 8 and 9) fall on the second factor, and only GAC statement 7 falls on the third factor. These results do not capture the egoistic, altruistic and biospheric values as proposed by Stern et al. (1993). However, this is not unique to this research, since both Ojea and Loureiro (2007:811), and Spash (2006:612) also found other loadings. For example, in Ojea and Loureiro (2007:811), the first factor is characterised by egoistic and altruistic values, and the second factor by biospheric values; in Spash (2006:612), factor 1 and factor 3 loaded similar GAC statements for example GAC 6, 7 and 8. The analyses, however, continue with the theoretical factors of egoistic, altruistic and biospheric orientations, similar to the procedure followed in the reference papers.

5.7.3 Cronbach’s Alpha test results

This Cronbach's alpha coefficient (Cronbach, 1951:297; Goforth, 2015:1) is an internal consistency test that measures the extent to which the responses are a consistent measure of items in the likert scale.
The value of the coefficient typically ranges from between 0 and 1 (no lower limit for the value) where the closer to 1 the value is, the greater the internal consistency of the items in the scale (Gliem & Gliem, 2003:87).

**Table 5.13: Cronbach’s alpha for discrete choice sample.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Corrected Item-Total Correlation</th>
<th>Cronbach's Alpha if Item Deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAC 1</td>
<td>0.720</td>
<td>0.602</td>
</tr>
<tr>
<td>GAC 2</td>
<td>0.609</td>
<td>0.625</td>
</tr>
<tr>
<td>GAC3</td>
<td>0.734</td>
<td>0.601</td>
</tr>
<tr>
<td>GAC 4</td>
<td>0.761</td>
<td>0.593</td>
</tr>
<tr>
<td>GAC 5</td>
<td>0.745</td>
<td>0.595</td>
</tr>
<tr>
<td>GAC 6</td>
<td>0.651</td>
<td>0.616</td>
</tr>
<tr>
<td>GAC 7</td>
<td>-0.207</td>
<td>0.761</td>
</tr>
<tr>
<td>GAC 8</td>
<td>-0.040</td>
<td>0.779</td>
</tr>
<tr>
<td>GAC 9</td>
<td>0.079</td>
<td>0.741</td>
</tr>
</tbody>
</table>

Results in Table 5.13 show that each individual Cronbach’s alpha coefficient is higher than 0.59, and the overall scale Cronbach's alpha is 0.691. Though other studies such as Ojea and Loureiro (2007:811) have found higher Cronbach’s alphas of 0.83, and Kotchen and Reiling (2000:93) of 0.73, the author is confident that this study’s alpha of 0.691 is a reasonable result because the recommended minimum for a good Cronbach's alpha test is 0.65 (Goforth, 2015:1).

**5.7.4 Multinomial results for discrete choice sample**

The dependent and independent variables to be used are shown in Table 5.14 for the double-bounded dichotomous.

**Table 5.14: Description of variables for discrete choice sample.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>Bid amount in euros proposed to each respondent Randomly assigned using €5; €10; €15; €20</td>
</tr>
<tr>
<td>Choice</td>
<td>Choice_no (dummy variable equal to 1 when diver chooses no, 0 if otherwise), which was the base outcome</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Choice_yes (dummy variable equal to 1 when diver chooses yes, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>Choice_not (dummy variable equal to 1 when diver chooses opt-out, 0 if otherwise)</td>
</tr>
<tr>
<td>Vis</td>
<td>vis20 (dummy variable equal to 1 when diver chooses 20 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>vis15 (dummy variable equal to 1 when diver chooses 15 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>vis10 (dummy variable equal to 1 when diver chooses 10 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>vis1 (dummy variable equal to 1 when diver chooses 1 metres visibility, 0 if otherwise)</td>
</tr>
<tr>
<td>Crowd</td>
<td>crowd1 (dummy variable equal to 1 when diver chooses 1-6 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>crowd2 (dummy variable equal to 1 when diver chooses 7-12 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>crowd3 (dummy variable equal to 1 when diver chooses 13-18 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>crowd4 (dummy variable equal to 1 when diver chooses 19-24 divers at a time, 0 if otherwise)</td>
</tr>
<tr>
<td>Groupers</td>
<td>lgrouper (dummy variable equal to 1 when diver chooses large number of small (&lt;50cm) groupers, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>sgrouper (dummy variable equal to 1 when diver chooses small number of large groupers (&gt;50cm), 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>mgrouper (dummy variable equal to 1 when diver chooses moderate number of both small (&lt;50cm) and large (&gt;50cm) groupers, 0 if otherwise)</td>
</tr>
<tr>
<td>Species</td>
<td>barracuda (dummy variable equal to 1 when diver chooses plenty of barracudas and dentex, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>lobster (dummy variable equal to 1 when diver chooses plenty of lobsters and octopus, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>eels (dummy variable equal to 1 when diver chooses plenty of moray eels and nudibranchs, 0 if otherwise)</td>
</tr>
<tr>
<td></td>
<td>baitball (dummy variable equal to 1 when diver chooses plenty of fish in large bait balls, 0 if otherwise)</td>
</tr>
<tr>
<td>Female</td>
<td>female (dummy variable equal to 1 if diver is a female; 0 if male)</td>
</tr>
<tr>
<td>Age</td>
<td>age1 (dummy variable equal to 1 if diver chooses age 29 or less, 0 if otherwise)</td>
</tr>
</tbody>
</table>
Table 5.1 shows the results of the multinomial logit regression, as well as the regression for 9 sub-samples according to the average score of each value orientation, that is, ego (ego_low, ego_neutral and ego_high); altruism (alt_low, alt_neutral and alt_high) and biospheric (bio_low, bio_neutral and bio_high) (see 5.6.2 for description).

In the multinomial logit model, the following variables were statistically significant: price, visibility, and most of the variables with diver crowding. The variables' large number of small groupers and plenty of barracudas and dentex were not significant at all in the main sample (mnl) and sub-samples. These sub-samples are used to investigate how value orientations influence respondents’ perceived value of the various aspects of diving, as in the empirical literature of Ajzen, (1991:179); Castellani et al. (2015:96); Grafeld et al. (2016:208); Parsons and Thur (2008:593); Reynisdottir et al. (2008:1078); and Beharry-Borg and Scarpa (2010:1138). The resulting coefficients shown in Table 5.16 are a reflection of the divers’ intentions in terms of choice sensitivity in the utility maximisation (Choi & Fielding, 2013:24).

