STUDY ON THE IMPACT OF ANTHROPOGENIC PRESSURE ON CORAL REEFS AROUND CAPE RACHADO, MALACCA AND RECOMMENDATIONS TO IMPROVE ITS MANAGEMENT

MOHAMED FAIZAN

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Name of Candidate: **MOHAMED FAIZAN**

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ABSTRACT

Coral reefs that occur in Malaysia are of global significance, and an important resource for the sustainable development of the country. One key step taken to conserve the coral reef resources in Malaysia, was the establishment of Fisheries Prohibited Areas (FPAs). Unfortunately, coral reef management measures are virtually non-existent at these areas, exposing the reefs to many pressures driven by the rapid development of the adjacent coastal areas. The limited understanding of the true economic value of coral reef ecosystems, is the main reason that sufficient resources are not appropriated and to manage and conserve this fragile yet important resource.

The aim of this study was to estimate the economic benefits of improving management of coral reefs that occurs at FPAs, by taking the FPA at Cape Rachado, Malacca as a case study. Contingent Valuation Method was adopted in this study, to elicit the willingness of pay (WTP) by local tourists for an improved coral reef management scenario for this area. The scenario was developed after a thorough review of literature related to this reef, followed by consultation with environmental experts and a site inspection visit.

The key findings of the review shows that the live coral and fish population at Cape Rachado reef is in decline. The reef is under constant stress from increased sediment-runoff and discharge of sewage and wastewater into this area. The situation is exacerbated by the lack of proper enforcement of existing prohibition of fishing and collection of any sea creatures within the FPA. Fishing and harvesting of corals still occurs within this FPA. Furthermore, large quantities of litter can be observed on the nearby beaches such as Blue Lagoon and Teluk Kemang, left behind by weekenders. The improved coral reef management scenario provides preliminary management measures to tackle these key issues.

The contingent valuation survey demonstrated that the local visitors were supportive of a conservation fee, if the money was exclusively used to fund the coral reef management scenario. The estimate of median WTP for conservation fee was MYR 3.00. If a conservation fee of MYR 3.00 can be fully captured from population of local visitors to the beaches along Port Dickson and Cape Rachado, it can conservatively generate as much as MYR 1.03 million per annum.

ABSTRAK

Terumbu karang di Malaysia mempunyai kepentingan global dan merupakan sumber yang penting bagi pembangunan negara ini. Penubuhan kawasan larangan perikanan (FPAs) adalah salah satu langkah utama yang diambil untuk memelihara sumber terumbu karang di Malaysia. Malangnya, langkah-langkah pemeliharaan terumbu karang hampir tidak wujud di kawasan-kawasan ini. Perkembangan yang pesat di kawasan pantai bersebelahan mendedahkan terumbu kepada pelbagai tekanan. Sumber yang mencukupi tidak diperuntukkan bagi mengurus dan memulihara terumbu karang kerana data dan kajian mengenai nilai ekonomi terumbu karang adalah amat terhad.

Tujuan kajian ini adalah untuk menganggar faedah ekonomi bagi meningkatkan pengurusan terumbu karang dikawasan FPAs. FPA Cape Rachado, Melaka dipilih sebagai lokasi bagi kajian ini. Kaedah Penilaian Jangka telah digunakan dalam kajian ini, untuk mengkaji kesanggupan membayar (WTP) oleh pelancong tempatan bagi memperbaiki pengurusan terumbu karang di kawasan ini. Penilaian ini dipilih selepas menjalani kajian kesusasteraan yang menyeluruh berkaitan terumbu karang diikuti dengan perundingan dengan pakar-pakar alam sekitar serta lawatan pemeriksaan di tapak kajian.

Penemuan utama dalam kajian ini menunjukkan bahawa terumbu karang dikawasan ini merosot bersam-sama dengan populasi ikan. Peningkatan dalam aliran sedimen tanah, pembuangan sisa serta kumbahan menjurus kepada pencemaran air laut. Kelemahan dalam penguatkuasaan larangan bagi memancing dan menuai terumbu karang memburukkan lagi keadaan terumbu karang di Malaysia. Aktiviti ini telah dilaporkan masih berterusan. Tambahan pula, sampah yang banyak dapat dilihat di pantai-pantai yang berhampiran seperti Blue Lagoon dan Teluk Kemang. Langkah-langkah awal perlu diambil bagi memastikan pengurusan dan pemuliharaan terumbu karang bertambah baik.

Kaji selidik menunjukkan bahawa pelancong tempatan menyokong penggenaan bayaran bagi tujuan pemuliharaan terumbu karang di pantai Cape Rachado, dengan syarat wang yang dikumpul digunakan khas untuk membiayai pengurusan terumbu karang. Anggaran median WTP bagi bayaran pemuliharaan ialah RM 3.00. Jika yuran pemuliharaan sebanyak RM 3.00 boleh dikumpulkan secara menyeluruh daripada pelancong tempatan di pantai Port Dickson dan Cape Rachado, program konservasi dianggarkan boleh menghasilkan sebanyak RM 1.03 juta setahun.

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My sincere gratitude to Malaysian Nature Society and FANLI Marine Consultancy Sdn Bhd, for sharing their insight into the environmental issues at Cape Rachado and Port Dickson. Special thanks to Mr. Sazali Bin Sakiran of Malaysian Divers Group (MDG) for sharing underwater photos of corals and sea creatures at Cape Rachado and sharing his view on the status of this reef.

I thank my friends Niloofar, Hamza and Aziz that took their time to accompany and assist me during the field surveys. In addition I would also like to thank Mr. Ahmed Bakhtier for his assistance in conducting the surveys in Bahasa Malaysia. Last but not least I would like to thank my parents, sister and wife for their continuous support, love and advices.

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LIST OF SYMBOLS AND ABBREVIATIONS

cm^2	Square Centimetre
CRMU	Coral Reef Management Unit
CTI	Coral Triangle Initiative
CV	Contingent Valuation
CVM	Contingent Valuation Method
FPA	Fisheries Protected Area
ha	Hectare
km	Kilometre
km^2	Square Kilometre
MDG	Malaysian Divers Group
mg	milligram
MNS	Malaysian Nature Society
MYR	Malaysian Ringgit
PD	Port Dickson
TEV	Total Economic Value
SIMCA	Sugud Island Marine Conservation Area in Sabah
US$	United States Dollar
WTA	Willingness to Accept
WTP	Willingness to Pay

1 INTRODUCTION

The aim of this study is to estimate the economic benefits of improving the management of coral reefs that occur at fisheries prohibited areas (FPAs) in Malaysia, by using the FPA at Cape Rachado in Malacca, as a case study. This area was selected, as it is among one of the first reefs to be declared as an FPA in Malaysia and also in view of its proximity to the university and logistical considerations for the on-site surveys required for this study. Economic value of improved coral reef management was elicited using contingent valuation method. This chapter presents background information of the study, followed by a brief description of the significance and the main objectives of the study. The chapter is concluded with a brief outline of this dissertation.

1.1 Background of study

Following a decline in fish catch in the early 1980s and understanding the vital role coral reefs played as habitat and breeding grounds for fishes, the government of Malaysia started taking steps to protect, conserve and manage the fragile coral reef resources of the country. One major step taken in purview of this initiative was the establishment of FPAs and marine parks (Department of Marine Park Malaysia, 2012). Fishing and harvesting of corals and other sea creatures are strictly prohibited at these sites.

Marine protected areas faces many challenges in terms of proper management. Lack of trained personnel, logistical problems, financial constraints and difficulties in enforcement of regulations and regular monitoring the health of coral reefs are some of the impediments for proper management of these areas in Malaysia (Burke, Selig, & Spalding, 2002, p. 40). FPAs and marine parks are managed by the federal government, while the coastal areas associated with these marine protected areas comes under their respective states. This split is also identified as a constraint for successful marine resource management in Malaysia (Islam, Noh, Yew, & Noh, 2013, p. 133).

Poor management of coral reefs at these marine protected areas in Malaysia, leaves them vulnerable to a barrage of threats. These include activities that destroy marine habitats, degrade water quality and reduce fish stocks (United Nation Development Programme, 2011, p. 1). Cesar (2000, p. 7) stated that the key reason, resources are not adequately appropriated for proper management of marine protected areas to curb the increasing rate of activities that threaten and destroy coral reef ecosystems is the lack of tangible figures to demonstrate the true economic value of coral reef ecosystems and the cost of continuing activities that destroy the reef.