It is interesting to note that most divers are egoistic high, but altruistic_neutral and biospheric_neutral. This shows that most divers in Portofino are egoistic and will perhaps have a positive willingness to pay towards conservation because it will indirectly benefit them as well (thus the altruistic and biospheric neutral).
Table 5.15: Multinomial results.

<table>
<thead>
<tr>
<th>choice_yes</th>
<th>Mnl</th>
<th>ego_low</th>
<th>ego_neu</th>
<th>ego_high</th>
<th>alt_low</th>
<th>alt_neu</th>
<th>alt_high</th>
<th>bio_low</th>
<th>bio_neu</th>
<th>bio_high</th>
</tr>
</thead>
<tbody>
<tr>
<td>price</td>
<td>-0.020*</td>
<td>-0.042</td>
<td>-0.078*</td>
<td>-0.028**</td>
<td>-0.025</td>
<td>-0.047**</td>
<td>-0.012</td>
<td>-0.047**</td>
<td>-0.017</td>
<td>-0.041</td>
</tr>
<tr>
<td>vis20 vs vis1</td>
<td>1.321***</td>
<td>3.185***</td>
<td>0.301</td>
<td>1.445***</td>
<td>2.108**</td>
<td>1.238***</td>
<td>1.548***</td>
<td>1.450***</td>
<td>1.263***</td>
<td>2.287***</td>
</tr>
<tr>
<td>vis15 vs vis1</td>
<td>1.054***</td>
<td>5.237***</td>
<td>-0.001</td>
<td>1.108***</td>
<td>2.888**</td>
<td>1.052***</td>
<td>1.186**</td>
<td>1.230***</td>
<td>1.181***</td>
<td>1.224**</td>
</tr>
<tr>
<td>vis10 vs vis1</td>
<td>0.775***</td>
<td>3.191***</td>
<td>0.353</td>
<td>0.797***</td>
<td>1.633**</td>
<td>0.841**</td>
<td>0.852***</td>
<td>0.578*</td>
<td>0.899***</td>
<td>1.548***</td>
</tr>
<tr>
<td>crowd1 vs crowd4</td>
<td>0.855***</td>
<td>0.559</td>
<td>1.178</td>
<td>0.597***</td>
<td>1.266**</td>
<td>0.476*</td>
<td>0.760**</td>
<td>0.443</td>
<td>0.810***</td>
<td>0.506</td>
</tr>
<tr>
<td>crowd2 vs crowd4</td>
<td>0.502**</td>
<td>0.700</td>
<td>0.356</td>
<td>0.355*</td>
<td>1.237**</td>
<td>-0.080</td>
<td>0.703**</td>
<td>0.340</td>
<td>0.464**</td>
<td>-0.130</td>
</tr>
<tr>
<td>crowd3 vs crowd4</td>
<td>-0.003</td>
<td>-1.400**</td>
<td>0.500</td>
<td>-0.251</td>
<td>-0.043</td>
<td>-0.667**</td>
<td>0.177</td>
<td>-0.175</td>
<td>-0.235</td>
<td>-0.228</td>
</tr>
<tr>
<td>lgrouper vs mgrouper</td>
<td>-0.420**</td>
<td>-3.161***</td>
<td>0.039</td>
<td>-0.343**</td>
<td>-1.442*</td>
<td>-0.316</td>
<td>-0.335</td>
<td>-0.388</td>
<td>-0.474**</td>
<td>0.096</td>
</tr>
<tr>
<td>sgrouper vs mgrouper</td>
<td>-0.025</td>
<td>0.000</td>
<td>0.811</td>
<td>-0.021</td>
<td>0.314</td>
<td>0.019</td>
<td>0.039</td>
<td>0.322</td>
<td>-0.049</td>
<td>-0.160</td>
</tr>
<tr>
<td>barracuda vs eels</td>
<td>-0.262</td>
<td>0.175</td>
<td>0.737</td>
<td>-0.381</td>
<td>-0.248</td>
<td>0.184</td>
<td>-0.114</td>
<td>-0.341</td>
<td>0.007</td>
<td>-0.246</td>
</tr>
<tr>
<td>lobster vs eels</td>
<td>-0.024</td>
<td>0.177</td>
<td>0.628</td>
<td>0.080</td>
<td>0.177</td>
<td>0.602</td>
<td>0.251</td>
<td>0.233</td>
<td>0.306</td>
<td>0.225</td>
</tr>
<tr>
<td>baitball vs eels</td>
<td>-0.139</td>
<td>0.190</td>
<td>0.701</td>
<td>0.625</td>
<td>0.188</td>
<td>0.658</td>
<td>0.249</td>
<td>0.265</td>
<td>0.319</td>
<td>0.230</td>
</tr>
<tr>
<td>_cons</td>
<td>-0.606**</td>
<td>-0.661</td>
<td>0.755</td>
<td>-0.510**</td>
<td>-1.220*</td>
<td>0.020**</td>
<td>-0.986***</td>
<td>-0.298</td>
<td>-0.677**</td>
<td>-0.496</td>
</tr>
<tr>
<td>Obs</td>
<td>1804</td>
<td>224</td>
<td>144</td>
<td>1824</td>
<td>212</td>
<td>1040</td>
<td>960</td>
<td>664</td>
<td>1208</td>
<td>332</td>
</tr>
</tbody>
</table>

*p<0.1; **p<0.05; ***p<0.001
5.7.5 Willingness to pay results

The willingness to pay result reflects intentions in monetary terms. Willingness to pay estimates (Table 5.16) were calculated by dividing the coefficients of the attributes by the coefficient of the price variables (Obeng & Aguilar, 2018:461).

The estimates for willingness to pay were calculated using equation 5.3 according to Schuhmann et al. (2013:31):

\[-\beta_A/\beta_P\] (5.3)

where \(\beta_A\) represents the coefficient of an attribute level and \(\beta_P\) represents the coefficient of the price. For the discrete choice sample, the demographic control variables such as gender, age, education and dive experience and the price for ego_low, alt_low, alt_high, bio_neutral and bio_high were not significant. Nevertheless, the following willingness to pay results were evaluated:

1. **Basic multinomial WTP**: divers, irrespective of their value orientations, showed the highest willingness to pay for 20 metres visibility (€66), the second highest is for 15 metres visibility (€52), third highest is for 6 divers (€42), fourth highest is for 10 metres visibility (€38), fifth highest is for 7-12 divers (€25) and then lastly, for 13-18 divers, the willingness to pay is a negative €21, which shows disutility for 13-18 divers. The rest of the attributes were not statistically significant.

2. The highest significant amount of willingness to pay is for 15 metres visibility versus 1 metre, with ego_low divers willing to pay up to €124.69, and alt_low up to €115.52, compared to the €52.70 in the basic multinomial model. This is interesting since 15 metres is only the second-best visibility level in this study, and this could point out that the divers are willing to pay the most for a realistic visibility level (15 metres), as compared to a somewhat difficult to attain visibility level of 20 metres. However, this is not true in the basic multinomial model, where all the divers are willing to pay the most of €66.05 for 20 metres visibility.

3. Egoistic value-oriented divers are willing to pay a range of €51.64 to €75.83 for 20 metres visibility, whereas altruistic value-oriented divers are willing to pay from €30.85 to €84.32, and biospheric value-oriented divers are willing to pay from €55.78 to €74.29. It is interesting that ego_low value oriented are willing to pay the most among the egoistic, and alt_low value oriented are willing to pay the most among altruistic, but bio_neutrals are willing to pay the most for 20 metres visibility among biospheric divers, rather than 5 metre visibility.
Table 5.16: Willingness to pay results.

<table>
<thead>
<tr>
<th>Description</th>
<th>ego_low</th>
<th>ego_neu</th>
<th>ego_high</th>
<th>alt_low</th>
<th>alt_neu</th>
<th>bio_low</th>
<th>bio_neu</th>
<th>bio_high</th>
<th>Basic mnl</th>
</tr>
</thead>
<tbody>
<tr>
<td>vis20 vs vis1</td>
<td>75.83***</td>
<td>51.64***</td>
<td>84.32**</td>
<td>26.34***</td>
<td>30.85***</td>
<td>74.29***</td>
<td>55.78***</td>
<td>66.05***</td>
<td></td>
</tr>
<tr>
<td>vis15 vs vis1</td>
<td>124.69***</td>
<td>39.57***</td>
<td>115.52**</td>
<td>22.38***</td>
<td>26.17***</td>
<td>69.47***</td>
<td>29.85**</td>
<td>52.70***</td>
<td></td>
</tr>
<tr>
<td>vis10 vs vis1</td>
<td>75.98***</td>
<td>28.46***</td>
<td>65.32**</td>
<td>17.89**</td>
<td>12.30*</td>
<td>52.88***</td>
<td>37.75***</td>
<td>38.75***</td>
<td></td>
</tr>
<tr>
<td>crowd1 vs crowd4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>46.64***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>crowd2 vs crowd4</td>
<td></td>
<td>12.68*</td>
<td>49.48*</td>
<td></td>
<td>27.2*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>crowd3 vs crowd4</td>
<td></td>
<td>-33.33**</td>
<td>-14.19**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lgrouper vs mgrouper</td>
<td></td>
<td></td>
<td></td>
<td>-75.26***</td>
<td>-12.25**</td>
<td>-57.68*</td>
<td>-27.88**</td>
<td>-21.00**</td>
<td></td>
</tr>
<tr>
<td>lobster vs eels</td>
<td></td>
<td>-20.21**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-18.43*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>baitball vs eels</td>
<td>-42.95**</td>
<td>-19.06**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p<0.1; ** p<0.05; *** p<0.001; blank spaces show insignificant willingness to pay
4. Ego_low value oriented divers value 15 metres visibility the most, followed by 10 metres visibility, then 20 metres visibility, and the last attribute with the highest disutility is large number of small groupers. Alt_low divers value 15 metres visibility the most, followed by 20 metres visibility, then 10 metres visibility, and the last attribute with the highest disutility is large number of small groupers. Bio_neutral divers value 20 metres visibility the most, followed by 15 metres visibility, then 10 metres visibility, and the last attribute with the highest disutility is large number of small groupers. It is interesting that bio_neutral divers is the only one of the three who hold the highest value for 20 metres visibility; perhaps this is because they value nature, and are thus willing to pay the most for the best level of visibility.

5. There is a general significant aversion for igroupers across all value orientations. Scuba divers that have a disutility for these two attributes, and therefore feel they should not pay user-fees for the improvement of these attribute levels. The highest disutility is from ego_low value-oriented divers with a willingness to pay -€75.26 for I grouper versus mgrouper. The divers are experiencing diminishing marginal utility, as discussed in Chapter 4, with the widespread groupers in the MPA.

6. Willingness to pay was predicted significantly for alt_neu divers who were willing to pay the most, €26 for 20 metres visibility, €22 for 15 metres visibility, then €17 for 10 metres and €10 for 6 diver crowding. Alt_neutral divers had a negative willingness to pay for 13-18 divers showing disutility. This is echoed in Spash (2006:620), and Ojea and Loureiro (2007:813), who conclude that altruism and egoism are significant in conservation.

7. What is also interesting is that ego_low value orientated divers had the highest willingness to pay amount for visibility (€124.69 for 15 metres visibility versus 5 metres) in the sample, followed by alt_neutral value-oriented divers (€115.52 for 15 metres visibility versus 5 metres) then bio_neutral divers (€74.29 for 20 metres visibility versus 5 metres). This is perhaps because ego_low have low levels of egoism and thus more levels of altruism and biopherism, which allows them to bid the highest bids. This confirms the literature that egoistic value orientation generally has a positive and significant willingness to pay (Ojea & Loureiro, 2007:812), although Obeng and Aguilar (2018:424) found that egoism has a negative willingness to pay as compared to altruism, and biospherism positively influences willingness to pay.

8. It was not surprising that the attribute crowd3 versus crowd4 both had a negative willingness to pay because diver crowding is a cause for concern for many divers (Lucrezi et al, 2017:399) due to congestion in the ocean, which puts pressure on the ocean’s resources.
It is also important to note that having a value orientation and stating a willingness to pay does not always translate into pro-environmental behaviour; this may be because current attitudes may change in the long run, as acknowledged in Nordlund and Garvill (2002:741).