Furthermore, a significant portion of the services provided by an ecosystem such as coral reefs is invisible in the market, resulting in little or no consideration given to them in policy decisions (Costanza, et al., 1997, p. 253). Reef Check Malaysia, recently published an advocacy report, to encourage the government of Malaysia to consider all the various services including the intangible services provided by reefs in policy decisions (Reef Check Malaysia, 2013).

1.2 Significance of study

Economic valuation studies of coral reef resources in Malaysia is scarce, no studies have looked into the economic value of coral reefs that occur in fisheries prohibited areas. This research contributes to fill in the gap in information regarding the economic value of reefs at FPAs in Malaysia. The findings of this research may help in development of more informed policies in regards to coral reef resource management especially at fisheries prohibited areas in Malaysia.

1.3 Research objectives

The main objective of this research is to estimate the Willingness to Pay (WTP) of tourists/visitors to Port Dickson for improved coral reef management at Cape Rachado fisheries prohibited area. The sub-objectives are as follows:

1. To review the existing coral reef management practices and current status of the reef at Cape Rachado, Malacca
2. To formulate an improved coral reef management scenario for Cape Rachado FPA
3. To conduct a willingness to pay survey for tourists/visitors at Cape Rachado and associated beaches along the Port Dickson coastline for the improved reef management scenario.

1.4 Dissertation outline

This section will provide a brief outline of the subsequent chapters. The dissertation is divided into six chapters, including the introductory chapter.

The second chapter provides a review of literature related to this study. This chapter starts with a general overview of the coral reefs that occur in Malaysia and the main coral reef management efforts in the country. This is followed by a detailed look at the reef that occurs at Cape Rachado and the threats to this reef. The chapter is concluded with a review of coral reef valuation studies.

Chapter three provides an exposition of the methodology adopted in this study. The chapter starts with a brief description of commonly used methods in valuation of coral reefs. This is followed by description of main advantages and criticism of the contingent valuation method, which was used in elicitation of WTP for an improved coral reef management scenario at Cape Rachado. The chapter is concluded with a description of steps taken in developing the improved coral reef management scenario for this area.

Chapter four provides the findings on the status of the reef and present coral reef management measures in place at Cape Rachado. This is followed by a detailed description of the improved coral reef management scenario developed to be used in the contingent valuation study. Lastly, description of the contingent valuation survey results and analysis is provided.

Chapter five provides a distillation of the main findings of the study, and discussion of possible policy implications based on these findings. The dissertation is concluded with a summary of the study and reflecting on research limitations and suggestions for further research.

2 LITERATURE REVIEW

This chapter provides background information in relation to this study. This includes, a brief description of the coral reefs that occur in Malaysia, and the key coral reef management efforts in the country. This is followed by a detailed review of literature, on the reef that occurs at Cape Rachado and the main threats to this reef ecosystem. The chapter is concluded with a review of previous coral reef valuation studies.

2.1 Coral reefs of Malaysia

Coral reefs form approximately 3600 km^2 area of Malaysia; it is estimated between 75% to 90% of reefs occur along the coast of Sabah (Burke, Selig, & Spalding, 2002, p. 39; Burke, Spalding, Perry, & Reytar, 2012, p. 30). Coral reef development is low along mainland of Peninsular Malaysia; with low diversity fringing reefs occurring on the west coast close to Port Dickson and on the east coast between Kuala Terengganu and Chukai. Coral reef occurrence is sparse along the coast of Sarawak, but reefs occur more on offshore islands close to both Sarawak and Peninsular Malaysia. (Spalding, Ravilious, & Green, 2001, p. 266).

Part of the country's coral reefs comes under the region named as the Coral Triangle, which is considered as the centre of world's marine biodiversity. To date, between 500 to 600 hard coral species and 200 soft coral species have been reported to occur in reefs of Malaysia (Ministry of Natural Resources and Environment, 2009, p. 5). In addition 925 fish species have been identified to occur in the reefs of Malaysia (Chong, Lee, & Lau, 2010, p. 2013).

Economic benefits from the coral reefs are immense to the country; for example the live reef fish exports from Sabah alone in 2007 was estimated at MYR 6.7 million (Komilus & Chin, 2011, p. 4). The reefs also play an important role in attracting tourists to the country, in 2013 alone a total of 793,359 are reported to have visited the marine parks in Malaysia (Department of Marine Park Malaysia, 2013). These numbers demonstrate the important role reefs plays in the economy of the country. During the Coral Triangle Initiative (CTI) summit at Mindanao, Philippines on 15th May 2009, the Prime Minister of Malaysia, Dato' Sri Mohd Najib said that Malaysia is committed to ensure marine ecosystem remained healthy and utilized sustainably to create wealth for the nation (George & Hussain, 2010, p. 435).

2.2 Coral reef management in Malaysia

The main source of legislative protection to the coral reefs and associated biodiversity of Malaysia is provided by the Malaysian Fisheries Act 1985 (Act 317); it provides legislative framework to designate marine parks and marine reserves (2006, p. 36). The Fisheries (Prohibited Areas) Regulation 1994, gazetted under the Fisheries Act allows for the establishment of Fisheries Prohibited Areas (FPAs). In addition, the following laws also provide direct and/or indirect protection to the reefs; Exclusive Economic Zone Act 1984 (Act 311) (2006) and the Environmental Quality Act 1974 (Act 127) (2006).

To date, a total of 42 marine parks has been gazetted under the Fisheries Act 1985; these parks are distributed over five states; Kedah, Terengganu, Pahang, Johor and W.P Labuan (Department of Marine Park Malaysia, 2012). Fishing is strictly prohibited within marine parks. Offenders caught could be charged a fine up to MYR 20,000 or sentenced to prison for a period of two years.

All visitors to the marine parks of Malaysia are required to pay a conservation charge (adults are charged MYR 5.00 and students, retirees and senior citizens are charged MYR 2.00). This is credited to the Marine Park and Marine Reserve Trust Fund. This fund is used to manage the park and also provide basic facilities for tourists (Department of Marine Park Malaysia, 2012). Draft amendment for this fee structure has been published on the website of Department of Marine Parks for public comments, and will come into effect on 1st July 2014. The amendment includes introduction of a fee dichotomy between citizens and non-citizens, variation in fees and validity period based on the location of the park and additional fees depending on the type of usage (e.g. research, documentary etc.) of the park (Department of Marine Park Malaysia, 2013).

In 2007, the Department of Marine Parks Malaysia managed 235,732 ha of marine protected areas (Ministry of Natural Resources and Environment, 2009, p. 18) this is approximately 9.9% of the total reef area of Malaysia. Statistical data published by the Department of Marine Parks Malaysia (2013) show that on average almost half a million tourists have visited these parks per year from 2000 to 2012 (Figure 2-1).

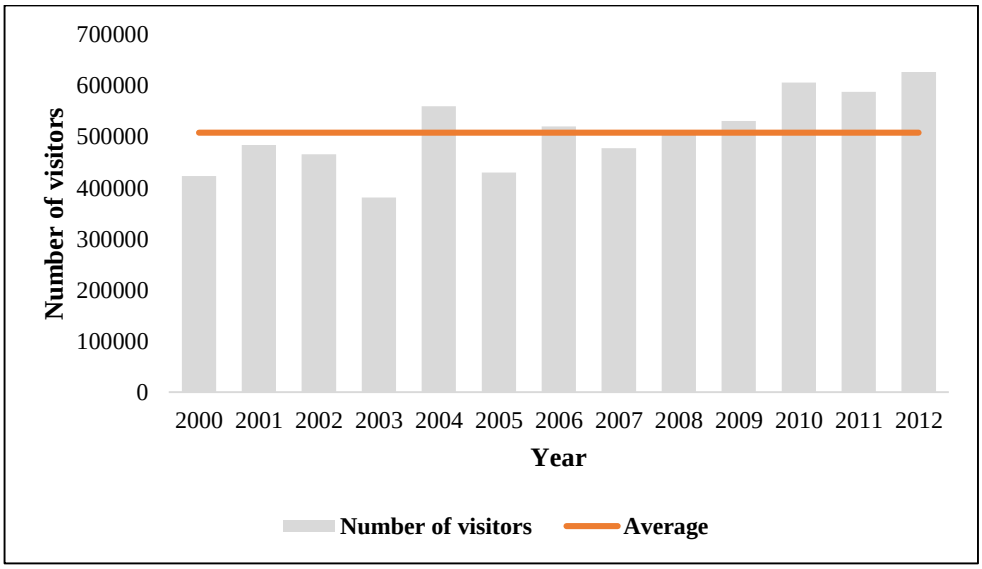

Figure 2-1 Total number of visitors to Marine Parks of Malaysia from 2000 to 2012 (Source: Department of Marine Park Malaysia, 2013)

Marine parks in the state of Sabah are under the jurisdiction of Sabah Parks, a statutory body formed under the National Parks Ordinance, 1962 that is under the Ministry of Tourism, Culture and Environment Sabah (Sabah Parks, 2001). Similar to marine parks under the Department of Marine Parks Malaysia, a conservation fee of MYR 5 is charged to all visitors to marine parks in Sabah, and is credited to "Park Fund" which is used for conservation and operation of the parks (Lydia, Louise, & Chung, 2007).