This shows that divers with different value orientations value attribute levels similarly but with different weights. The lack of significance of the demographic variables shows that there are homogenous preferences in this sample. Therefore, policy makers can use this information to concentrate on improving these two attributes, so that diver utility is increased and future willingness to pay can be realised. Judging from the number of observations, most divers have the highest egoistic value orientations than biospheric and altruistic, which means that most divers will be willing to pay for conservation if they will independently realise a gain from it. Policy makers should use this knowledge to present egoistic marketing campaigns for the payment of user fees, since it speaks to the predominant value orientation. For example, a marketing campaign that emphasises how the payment of a user fee will give extra benefits for individual divers in terms of reduced diver crowding.

5.8 Conclusion

It is believed that individuals who are certain that specific human actions are causing adverse environmental consequences for the resources they value, are most likely to invest in conservation initiatives. At one extreme there are individuals driven by egoistic value orientations who only engage in pro-environmental behaviour because the damage affects their individual self, and then on the other end there are individuals with biospheric value orientation who engage in pro-environmental behaviour to prevent damage to nature and other living organisms.

Considering the different ways user activities can impact the marine ecosystem, this study was important in understanding the behavioural views and attitudes of the dive community. This information will go a long way in the development of efficient policy regulations and education programs to mitigate future damage to the marine ecosystem.

The results show that all three value orientations have a significant and mostly positive influence on willingness to pay for the different attribute levels. This gives a solid contribution to the Portofino MPA because it identifies the environmental attributes that divers value in Portofino, for which they would be willing to pay. Since water visibility and diver crowding are valued the most, these results confirm the conclusions of previous studies in the direction of the relationship between divers’ value orientations and how they influence willingness to pay. These results also support the research into identifying the significant value orientations of users of an MPA in
addition to their socio-demographic factors, so as to inform policy makers on what influences pro-environmental behaviours.

The paper divides each value orientation into three levels of intensity, which are low, neutral and high. These three levels of value orientation intensity enable the model to estimate significant effects of each value orientation, on willingness to pay- and the contribution is that ego_high has the highest willingness to pay, followed by bio_low and alt_neutral. It may be worthwhile to establish educational programs that appeal to the users of the MPA, particularly divers, in terms of the personal benefits, societal benefits and environmental benefits for nature by engaging in pro-environmental behaviour and paying a user fee.

This paper also contributes to the literature through the econometric analysis that tested for moderating and mediating effects of the value orientations on willingness to pay and confirmed no significant moderating or mediating effects.
CHAPTER 6 RECOMMENDATIONS AND CONCLUSIONS

6.1 Introduction

This final chapter aims to discuss and conclude the results of this study according to the aims and objectives set in Chapter 1, give recommendations based on the study’s findings and suggest areas of future research.

The sustainability of the ocean and seas is managed and regulated by Marine Protected Areas (MPAs), which are established to protect and preserve marine ecosystems. Since MPAs are considered common pool resources, they are subject to rivalry and non-excludability, which has led to degradation and depletion of marine life, mostly because of human activities. These MPAs, which are vital for the sustainable protection of the marine ecosystems, are usually poorly funded with little financial means to fund their conservation strategies.

One way of encouraging funding for MPAs is by determining the economic value of MPAs and funding opportunities through the user-payer principle. The user-payer principle advocates for the users of an environmental resource to bear the costs incurred in using the resource. This study focused on scuba divers as a group of users of the Portofino MPA and determining the value they place on the MPA through a willingness to pay analysis. The study further determined the specific environmental attributes for which scuba divers are willing to pay, and the value orientations that influence pro-environmental behaviour.

The main aim of this study was to assess scuba divers’ attitudes towards environmental protection of common pool resources and willingness to pay, to contribute towards marine life conservation in order to ensure that divers’ activity today is sustainable for future generations to enjoy. This is achieved through the following objectives:

i. To evaluate the feasibility of the user-payer principle in the context of scuba diving and its contribution towards sustainable scuba diving tourism.

ii. To determine scuba divers’ willingness to pay for marine conservation and the reasons why they are willing or not willing to pay.

iii. To evaluate the aspects of the marine resources that divers deem important, for instance, good water quality, coastal development and reduction of sea bottom mortality.

iv. To determine the divers’ attitudes towards environmental protection through value orientations, and their opinion on the effect of human behaviour on marine resources.

v. And to make recommendations on the applicability of a scuba diving levy that may guide policy decisions and regulations.
The next section shows how each of these objectives were achieved and draws conclusions based on the research results.

6.2 Conclusions of the study

6.2.1 Conclusions of Chapter 2

The first specific objective of this study, which was to evaluate the feasibility of the user-payer principle in the context of scuba diving and its contribution towards sustainable scuba diving tourism was achieved in Chapter 2. Chapter 2 reviewed the theoretical literature on common pool resources, marine protected areas, environmental degradation and the user payer principle.

As a point of departure, the importance of the ocean was discussed. This included the creation of jobs, which translates into a source of income and provision of a better standard of living. It was shown that the ocean and its resources provide a source of: (i) food through recreational and subsistence fishing, (ii) tourism through various recreation activities such as scuba diving and yachting, (iii) coastal protection from floods, erosion and damage to property and houses. The marine ecosystem also (iv) supports a wide range of biodiversity and (v) offers an important source of extracts for medicinal purposes. All these benefits make the ocean and its limited resources vital for the livelihoods of people, animals and nature.

The literature also established that the number one cause of concern for the destruction of ocean resources is summarised by the tragedy of the commons, because the ocean resources are non-excludable, yet rival. The unregulated behaviour that comes with open access and rival goods, means degradation of environmental resources, thus threatening the existence for future generations.

In addition, the main causes for the exponential degradation of ocean resources were identified, including eutrophication, contaminations such as sewage, deforestation, depletion of coral reefs and habitat destruction, climate change, invasive species, sea level rise, loss of wetlands and over fishing. While scuba diving is not a clear factor influencing degradation of marine resources, recent research has shown that adverse diving behaviour and increased diving activity also puts pressure on these resources. In addition, total destruction would also mean the loss of income for communities that depend on diving tourism.

The three models of resolving the tragedy of the commons were identified: (i) capitalist model (which motivates for privatising the oceans so that costs are internalised and conservation is promoted), (ii) socialist model (which calls for the government to nationalise natural resources and promote equitable efficient management) and (iii) the anthropological model (which motivates
the joint cooperation of the government, business stakeholders, MPA management and the community modifying the management plan). Considering the limitations of the capitalist and socialist model, this study adopts the anthropological model by encouraging an MPA collectively managed by all the stakeholders.

The literature acknowledges the introduction of MPAs since the 1950s, to protect and preserve specific ocean areas from degradation. The study area for this research, Portofino MPA, is one of the smallest Italian MPAs located in an affluent village called Portofino on the north-western Ligurian sea. It was established in 1999 and is made up of 3 zones (Zone A no take, Zone B regulated take and Zone C buffer zone). The Portofino MPA is popular for its red coral population, the coralligenous community, gorgonian populations, groupers, brown meagre, dentex and barracuda, to name a few. This MPA was chosen because it is representative of diving systems in Europe and shed light on the differences in willingness to pay for marine conservation by scuba divers in Europe compared to previous studies, which are mostly based on Asian and Australian diving destinations, and their reasons for not being willing to pay.

The main research question of this study was zoomed in, where the literature examined the user-payer principle as a solution for the problem of inadequate funding of MPAs. The study finds different sources of funding opportunities (such as private company funding, donor sponsorship, government investments) but a more stable source is found in imposing a user-fee, or rather carrying out a willingness to pay study to value the Portofino MPA. Though this study focused on imposing a user fee for divers only, further studies can be conducted on the potential of other users contributing to conservation through a user fee. Using user fees as a source of funding was found to be a feasible source of funding by previous WTP studies, which concluded that divers are prepared to accept significant charges to use resources within protected areas and in so doing contribute to the conservation of marine habitats. Though the results show many protest votes but the WTP is still positive. Since this study advocates for the anthropologist model, it is important for divers to participate in the management of the MPA and contribute to the decision of a user fee. This will work to diminish the protest vote if the divers realise value for their contribution in these decisions.

Willingness to pay is a use-value and non-use value that can be measured using either revealed preference methods or stated preference methods. It was concluded that of the non-use value methods, stated preference methods are best suited to determine willingness to pay in this study, using a combination of contingent valuation and discrete choice experiments. In conclusion, objective 1 was achieved through reviewing the literature that builds up to user fees as a sustainable source of financing an MPA and it was concluded that it is a feasible method that can be carried out, according to past studies. This WTP value was concluded to be instrumental in
informing policymakers on the economic value of the MPA. This information could then be used to motivate for more stable funding. It was also concluded that policy on user fees can then establish a suitable user fee for an MPA only once a willingness to pay study has been conducted through empirical research.

6.2.2 Conclusions of Chapter 3

The second specific objective of this study, which was to determine scuba divers’ willingness to pay for marine conservation and the reasons why they are willing or not willing to pay, was achieved in Chapter 3. Chapter 3 is the first research article from this study, that aimed to assess scuba divers' willingness to pay a user fee in The Portofino MPA.

As a point of departure, scuba diving as a tourism activity was introduced. It was shown that it is a thriving ocean activity attracting many more divers every year. Scuba divers are concluded to have an interest in keeping the ocean sustainable. With the lack of funding problem that comes from sourcing funds from donors and governments, the user fee is often seen as an alternative source of funding. The user fee was also motivated through other case studies that have successfully implemented it as a main source of funding. Most notably, in the Bonaire National Marine Park in north-west Venezuela, the Bunaken National Marine Park in Indonesia, the Namena Marine Reserve in Fiji, and the Gilutongan Marine Sanctuary in the Philippines.

For this research, the Portofino MPA offers a European perspective since it is well known. Most willingness to pay studies use contingent valuation method, although it is criticised for the embedding effect and the use of means or medians as an estimate for WTP. The double bounded dichotomous choice method is chosen because it is a stated preference method that employs a follow-up bid, and therefore addresses some of the concerns of the stated preference methods.

The analysis uses the upper and lower bound dichotomous questionnaire, surveying a sample of 442 scuba divers in the Portofino MPA. This data were collected during the peak season of diving, June and July in 2016 from 7 dive operators in Portofino. The econometric analysis, using a double-bounded dichotomous choice contingent method, estimated a probit model following the method of Lopez-Feldman (2012:12). Although various demographic variables were introduced in the model, the results show that those do not have an influence on WTP.

A mean willingness to pay amount of €6.79 was estimated per dive and this estimate was found to be relatively lower than most double-bounded dichotomous WTP amounts in previous studies. This article found some non-responses to the willingness to pay bids, and this was recorded as the protest vote. The article estimated 146 respondents for the protest vote. Most divers from the protest vote (45%) did not want to pay because they believe it is the government’s responsibility
to pay for conservation of the MPA, 27% because they think the bid amounts are too expensive, 13% because they feel that since users of the MPA do not pay, neither should they and 15% for other reasons. It was concluded that there are different reasons for not willing to pay user fees in Portofino, but the main reason is that divers feel that the government should be responsible for the paying of conservation. It was also concluded that there is a potential opportunity for using user fees as a source of funding for the MPA, for its initiatives towards sustainable marine life. Nevertheless, user fees were concluded to have a financing potential that could go a long way in reducing the financial constraints of managing a MPA. Assuming that the dive population in Portofino is 10,000 divers, who dive an average of 2 or 3 dives, then (20,000 to 30,000 dives x €6.78) would give an annual revenue of €135,600 - €203,400 to the Portofino MPA. The user fees could also be used to control the number of divers so as to reduce pressure on the ecosystem and marine life.

6.2.3 Conclusions of Chapter 4

The third specific objective of this study, which was to evaluate the aspects of the marine resources that divers deem important (for instance good water quality, coastal development, reduction of sea bottom mortality), was achieved in Chapter 4. Chapter 4 was the second article from this study, and the attributes were valued using a choice modelling questionnaire.

A background to choice experiments of common pool resources concluded that individuals’ economic choices can be explained through observing and analysing their preferences and socioeconomic factors. Since individuals always seek to maximise their utility, the analysis used the random utility theory and individual maximisation theory in combination, as foundation for choice experiments.

A discrete choice experiment was administered to a sample of 556 scuba divers in Portofino, from seven different dive operators. The survey was conducted in the peak dive months June and July 2017. A discrete choice experiment is a willingness to pay method that requires respondents to make a choice among a set of different environmental attribute levels. Six attributes were chosen for this case study, as recommended in the past discrete choice empirical studies of MPAs and as applicable to Portofino. The attributes included water visibility (4 levels), diver crowding (4 levels), groupers (3 levels) and species (4 levels) and a willingness to pay price (4 levels).