On the other hand, only six areas have been declared as FPAs under the Fisheries (Prohibited Areas) Regulation 1994; two in the state of Sarawak and four areas in the state of Malacca. In contrast to marine parks, no conservation fee or entrance fee is charged on visitors to FPAs. In addition, Department of Marine Parks Malaysia nor the Department of Fisheries keep records of visitors to FPAs, and no coral reef monitoring is carried at these areas. This leaves a significant gap in information on the status of the FPAs.

2.3 Goods and services provided by coral reefs

Global coral reef associated species estimates range between 600,000 and 9 million (Plaisance , Caley, Brainard, & Knowlton, 2011, p. 1). Given their diverse nature, coral reefs are considered as one of the most productive ecosystems of the world (Moberg & Folke, 1999, p. 215). This in turn translates into a rich source of goods and services. Global estimates of the value of goods and services provided by the reef resources are high. For example, study by Cesar, Burke and Pet-Soede (2003, p. 4) estimated the total value of global reef resources at US$ 29.8 billion per year. Study by Costanza et al. (1997, p. 256) estimated the global value of coral reef ecosystem services yielded an estimated value of US$ 375 billion per year.

Studies show that a healthy and properly managed reef can continuously yield between 4.5 to almost 13.6 tonnes of seafood per square kilometre per year (Burke et al., 2012, p . 9). Furthermore it is estimated that one square kilometre of healthy reef can supply enough protein to 300 people, without access to any other protein source (Jennings & Polunin, 1996, p. 48). This shows that coral reefs are an excellent source of food, nutrition and also income especially for coastal communities.

The diversity of life in coral reef ecosystems support makes it an excellent source to explore for pharmaceuticals, as higher biodiversity equates to high chemical diversity (de la Calle, 2009, p. 210). Since this is a fairly recent discipline, the opportunities for exploration and discovery are vast, and the potential benefits to the economy as well the pharmaceutical sectors of the country are high.

Moberg and Folke (1999) categorized the services provided by the reefs into five broad groups; (1) physical structure services such as shoreline protection by reducing energy of waves (Burke et al., 2012, p . 12), (2) biotic services such as maintenance of biodiversity by providing spawning, breeding and nursery grounds for different species, (3) biogeochemical services such as nitrogen fixation, (4) informational services such as climate records, and (5) social and cultural services such as support to recreational activities like snorkelling and scuba diving.

Consequently, damage to the coral reef ecosystems comes with severe economic implications; estimates of economic loss for Southeast Asia (including Malaysia) following the mass coral bleaching event in mid-2010 was between US$ 50 – US$ 80 million (Doshi et al., 2012).

2.4 Study area: Cape Rachado, Malacca

Cape Rachado is located on the western coast of Peninsular Malaysia, approximately 17 km south of Port Dickson, Negeri Sembilan. This is a small rocky cape of roughly one square kilometre, extending into Straits of Malacca from Si Rusa, Negeri Sembilan (Figure 2-2), but is an exclave of the state of Malacca.

The cape forms a hill dipterocarp forest (Forestry Department Peninsular Malaysia, 2014). This was among the first areas declared as a forest reserve in Malaysia. In 1921, an area of 80.97 ha of the cape was gazetted as a permanent forest reserve, however 19 ha area was removed from the reserve in 1969 and later in 1971 the remaining forest reserve area was also declared as a wildlife sanctuary (Department of Forestry Malacca, 2012). Currently, the forest reserve and wildlife sanctuary is under the management of Department of Forestry Malacca (shown red in Figure 2-3).

This forest area serves as a vital stopover point for migratory birds; making this area one of the most well-known bird watching site in Malaysia. A diverse variety of migratory birds (e.g. Honey Buzzards, Chinese Goshawks, and Grey Face Buzzards) visit this hill forest every year (BirdLife International, 2013).

The beaches adjacent to Cape Rachado along the coast of Port Dickson; such as the Blue Lagoon Beach and Teluk Kemang Beach (Figure 2-4) are famous among weekenders and these beaches are reported to attract millions of holidaymakers (Abdullah, 1995, p. 158).

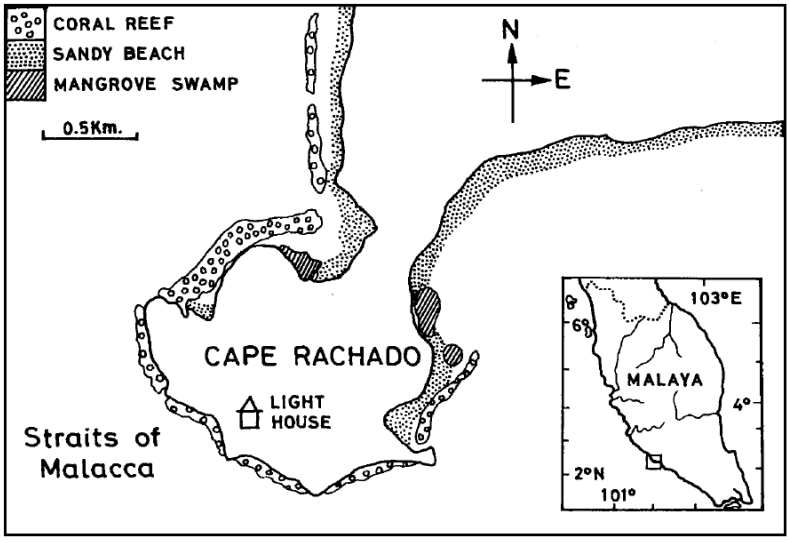

Figure 2-2 Location map of Cape Rachado, Malacca highlighting coral reef area at Cape (adapted from Goh & Sasekumar, 1980, p. 26)

Figure 2-3 Wildlife sanctuary and forest reserve at Cape Rachado[1] marked red in the map

[1] Map is adapted from Biological diversity Clearing House Mechanism Malaysia's website: http://chm-malaysia.org/Bio-Diversity-Databases/Protected-Areas/View-Map.aspx (accessed 10 February, 2013)

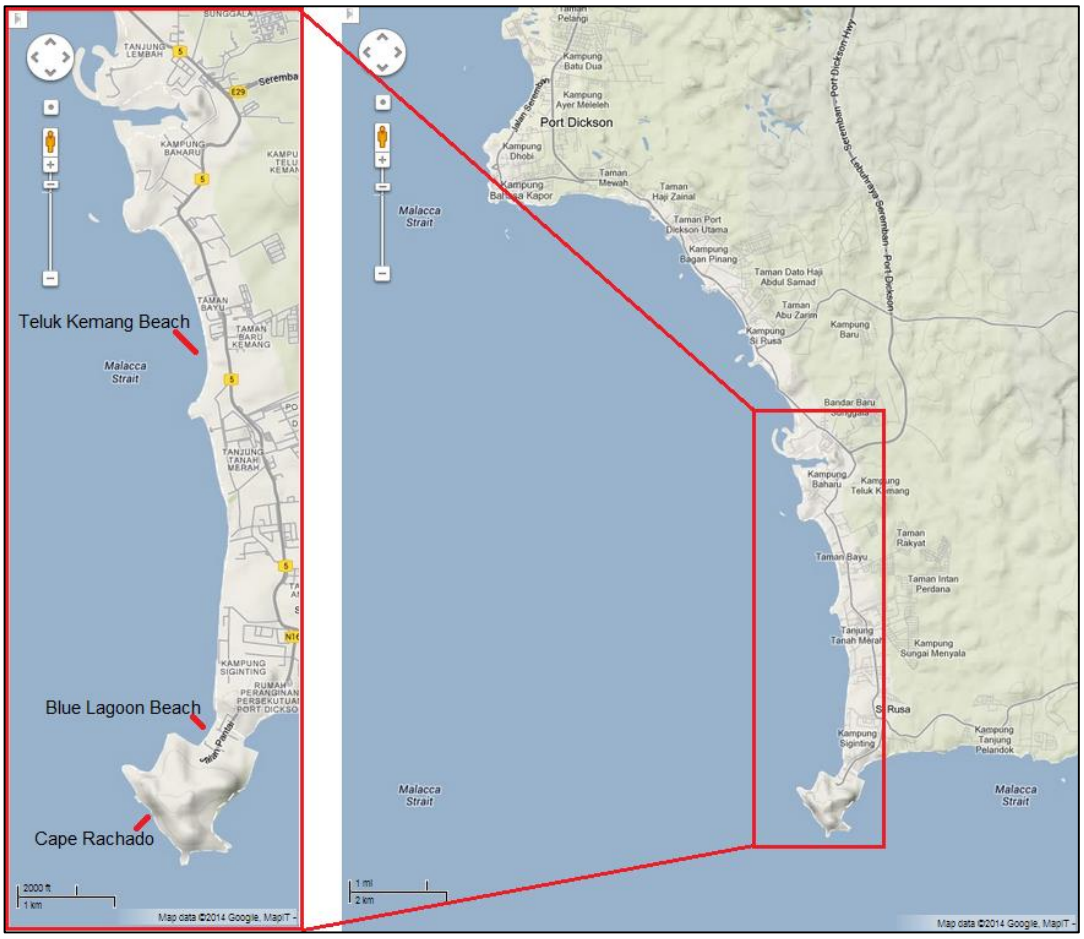

Figure 2-4 Map of Blue Lagoon Beach and Teluk Kemang Beach in relation to Cape Rachado[2]

[2] Google Maps. (2014). Cape Rachado, terrain map (Map data ©2014 Google, MapIT). Retrieved from https://maps.google.com/maps?sll=2.4088889,101.8494444&sspn=0.0082325,0.0109864&q=Tanjung+Tuan&output=classic&dg=opt (accessed 8 June, 2014)

2.4.1 Coral Reef at Cape Rachado

The cape is surrounded by a fringing reef, composed of three distinctive reef environments from the cape's rocky shore; an intertidal reef flat that extends roughly 50 – 60 m into the sea, followed by reef edge which extends about 17 m composed of characteristic surge channels that terminates to a gentle reef slope to a flat muddy bottom into the Straits of Malacca (Goh & Sasekumar, 1980, p. 27).

This reef is small and low in terms of diversity compared to most reefs that occur in the country (Spalding, Ravilious, & Green, 2001, p. 266). However, coral diversity at Cape Rachado (41 coral species) is on a par with reefs that occurs in the Straits of Malacca; like Pulau Payar (70 coral species) and Pulau Sembilan (30 coral species) (Gopinath, Yusoff, & Shariff, 2000). The reef is dominated by hard corals; near shore areas dominated by *Porites* species, middle by *Goniastrea* and *Goniopora* species (Phang, 1995, p. 26). The reef flat supports seaweed beds; mainly composed of *Sargassum*, *Turbinaria* and *Padina* species (Wong & Phang, 2004, p. 80).

The studies done at this reef have mainly focused on the coral, seaweed species and the effect of sedimentation on these species. No studies are available that specifically looks into the assemblage of fishes that occurs in the reef, or species that indicates health of the reef or other commercially important species that occur on the reef. These types of studies are important as indicators of the overall health and also the economic potential of a reef (Hill & Wilkinson, 2004, p. 4).

2.4.2 Cape Rachado as a Fisheries Prohibited Area

Part of this reef was first declared as a FPA in 1988, and additional two sites at Cape Rachado (local name of Cape Rachado) were declared as FPAs in 1994 under the amended Fisheries (Prohibited Areas) Regulation 1994 (Department of Marine Park Malaysia, 2012). Fisheries (Prohibited Areas) Regulation 1994 defines these areas as follows:

1) Tanjung Tuan - Maritime waters within one nautical mile from the outer most points of Tanjung Tuan, Malacca as measured at low water mark from Latitude 02^{o} 24.86' North, Longitude 101^{o} 51.38' East to Latitude 02^{o} 24.95' North, Longitude 101^{o} 51.38" East.
2) Tanjung Tuan 1 - Maritime waters within one nautical mile from the outermost points of Tanjung Tuan, Negeri Sembilan as measured at low water mark from Latitude 02^{o} 26.90' North, Longitude 101^{o} 51.53' East to Latitude 02^{o} 24.95' North, Longitude 101^{o} 52.38' East
3) Tanjung Tuan 2 - Maritime waters within one nautical mile from the outermost points of Tanjung Tuan, Negeri Sembilan as measured at low water mark from Latitude 02^{o} 24.86' North, Longitude 101^{o} 51.53' East to Latitude 02^{o} 25.30' North, Longitude 101^{o} 54.80' East

Collection of shells, harvesting of mollusc, corals and fishing in this area without prior permission from the Department of Fisheries Malaysia is strictly prohibited (Department of Fisheries Malaysia, 1994).

2.4.3 Threats to coral reef at Cape Rachado

The coastline stretching from Port Dickson to Cape Rachado was among the first areas developed for coastal tourism in Malaysia, with a number of various tourist accommodations and recreational facilities established across this stretch (Wong Poh-Poh, 1990, p. 217). No official records have been published on the exact number of visitors and/or tourists that use the beaches along this coast.

One study that looks at the beach recreation in Port Dickson estimates that the Teluk Kemang Beach alone could have as many as 30,000 people on a given weekend (Abdullah, 1995, p. 158). This was approximately 30% of the total population of Port Dickson in 2010 which was reported at 110,991 (Department of Statistics Malaysia , 2010). Rapid and poorly planned tourism, especially at coastal areas, can potentially be the main driver of many negative pressures on a coral reef ecosystem; such as increased sedimentation, damages to the reef by direct contact of tourists and many more (Diedrich, 2007, p. 985).

In fact, environmental concerns have been raised in studies carried out in the area, in conjunction with the development of this area. This includes sedimentation and siltation of coastal waters from land clearing activities (Lee, Mohamed , Bujang, & Ali, 2004, p. 601). One example that highlights this is the removal of a portion of mangroves along the coast at this area, for the construction of a condominium in 1985-1986 resulting in excessive siltation over the corals causing significant damages to corals and seaweed assemblages at the site (Phang, 1995, pp. 23-24). Similar observations were reported in conjunction with tourism development of Pulau Langkawi; where increased coastal development and population resulted in reduced water quality (Nickerson-Tietze, 2000, p. 387).

The mean sedimentation rates of waters not subject to human disturbances are reported to be within the range of less than 1 to 10 mg/cm^2/day (Rogers, 1990, p. 189). Comparison of sedimentation studies done at Cape Rachado in 1979 and 2004 shows that the sedimentation levels were high and had increased from a range of 0.95 to 54.3 mg/cm^2/day (Chark & Hoare, 1979) to 27.31 ± 3.2 to 233.59 ± 52.04 mg/cm^2/day (Lee et al., 2004, p. 601). Sedimentation is a significant problem for coral reefs, especially on the western coast of Peninsular Malaysia (Tatsuki et al., 2007).

The problem is further intensified by the discharge of sewage and waste water into the sea and the coastal geomorphology of the area that reduces dispersion of these stressors (Wong Poh-Poh, 1990, p. 217). A total of 82 wastewater pipes lines (Figure 2-5) was reported to directly discharge wastewater from homes and hotels into the sea at this area; and the waters were highly contaminated with faecal coliform and unsafe for recreational use by humans (Hamzah, Kipli, Ismail, Una, & Sarmani, 2011).