Using the method in Castellani et al. (2015:92), the paper used a multinomial logit model, conditional logit, nested multinomial logit and a multinomial probit model in STATA to estimate the choice experiment regression. These models were done to cater for the weaknesses of the multinomial logit model, most notably preference heterogeneity, and give a more robust result.
In conclusion, the most preferred and highest valued attribute at Portofino Marine Protected Area is water visibility of 20 metres. Divers are willing to pay a range of €49.34 to €64.89 for 20 metres visibility and up to €52 for 15 metres visibility. Diver crowding of 6 divers has the highest willingness to pay for the least number of divers at a time. Results show that divers are willing to pay at least €23.62 to €38.56 for 1-6 divers and avoid overcrowding, and within a range of €13.03 to €26.72 for 7-12 divers. These estimates for WTP of specific attributes are much higher than the WTP for diving because the first survey asked for a user fee for general conservation and the respondent WTP was conservative, but because the choice questionnaire was specific in the attribute for the WTP, the respondent WTP was higher reflecting how much value the divers place on specific attributes and are willing to pay for.

It was also found that there is an aversion for willingness to pay for species abundance and diversity, with willingness to pay values within a range of -€6.76 to €4.83, and an aversion for small numbers of large groups, with an amount of €1.09 to €1.22, which shows a great magnitude of disutility.

It was further concluded that these results can be used to establish and implement user fees as a revenue maximising option, by restricting diver crowding and conservation efforts to improve water visibility. It was also suggested that in order to compensate for the losses due to increased restrictions on diver crowding and restrictions that improve water quality and also be used in more rigorous marketing campaigns. Water quality can be improved by efforts to reduce water pollution, boat dumping, coastal development and overuse.

6.2.4 Conclusions of Chapter 5

The fourth specific objective of this study, which was to determine the divers' attitudes towards environmental protection through value orientations, and their opinion on the effect of human behaviour on marine resources, was achieved in Chapter 5. Chapter 5 is the third article of this study, which investigated possible mediating and moderating effects and the influence of value orientations on willingness to pay for scuba divers in Portofino.

The article concluded on the background to the theory of planned behaviour and the value belief norm model, both of which lead to the assumption that environmental behaviour is a function of value orientations and other socio-demographic factors. These value orientations are divided into three: egoistic values, altruistic values and, biospheric values.

The method of investigation was mainly derived from Ojea and Loureiro (2007:811). Respondents from the two samples were asked to evaluate the 9 items presented to them on a five-point Likert scale. Using the 9-item adverse human behaviour actions from the 2016 sample (442
respondents), the article estimated dive level specialisation as a mediator and moderator effect, following the analysis in Thapa et al (2005:58). The results showed that the environmental knowledge is positively related to willingness to pay. In conclusion, divers who are more aware and informed about the MPA are more likely to be willing to pay user fees. The article concludes that the level of dive specialisation does not moderate or mediate the relationship between environmental knowledge and willingness to pay.

Using a General Awareness of consequences scale with 9 items, data collected from the 2017 sample (552 respondents) was analysed in an exploratory factor analysis and a multinomial logit model in Stata following the study of Ojea and Loureiro (2007:811), to examine how different value orientations affect the divers’ willingness to pay.

In conclusion, low egoistic value orientated divers had the highest willingness to pay amount for visibility (€124.69 for 15 metres visibility versus 5 metres) in the sample, followed by neutral altruistic value-oriented divers (€115.52 for 15 metres visibility versus 5 metres) than neutral biospheric divers (€74.29 for 20 metres visibility versus 5 metres). It was concluded that since low egoistic oriented divers have low levels of egoism, the egoistic value orientation implies that low egoistic divers have high levels of altruism and biopherism, which allows them to bid the highest bids. This was also true in previous studies where the highest bids were made by egoistic value oriented respondents.

It was also concluded that most divers are egoistic high, but neutral altruistic and neutral biospheric. This shows that most divers in Portofino are egoistic and will have a positive willingness to pay towards conservation because it will indirectly benefit them as well (thus the altruistic and biospheric neutral). This is important for policymakers because it can be used to tailor-make marketing campaigns in such a way that user fees are encouraged by appealing to the predominant value orientations, which is egoistic high. This also shows the potential for discriminatory marketing campaigns for user fees within the MPA, although this should be checked for practicality because of potential administrative difficulties in determining predominant value orientations within divers.

6.2.5 Conclusions on Objective 5

The fifth specific objective of this study, which was to make recommendations on the applicability of a scuba diving levy that may guide policy decisions and regulations, was achieved in Chapter 3, 4 and 5.

Establishing a user-fee in MPAs has been reviewed as a viable method of financing MPAs in different parts of the world, mainly South East Asia, Australia and the Caribbean. This principle is
theoretically feasible when a willingness to pay empirical research study is conducted, through revealed or stated preference methods, to estimate a maximum willingness to pay amount, as well as the applicability of the user fee in that particular MPA.

This study concluded that the maximum willingness to pay amount that can be charged at Portofino MPA is €6.79 per dive. Policymakers can use this estimate as a conservative estimate that can be charged to all divers across the different demographic characteristics. The study also concluded that since most of the protest vote believed that it is the government’s responsibility to pay for conservation, it might be worthwhile to invest in education programs that inform the divers of the increased pressures on government’s budget such that MPAs should take up the responsibility of finding consistent revenue sources.

It was further concluded that divers in Portofino value 20 metres visibility and 6 divers at a time, the most out of the different environmental attributes. Therefore, water visibility and reduced diver crowding are important attributes for which the divers are willing to pay, and species diversity and abundance are relatively less important (which contradicts previous research that found that species abundance and diversity have a high willingness to pay).

Considering that most of the divers in Portofino MPA are found to be highly egoistic, this study concludes that the €6.79 user fee should be marketed as going towards stringent measures to ensure the best water visibility and to restrict diver crowding in the MPA. The user fee can be justified by appealing to divers through high egoistic marketing campaigns that put emphasis on how paying user fees can benefit individual divers, and less on how it benefits other divers and nature.