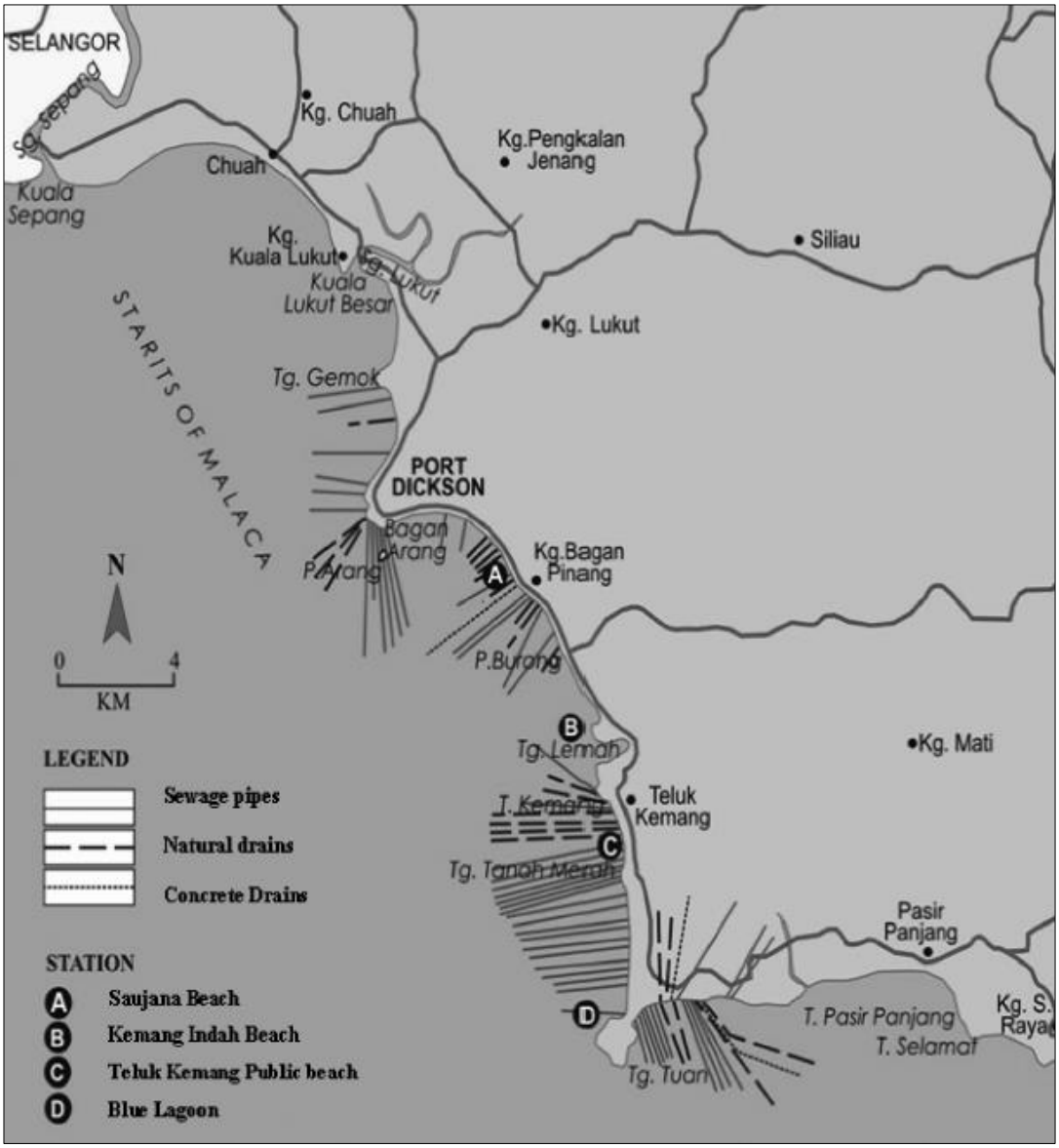

Figure 2-5 Map showing sewage pipes, natural drains and concrete drains along Port Dickson Coastline (adapted from Hamzah et al., 2011, p. 94)

In addition to these threats, coral harvesting and fishing have been reported at Cape Rachado, many times in the past (Malaysian Nature Society, 2007). This indicates the anglers and people involved in collection of corals and other sea creatures from this reef are unaware of prohibition of fishing and collection of sea creatures, and also poor enforcement of the regulation at the site.

Furthermore, the coral reef ecosystems face threats from outbreaks of natural predators of corals such as Crown-of-Thorn starfish, disease and global threats such as ocean acidification and climate change (Bellwood, Hughes, Folke, & Nyström, 2004, p. 827). Reef resilience against such events can be increased by reducing the human pressure on reefs through implementation of proper management tools.

2.4.4 Current Status of the Reef at Cape Rachado

At present, there is no regular coral reef health monitoring done at Cape Rachado. Hence, this research relies on available studies to deduce the status of the reef. The earliest coral reef study for Cape Rachado done was in 1976 (Goh & Sasekumar, 1980); in this study the reef flat and reef edge to the north-west of the cape was reported to have a live coral cover of 26.5% and 59.6% respectively. Nearly identical live coral cover estimates (reef flat with 27% live coral reef edge with 60% live coral cover) were reported in a study carried out from 1987 to 1988 at three different locations of the reef (Phang, 1995, p. 26).

In contrast to these estimates, a study done in 2004 showed that the mean coral cover near Cape Rachado has declined to 16.8% and concluded the reef was in poor condition (Lee et al., 2004, p. 599). The results are indicative of a decline in live coral coverage at this area, especially due to increased sedimentation and discharge of sewage and water into this area.

Similar observations have been reported at Pulau Perhentian, where the live coral coverage had reduced considerably due to discharge of untreated sewage from many hotels in the island combined with El Niño event in 2010 (Hyde, Chen, & Chelliah, 2013, p. 123). This example shows that coral ecosystems are highly fragile and could sustain considerable damage from cumulative pressures that are from humans and nature itself. The example at Pulau Perhentian underlines the important role of regular coral reef monitoring, as the observers were able to identify changes to the reef ecosystem following major events such as El Niño and also local pressures. This helps to focus management measures.

In view of the many threats to the coral reef in the area, and the increasing number of people that uses this area for recreation, it is likely that the reef will further deteriorate without proper management measures. In addition, these findings also emphasizes the need to have regular coral reef monitoring at Cape Rachado.

2.5 Economic valuation of coral reefs

One of the earliest studies which looked at the economic aspect of the coral reef was by Hodgson and Dixon (1988); in which they estimated the cost of sedimentation of the reef environment on tourism and marine fisheries due to logging at Bacuit Bay, Palawan, Philippines, against the benefits of a ban on logging. The study estimated that if logging activities continued it would result in a reduction of gross revenue by more than $ 40 million over a 10-year period, compared to a logging ban.

A similar study that was carried out more recently by Burke and Maidens (2004) estimated that continued degradation of coral reef that occurs in the Caribbean would result in a loss of up to US$ 300 million per year in net revenues from dive tourism and up to US$ 140 million per year in reef associated fisheries by 2015.

In addition to demonstrating the cost of degradation, economic valuation studies on coral reefs have been used in determining the viability of managing marine protected areas, conducting coral reef restoration programs and also selecting most sustainable coastal zone management approaches (Spurgeon, 2001).

Table 2-1 presents some examples of valuation studies along with the reefs location, valued good and/or service of the reef, valuation techniques used and estimated value in US$.

Table 2-1 Examples of coral reef valuation studies

Study	Location	Good(s) and/or service(s) measured	Valuation Technique(s)	Estimated Value (US$)
Carr & Mendelsohn **(2003)**	Great Barrier Reef, Australia	Recreational value	Travel Cost Method	18 – 40 billion per year
Cesar & van Beukering **(2004)**	Coral Reefs of Hawai'i	Total Economic Value	SCREEM (Simple Coral Reef Ecological Economic Model)	Net benefit of 360 million per year
Ahmed, Umali, Chong, Rull, & Garcia **(2006)**	Bolinao, Philippines	Recreational and conservation benefits of coral reefs	Travel Cost Method and Contingent Valuation Method	4.7 million per year

It should be highlighted that the economic value of the coral reef ecosystem is not restricted to the direct benefits such as the number of fishes it provides to the fishing industry or the number of tourists it attracts. The following sub-section, provides a description of various economic values of a coral reef ecosystem.

2.6 Total Economic Value of a coral reef ecosystem

Environmental economists describes the economic value of coral reef ecosystem within the broad concept of Total Economic Value (TEV), which includes both use and non-use values. The concept of TEV was first applied to coral reef valuation in 1992 (Spurgeon, 2001, p. 50). Figure 2-6 provides the breakdown of values of a coral reef ecosystem within the TEV concept. As it can be observed from the diagram significant portion of the economic value of coral reef are non-use values; such as option and bequest values.

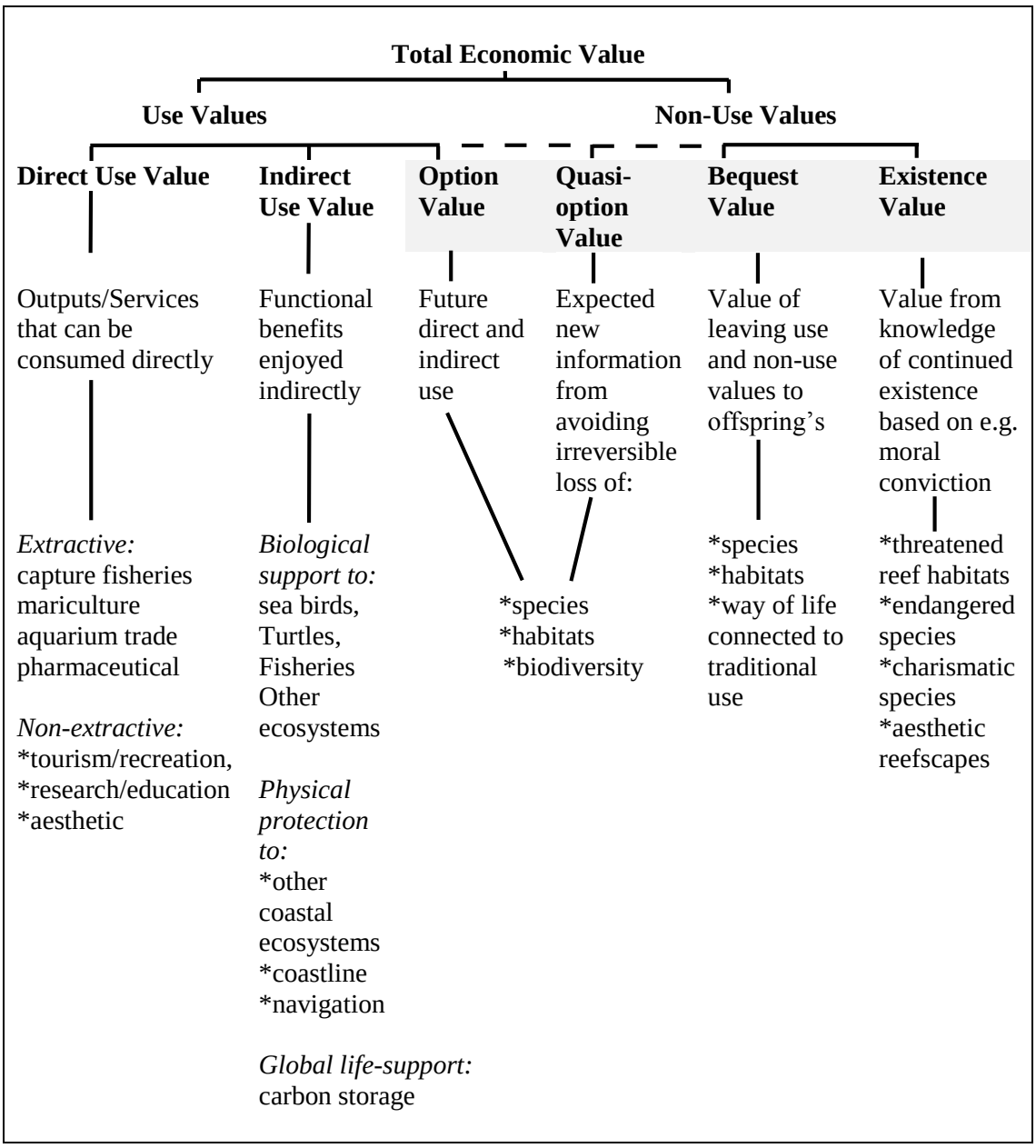

Figure 2-6 Total Economic Value of coral reefs (Source: Cesar, 2000, p. 20)

2.7 Coral reef valuation methods

Coral reef provides numerous goods and services (section 2.3). However there are no fully formed markets in which all these goods and services are traded, making a considerable portion of the reefs economic value invisible in the market place (Johansson, 1993, p. 46). For example, the value of fishes caught from a reef can be obtained by looking at the market price of the fishes, however no such market exists for indirect use or non-use values (section 2.52.6).

Hence, economists rely on other means for determining the value of non-market environmental goods and services (Farber, Costanza, & Wilson, 2002, p. 388). Most frequently used techniques to determine value of environmental resources can be divided into two main classes:

1) Revealed preference techniques; used to measure direct use values by looking into decisions people make in respect to activities that use or are affected by particular environmental goods or services.
2) Stated preference techniques: a survey approach, in which individuals are asked directly for the values they place on the environmental goods or services. This technique can be used to measure both direct and in-direct use values (Kahn, 2005, p. 99).

Table 2-2 presents some of the commonly used valuation methods under these two classes of valuation techniques.

Table 2-2 Example of techniques in economic valuation of non-market goods and services[3]

Technique class	Method	Description
Revealed Preference	Hedonic Pricing Method	Estimates the value of environmental amenities that affect prices of marketed goods e.g. price of housing.
	Travel Cost Method	Estimates the cost of travel to a destination to estimate the demand function.
	Replacement Cost Method	This method uses a proxy approach; for example the cost of investment on coastal protection measures such as breakwaters used as substitute for replacing coastal protection function of a healthy coral reef.
Stated Preference	Contingent Valuation Method	Survey based method, in which individuals are asked, their willingness to pay (WTP) for a benefit or willingness to accept (WTA) as compensation for a change in environmental amenity.

The focus of present study is to estimate the willingness to pay (WTP) of visitors/tourists for improved management of coral reef at Cape Rachado, FPA. Given the flexibility of contingent valuation method (CVM), to measure such a shift in quality of an environmental good, as opposed to its counter-parts such as hedonic pricing or travel cost (Carson & Hanemann, 2005, p. 824), CVM is selected for this study.

[3] Kahn (2005, pp. 99-117), Johansson, (1993, pp. 46-59) and Cesar (2000, p. 26)

2.8 Contingent Valuation Methods

Carson (2000, p. 1413) describes contingent valuation method as a survey based method used to place monetary values on environmental goods and services that are not traded in the market place. This method was first used in 1963 by Davis to elicit the benefits of outdoor recreation (Hoyos & Mariel, 2010, p. 330). Since then, CVM has been used in estimation of various environmental benefits such as improvement of air and water quality, protection of wildlife areas, endangered species and even in surveys that look into ways to reduce transportation risks (Carson, 2000, p. 1413).

In fact, contingent valuation (CV) is the most frequently used method in similar coral reef valuation studies (Brander, Beukering, & Cesar, 2006, p. 211). Furthermore, CVM has been used in the few coral reef valuation studies that have been conducted in Malaysia (Yeo, 2003; Yacob et al., 2009; Ahmad et al., 2009). CV is also the only method available that can elicit non-use values – such as passive, existence value – of environmental amenities, as well as the value of environmental improvements, where data is not available (Food and Agriculture Organization, 2000).

However, given the pecuniary nature of CV application, many doubts and concerns surrounds the reliability and validity of CV estimates. Many of these doubts and concerns have been subject to empirical studies, which have helped improve and make CVM a more robust and reliable means of economic valuation (Arrow, et al., 2001).

The main concern about CV revolves around the hypothetical nature of its application, as no actual monetary transactions take place (Boyle & Bergstorm, 1999, p. 185). Opponents of CVM argue that, with the lack of actual money transactions, responders to CV surveys will tend to significantly overstate their WTP, compared to their actual payment (Murphy, Allen, Stevens, & Weatherhead, 2005, p. 313).

Comparison of the results obtained from contingent valuation studies against, those estimated using indirect methods such as travel cost method or the hedonic pricing method yielded similar results (Mitchell & Carson, 1988, p. 188). In addition, a study has shown familiarizing the responders with the goods in question prior to elicitation of WTP, reduces hypothetical bias and produces reliable CV estimates (Schläpfer & Fischhoff, 2012). Meta-analysis of CV studies shows that hypothetical bias is not a significant problem in CV estimations (Murphy et al., 2005, p. 323).

Perceived strategic misrepresentation of WTP by CV respondents, is another concern of CVM critics. That is, responder may overstate or understate their WTP to favour the outcome of the study towards what they would like to happen. Empirical studies to determine this bias indicates that, this is not widespread, but a minor problem especially if responders were asked about their WTP, instead of WTA (Shechter, 2000, p. 92).

In contrast to other economic valuation methods, CV surveys can provide important information on both use and non-use benefits of environmental resources. It should be highlighted that a programme to improve coral reef management involves significant non-use values. Therefore despite the doubts that surrounds CVM, it can produce useful information to help make beneficial policy decisions. The key to ensure reliability while using CVM is to ensure clarity in presentation of the hypothetical scenario and WTP elicitation questions (Shechter, 2000, p. 91).

For this study, a hypothetical scenario was developed to improve the current status of the reef at Cape Rachado, via implementation of improved coral reef management measures. This was presented to responders of the contingent valuation survey. Steps taken to develop the scenario are presented in section 3.23.2, and details of the scenario is discussed section 5.1.