6.3 Contribution of the study

The aim of the study was to assess scuba divers’ attitudes towards environmental protection of common pool resources and willingness to pay to contribute towards marine life conservation in order to ensure that divers’ activity today is sustainable for future generations to enjoy. To fulfil this, a thesis submitted in the fulfilment of a Philosophy Doctor should make one or more contributions to the field of study. This can be done either through a literature contribution and methodological contribution and/or a practical contribution. This study presents a valuable contribution in terms of revealing willingness to pay, the most important attributes in the MPA for divers, and the value orientations that stimulate pro-environmental behaviour in divers; this is important since Portofino is largely a tourism-based community. Since unregulated environmental degradation negatively affects recreational activities, employment and income generation, willingness to pay surveys become instrumental in implementing user fees that can encourage
users, such as divers, to contribute towards conservation of the MPA. Since Portofino MPA is already struggling to secure guaranteed funding, user fees are a potential source of revenue for the sustainable running of the MPA. The specific contributions are discussed below.

6.3.1 Literature and method contribution

Firstly, the majority of research on willingness to pay, especially scuba divers’ willingness to pay for conservation was found to be mainly based in South East Asia, Australia and the Caribbean context, but very little is available for the European context. Therefore, this study is the first comprehensive study for the European context, contributing to the limited literature of diving systems in Europe. The study site, Portofino MPA, is a popular tourism and diving site that is representative of diving systems in Europe, with characteristic red coral population, the coralligenous community, gorgonian populations, groupers, brown meagre, dentex and barracuda, to name a few. The European context is clearly different from the existing literature, in that the willingness to pay amounts in Portofino MPA (European context) are higher compared to the amounts found in Asia (Caribbean context). This study is thus very relevant, and understanding European diving destinations is an area that needs much more research.

This study is also the first of its kind in analysing willingness to pay using the double-bounded dichotomous choice contingent method, evaluating the value of each environmental attribute using choice experiments and then identifying the value orientations that encourage pro-environmental behaviour in divers, incorporated into one study and conducted at one site. The other similar studies that used the same methods as in this study for willingness to pay, either focused on: (i) the double bounded dichotomous choice contingent valuation methods only, or (ii) they used the double bounded dichotomous choice together with the single-bounded dichotomous choice, or (i) they focused on the choice experiment method only. This study has thus provided a new, unique perspective on the valuation of MPAs, and presents a well-rounded approach in understanding scuba divers’ willingness to pay for conservation.

This study also offered a literature contribution in terms of the profile of scuba divers diving in Portofino MPA in 2016 and in 2017. A sample of divers in Portofino MPA were surveyed in the peak dive season in Italy in 2016, using contingent valuation (double-bounded dichotomous). Then in 2017, a sample of divers in Portofino MPA were surveyed in the peak dive season using a discrete choice experiment. These choice sets allowed this study to estimate the value of each environmental attribute and the importance according to the divers. The survey also allowed the author to examine the change in preference in response to each choice made. Therefore, it has added to the limited sample size of previous research on Portofino MPA. The current sample size of the study included 442 divers for the 2016 sample and 556 divers for the 2017 sample, collected
during the peak dive months in Portofino. This study confirms the existing literature about the demographic profile of scuba divers in Portofino. It is a male dominated activity attracting mostly middle-aged (40-49 years old) individuals. Scuba diving in Portofino predominantly attracts Italians from all over Italy, and a small percentage of other Europeans and divers from the rest of the world. The divers are mostly educated with at least a diploma and have on average 7 years of experience. This study’s sample size is in the median, as most samples have collected much lower sample sizes, for example, 1665 in Barbados; relatively few studies have collected much higher, for example, 1537 in Eastern Florida. All scuba diving samples have shown that scuba diving is a male dominated activity, with mostly middle-aged divers.

6.3.2 Practical contribution

The practical contribution of this study can be divided into contribution for management and then contribution for policy. The following analysis evaluates the contribution for the MPA management.

The practical contribution for management:

In terms of practical contribution relevant for the MPAs management, this study has made the following contributions:

- Chapter 4 provides useful information to help policy makers formulate policies on which environmental attributes of the MPA can concentrate. This was done by revealing that the highest valued attribute in Portofino MPA is underwater visibility, with an estimated willingness to pay of up to €49. Reduced diver crowding is the next most valued attribute in Portofino. The management of the MPA can use this information to concentrate on improving water visibility and impose restrictions on diver crowding. Water visibility can be improved by reducing water polluting activities like onshore developments and other activities that increase the build-up of sediments (Farr et al., 2016:333). Further research could be spearheaded by the government on how to improve water visibility at Portofino MPA. Though this could initially result in revenue loss from decreased number of divers, gains can be realised through user fees and the resulting improved attribute conditions.

- Chapter 4 also contributes by statistically revealing that there is disutility when it comes to willingness to pay for groupers in Portofino. This could be attributed to the widespread abundance of groupers in the MPA, as such that divers are experiencing diminishing marginal returns. This is interesting because it contrasts with other studies that have found a positive willingness to pay for species abundance.
• Chapter 5 contributes by revealing that there is definite environmental concern in divers in Portofino and the identification of an economic value of each environmental attribute. This can be used to justify conservation budgets by management in Portofino MPA through a social benefit angle. By identifying the magnitude of willingness to pay, the social benefits of improving the MPA for the community are revealed, because preserving the Portofino MPA ecosystem would be beneficial for continued economic and cultural generating activities on which locals survive. Therefore, a social benefit to the Portofino community is also valued with these willingness to pay values.

• It was also interesting to note that Italians were more willing to pay than the foreigners. This could be a result of foreigners being less willing to pay for protection efforts in developed countries than in developing countries, where it is generally assumed that governments have sufficient funds to finance conservation. This result should be tested for generalisation.

The practical contribution for policy:

• Chapter 3 presents useful information that can assist policy makers in the funding of the Portofino MPA. The estimated willingness to pay of €6.78 serves as a reservation price, which is a maximum price that the MPA can charge for entry. This estimation can be used by policymakers as an idea of an acceptable amount for user fees that can be implemented for revenue generation in covering the conservation costs of the MPA.

• Chapter 3 also confirmed the literature that willingness to pay has a positive relationship with age and education, although the relationship is not linear. The study also confirmed the literature of females having a higher willingness to pay than males, although this could not be generalised to all diving populations. Also, bid amount sensitivity, where the higher the bid value, the lower the willingness to pay. This indicates that user fees can be thought of as being price elastic, with an increase in price leading to a decrease in WTP. The results have also challenged the common belief that dive experience would have a positive relationship with willingness to pay. This study found that the higher the dive experience, the less the diver is willing to pay. Policy makers can take these differences in the relationships between willingness to pay and demographics, and bear them in mind when coming up with a user fee for divers to pay.