2.8.1 Economic Theory behind Contingent Valuation

Before proceeding with a description of CVM, a minor digression is made in this section to explain the theoretical underpinnings of this method. In a contingent valuation study, the key economic measure that is estimated is the Hicksian consumer surplus; as either the individuals willingness to pay for an improvement to the current status of an environmental amenity, or his/her willingness to accept as compensation for a loss in an environmental amenity (Carson, 2000).

Contingent valuation measures are based on the economic axiom, that individuals have preferences that have the properties stated in Hicksian consumer theory (Sugden, 1999, p. 152). Let's assume there are n conventional market goods $X_1, X_2 \ldots X_n$ and a non-market good (environmental amenity) q^0. The individuals' preference over the consumption of bundle of these goods can be expressed as a utility function $U(X, q^0)$, and his/her utility maximization expressed as:

$$max\ U\ (X, q^0) \quad subject\ to\ P_x.X = M \tag{2.1}$$

In equation 3.1, P_x is the vector price for the market goods, and M is the income of the individual, and q^0 is the present status of the environmental amenity available without a cost. The individuals demand function can be obtained by solving equation 3.1, which is $X(P_x, q^0, M)$. The individuals' indirect utility function, can be obtained by substituting this demand function into his/her utility function, which results in $V(M, P_x, q^0)$. Where V represents the indirect utility function.

In this study, tourists/visitors to Cape Rachado and adjacent beaches along the coastline of Port Dickson will be asked if he or she is willing to pay for an improved coral reef management scenario. The probability that the individual will be willing to pay is if his/her utility from paying for the good is greater than not having to pay. In terms of the indirect utility function this can be represented as:

$$V(M - P, q^1) > V\ (M - 0, q^0) \quad (2.2)$$

This indicates that individuals will respond with a 'yes' answer, only if utility he or she derives from paying (price *P*) for improvement of coral reef management (q^1) is higher than leaving the coral reef as it is (q^0) and not paying any amount. Hence, the value the individual place on the improved environmental condition is their compensating surplus (maximum WTP from current income). WTP can be defined as follows (Food and Agriculture Organization, 2000):

$$V(M - WTP, Px, q^1) > V\ (M - Px, q^0) \quad (2.3)$$

2.9 Coral reef valuation studies in Malaysia

Coral reef related economic valuation studies in Malaysia, has been mainly focused on marine park areas. This includes one study that elicited the recreational benefits of Pulau Payar Marine Park, Kedah (Yeo, 2003), another study that elicited the WTP of visitors for conservation of Pulau Payar Marine Park and Pulau Redang Marine Park (Yacob, Radam, & Shuib, 2009). Lastly, a study that looked into visitors WTP to reduce crowding effect damage to the reefs that occurs at the marine parks in Pulau Payar, Pulau Redang and Pulau Tioman (Ahmad & Hanley, 2009).

The study by Yeo (2003) employed a payment ladder design contingent valuation survey method, in which visitors were presented with a range of Ringgit values and asked for their maximum WTP per entrance to the park. WTP was estimated at MYR 16.00 and the potential recreational value of the reef system at MYR 1.48 million per year, based on number of visitors. The study showed that the revenue from an entrance fee to the parks would significantly contribute to address problems at Pulau Payar Marine Parks such as lack of proper sewage disposal system.

The study by Yacob et al., (2009) used a dichotomous choice survey design contingent valuation method, which asked the visitors WTP for conservation of marine park resource. The study estimated visitors WTP between MYR 7.8 to MYR 10.6 per year for Pulau Payar Marine Park and a WTP of MYR 7.30 to MYR 8 per year for Pulau Redang Marine Park. The average benefits estimate were MYR 0.103 million per year for Pulau Payar Marine Park and MYR 0.064 million per year Pulau Redang Marine Park.

The study by Ahmad et al (2009), which used a double bounded CV approach, asked the visitors to the marine parks their WTP to visit the park in future if the number of visitors were reduced by half. The study showed that overseas visitors were willing to pay a higher amount compared to locals, and the potential revenue from the marine parks can be increased almost two fold, compared to what the parks generated at the time of the study. Information gathered from economic valuation studies helps to make more informed, environmentally and economically sound decisions.

Information gathered from economic valuation studies helps to make more informed, environmentally and economically sound policy decisions.

2.10 Summary of key findings

Malaysia is blessed with rich coral reefs that are of global significance, and they provide a multitude of ecological, as well as social and economic benefits to the country. Hence, the sustainable utilization of these fragile resources is vital for the well-being and development of the country. Malaysia has taken important steps in protection and conservation of coral reefs; such as designation of marine protected areas and fisheries prohibited areas. Despite designation of the marine protected areas, some of the reefs are still under threat from continued degradation of water, unsustainable fishery and other activities that destroy the marine habitats. One key reason that management effort fall short to be effective, is budgetary constraints.

Coral reef at Cape Rachado, is the only hard coral reef on the southern part of Strait of Malacca, along the western coast of peninsular Malaysia. This reef was among the first areas designated as fisheries prohibited area in Malaysia. However the reef is threatened by continued fishing, coral harvesting, and reduced water quality due to rapid coastal development. Economic valuation study, to measure the willingness to pay for improved management of the reef by visitors to this area may help appropriate more resources to manage this reef area and improve existing policies towards the reef conservation.

3 METHODOLOGY

This chapter provides a detailed discussion of the methodology adapted for this research. The first step was to review literature on coral reef valuation, and select a suitable valuation method for this study. Based on the review Contingent Valuation Method, was selected as it can be used to determine economic benefits/loss of a shift in existing environmental quality. In this case, to elicit the economic value of improving the coral reef health at Cape Rachado via an improved coral reef management scenario. The improved coral reef management scenario was developed, by reviewing the current status of the reef and existing management measures on the ground. Based on these findings, policy recommendations were formulated. Figure 3-1 provides an outline of major steps in the research.

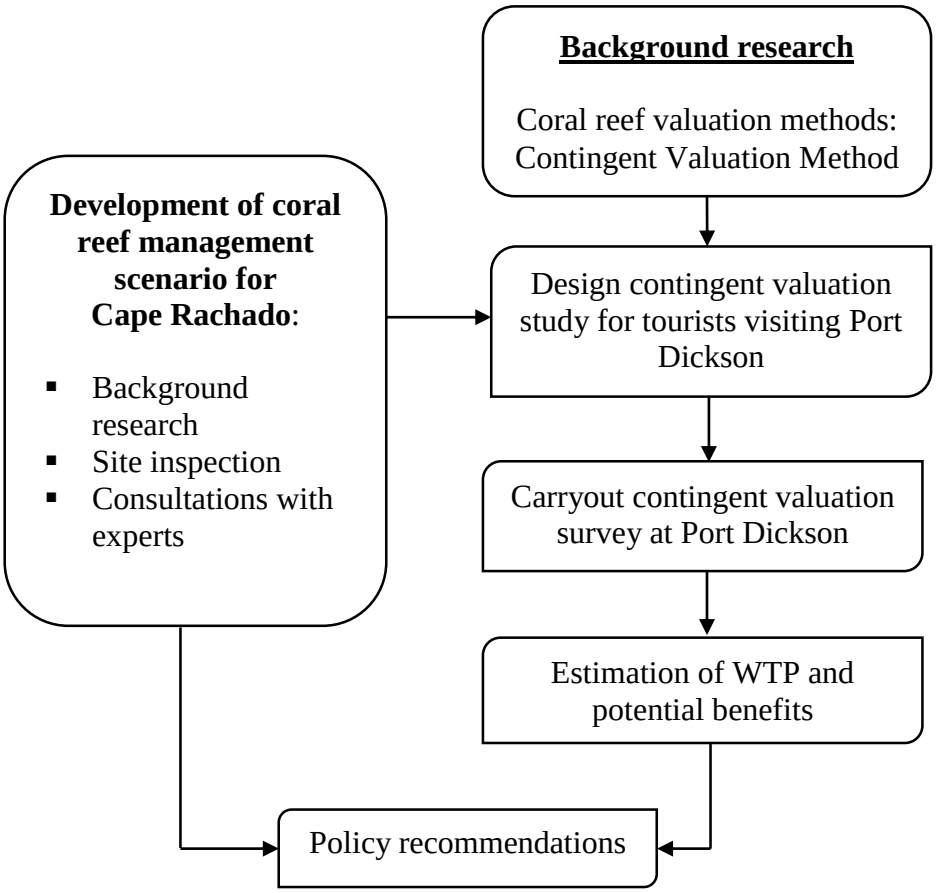

Figure 3-1 Research design outline

3.1 Study design

Study design is explained in two parts; the first part describes the steps taken in development of the CV instrument with details of its contents, and the second part focuses on the overall experimental design of the study.