• Chapter 3 also contributed by identifying some of the reasons for divers not being willing to pay for conservation. The most stated reason was that the government should pay for conservation and also that the suggested user fees are too expensive. This shows that it is important to instil trust that the funds will go towards marine conservation and not be wasted.
The social benefits of improving the MPA for the community are also revealed through willingness to pay since preserving the Portofino MPA ecosystem could provide the community with multiplier effects through continued economic and cultural generating activities on which locals survive. This is an important contribution for policy because it gives more reason to encourage financing of the MPA through a user fee, since it brings positive spillover effects to the economy of the surrounding community.

Chapter 5 reveals that most divers in Portofino are egoistic high, but neutral altruistic and neutral biospheric. This is very insightful for policy because egoistic value orientations are driven by self-benefit, meaning that they are most likely to contribute towards conservation because it will indirectly benefit them as well (thus the altruistic and biospheric neutral). These results provide a further contribution in terms of forecasting changes that are needed in the MPA via an egoistic value orientation, where emphasis is put on how paying a user fee can benefit the individual diver.

6.4 Recommendations of the research

The recommendations of this study are two-fold, first the recommendations for management and policy are discussed, then second the recommendations for future research follow.

6.4.1 Recommendations for management and policy makers

Since the study has motivated for the anthropological theory of managing common pool resources by fostering a cohesive management involving the users of the MPA, community, policy makers and management, this section will discuss the recommendations for management and policy makers:

- There is potential of revenue generation through user fees that can be realised in MPAs in Europe. Firstly, because the MPA needs guaranteed funding for maintenance, secondly, because it reduces pressure on the MPA to increase the number of divers to meet costs and thirdly because user fees allow divers to directly contribute to conservation efforts. Considering the different types of user fees that can be implemented, including entrance fees, concession fees, general user fees, royalties and sales revenue, and licenses and permits (Reid-Grant & Bhat, 2008:130), the government should use general user fees as a funding mechanism. This potential financing strategy can fund current management initiatives, conservation, research, and education programs, as is a concern for most MPAs. Therefore, these figures can be used by policy makers as an acceptable amount for a user fee, and most importantly, the environmental attributes the divers value the most and for which they are willing to pay. Though this study has shown revenue potential, it is important to bear in mind
that most respondent divers were not willing to pay because they believe it is the government’s responsibility to pay for conservation.

- The possibility of the willingness to pay having different values for different individuals, especially since it is charged per dive in euros, it might be interesting to find out how this difference in value will impact individual users of the MPA.
- After imposing the user fee, it is advisable to carry out periodic reviews of the effectiveness of the user fee in contributing towards conservation and effectiveness in minimising visitor diver overcrowding. Diver feedback would be instrumental in evaluating customer satisfaction levels.
- The divers who were not willing to pay for different reasons, could be a result of misinformation about the benefits of user fees. The government and management of the MPA should collaborate to inform divers and general users of the MPA about the need for financial contributions. This can be done during dive briefings, outreach programs and marketing campaigns of dive operators.
- The government and the MPA management should also work to encourage confidence and trust in the MPA management, that they will use the user fees revenue for conservation. This works to instil confidence and support from all the stakeholders, especially the resource users who contribute towards change.
- Improving water quality for better visibility and restricting diver crowding is advisable, as these are the attributes that are most important to the divers. This calls for the government to invest in ocean water quality and water visibility research in MPAs. This research will inform and suggest ways of improving water visibility and quality, which will have the ripple effect of encouraging marine biodiversity and degradation recovery. This will work to attract more divers in the long-run.
- Taking on the recommendations by Hoyt (2009:702) on steps to effective management of MPAs, policymakers are encouraged to: incorporate stakeholder involvement from the beginning and throughout the process; re-evaluate the management plan, subject to periodic re-examination and revision; offer management training; develop effective enforcement regimes and conduct periodic reviews and evaluations to assess whether objectives are being met.

6.4.2 Recommendations for future research

- While this study was beneficial in providing insight into the divers’ willingness to pay in Portofino, future research could expand this research into other diving sites in Italy and Europe to fully analyse the willingness to pay for user fees in the region and the determinants thereof.
- Future studies can concentrate on combining contingent valuation and choice experiments with the revealed preference methods for more efficient estimates and to further minimise the biases of each method. In addition to this, future studies can also include alternative methods of valuation, for example direct valuation techniques, quantifying externalities, willingness to accept and social versus economic benefits methods.

- It would be interesting to test the notion that locals are more willing to pay for conservation than foreigners, in a developed country, as compared to foreigners being more willing to pay for conservation in a developing country. This could test whether this notion is a generalisation or biased since the sample in Portofino is predominantly Italian, thus exaggerating the result.

6.5 Limitations

In terms of limitations of the study, some elements of the study can be improved, and these are listed as follows:

- Though study was conducted in one site, Portofino MPA, and the sample sizes were quite large: 442 and 556, this case study will not necessarily be applicable to Marine Protected Areas all over the world because MPAs differ in size, product offering and management objectives. Another drawback from the sample characteristics is that the sample was not very diverse, most of the respondents were Italians, and though this is because the site mainly hosts Italian divers, it would have been better too get more of the foreigner perspective. However, this site offers a good example for the Italian and European context. Future research could expand into other diving sites in Italy and Europe to more fully analyse the willingness to pay for user fees in the region and the determinants thereof.

- The study also has the limitations that stated preference methods have, in that they measure proclaimed preferences rather than actual or real preferences. The double-bounded dichotomous choice contingent method is unlikely to completely eliminate the biases associated with the contingent valuation method.

- The assumptions that respondents are utility maximising and aware of the surplus they derive from a resource can be challenged; also the different biases that come with stated preference methods, such as design biases, strategic bias and hypothetical bias. Future research could assume willingness to pay as a conservative estimate of potential user fees.

- Dive level specialisation measured in this study lacks the comprehensiveness that could allow the study to test for mediation and moderation effects, and future research could therefore improve this measure.
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Organization, October 2010, Geneva, Switzerland.


ANNEXURES

Appendix A: Multinomial logit results of Chapter 4

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Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01

Appendix B: Example of the Double Bounded Dichotomous Questionnaire

Appendix C: Example of the Choice Experiment Questionnaire