3.1.1 Development and contents of CV survey questionnaire

Contingent valuation survey relies on a questionnaire survey, as described earlier the design of the questionnaire plays a crucial role in ensuring reliable value estimates. Literature recommends a good CV instrument must contain the following contents;

1) Introductory section that explains the purpose of the survey, with warm-up questions to make the responders comfortable to participate in the survey.
2) Detailed description of the hypothetical market scenario, that is under valuation. This section can be aided by photos, charts and other illustrations, it is important to allow the responder to understand the scenario. In addition, this should also include the method of payment and institutional setting in which the scenario is being implemented.
3) WTP elicitation question, in which responder is asked about his/her willingness to pay for the scenario described. This should be followed up by, questions to determine the reason why the responder is willing to pay the amount he/she stated, or why they are not willing to pay. The NOAA panel recommends the responders be reminded of their budgetary constraints, and other available substitutes, prior to asking the WTP question, to avoid over or under stating the value by the responder (Arrow et al., 2001, p. 14).
4) Questionnaire should also ask the responder about their demographic information, such as age, education level and their attitude towards the environmental amenity under valuation (Food and Agriculture Organization, 2000; Carson, 2000, p. 1415)

Based on these recommendations, the CV questionnaire for this survey was developed into four main sections. Section A explains the purpose of the study, and follows up with question regarding their visit and experience to the area. This section also included questions exclusive to scuba divers; comprised of questions about their dive experience and whether or not they had dived at Cape Rachado reef and their views on the status of the reef.

Section B, provided the responders with a detailed description of the current status and threats to the reef at Cape Rachado, and proposed improved management scenario. This includes the institutional setting in which the scenario will be implemented, and a description of proposed mechanism to finance this programme i.e. via a conservation fee levied on visitor.

Section C, included WTP elicitation question. Payment ladder design is adopted for this question (Yeo, 2003), in which responders are presented with a series of monetary values starting from MYR 0.50 that goes up to MYR 100 and were asked for their maximum WTP within this range. Follow up questions were asked why they were willing to pay the amount they stated or why they were not willing to pay for the stated scenario.

Section D, included questions on the socio-economic characteristics such as gender, age and employment status of the responder. This section also included questions to determine the responder's awareness on threats to coral reefs and also their attitude towards environmental issues. Complete questionnaire is presented in Appendix A.

Table 3-1 gives a brief description of all data variables that were collected in the CV survey. The variables are placed into five broad categories; social, economic, behavioural and attitudinal and their willingness to pay (WTP). Socio-economic variables collected helped to establish the characteristics of the samples population. Attitude and behavioural variables gives a measure of responders' familiarity with the area and environmental awareness. WTP variable provides the responses to the elicitation question.

Raw data collected from the surveys was analysed using the software Statistical Package for Social Science (SPSS) version 17.0.

Table 3-1 Description of variables used in the CV survey

Variable	Description
Social	
Gender	Gender; male or female
Age	Age group
Education	Education level
Economic	
Employment	Employment status at the time of survey
Income	Monthly income range
Behavioural and Attitudinal	
Visits	Number of visits to Port Dickson (PD)
Purpose	Main purpose of the visit to PD
Snorkel	Plan or have snorkelled during last visit to PD
Scuba dive	Plan or have dived during last visit to PD
Dive certification	Scuba dive certification level
Years diving	Number of years responder have been scuba diving
Briefing	Whether or not responder was briefed with precautions to avoid damage to reef prior to dive at Cape Rachado
Experience	Whether or not responder has experience diving in any other country besides Cape Rachado
Quality	Comparison of reef quality at other reefs in the country
Organization	Whether or not responder belongs to an environmental organization
Projects	Whether or not responder participates in any environmental projects
Donations	Whether or not responder donates to environmental causes
Threats to reef	Awareness on threats to coral reefs
WTP	
WTP for conservation	Maximum amount responder is WTP as a conservation fee per visit to PD in Malaysian Ringgit

3.1.2 Experimental design

The status of the coral reef and existing management measures at Cape Rachado was reviewed, prior to development of an improved management scenario. This involved, a thorough literature review, followed by consultations with environmental experts that are active in this area. Lastly a site inspection visit was done to verify the findings from the reviews and consultations. Based on the findings, an improved management scenario was developed. The scenario composed of preliminary management measures that can be undertaken to address the key issues identified. In addition, the expected benefits of these measures were also identified.

The target sample for this survey were people who had visited the beaches along Port Dickson and/or Cape Rachado, and who would have been familiar with the status of the area. Hence, they were more equipped to understand and make a decision on the scenario that was presented. During the preliminary site inspection visit, it was observed that most visitors/tourists come to Cape Rachado and adjacent beaches during the weekends; and are made up of locals. Hence, the target population for this study was local tourists/visitors to Cape Rachado and adjacent beaches in Port Dickson.

Once the questionnaire was developed, it was pre-tested to ensure that responders understood the questions and scenario that was described. Ten people were randomly selected from the beaches at Blue Lagoon Beach. During the pre-testing of the questionnaire the following observations were made; three of the ten randomly selected people declined to participate in the survey as it was conducted in English. Five out of the seven people that did reply were not aware of threats to coral reefs. However people who did participate in the pre-testing did understand the questionnaire, and the scenario that was presented. The results of the pre-testing are presented in Appendix B.

To improve the questionnaire, photos of the marine life that occurs at Cape Rachado was included along with more descriptions of the reef in section B. The survey was also conducted in the local language (Bahasa Malaysia) to ensure that the strata of tourists/visitors to this area that were not comfortable to respond in English were also included. In addition, the questionnaire was also made available online for locals who have visited Cape Rachado or the beaches near Cape Rachado to respond. The target sample size was 300; 200 via face-to-face interviews, and 100 via self-administered online survey.

3.2 Development of improved coral reef management scenario

First step, in development of the improved coral reef management scenario was to review the available literature related to Cape Rachado coral reef and the FPA.

This was followed up by consultations with a local Non-Governmental Organization (NGO), the Malaysian Nature Society (MNS) that have been actively involved in conservation of Cape Rachado forest reserve and organizing annual bird watching events at the cape. MNS has called out for active monitoring of the FPA, and reported incidences of fishing within the FPA to the authorities in the past (Malaysian Nature Society, 2007).

Next, local environmental consultancy firm, FANLI Marine & Consultancy Sdn Bhd was consulted. FANLI has been involved in the preparation of the Integrated Shoreline Management Study for Port Dickson and Negeri Sembilan (FANLI Marine & Consultancy Sdn Bhd, 2010).

In view of the limited literature available on the present status of the reef, a local scuba dive instructor from the (Malaysian Divers Group) who frequently dives and organizes dive trips to reef at Cape Rachado was interviewed, to get his views on the current status of the reef.

These were followed by a site inspection visit to verify findings from literature and consultations, and also to observe the current usage of the area. Table 3-2 provides a list of people interviewed.

The improved coral reef management scenario was developed to address the key issues that were identified. To ensure that the scenario is understandable and convincing to the responders, measures that can be implemented in a near future were selected. In addition, expected benefits from implementation of these measures were described along with them.

Table 3-2 People consulted in the development of improved reef management scenario

Name	Position	Organization/Company
Mr. Andrew Sebastian	Head of Communication	Malaysian Nature Society
Mr. Faedzul Rahman	Senior Conservation Officer	Malaysian Nature Society
Mr. Gopinath Nagaraj	Principal Consultant	FANLI Marine and Consultancy Sdn Bhd
Ms. S.S. Puvanes	Director – Operation	FANLI Marine and Consultancy Sdn Bhd
Mr. Sazali Bin Sakiran	Scuba Dive Instructor	Malaysian Divers Group

4 RESULTS AND ANALYSIS

This chapter presents results and the analysis of the key findings of the study. The chapter starts with a detailed description of the present status of the FPA, followed by the improved coral reef management scenario. The chapter is concluded with the results and analysis of the contingent valuation survey.

4.1 Current status of Cape Rachado FPA

The fisheries prohibited area of Cape Rachado is under the jurisdiction of the Department of Fisheries Malaysia. Despite prohibition of fishery and harvesting of marine creatures at the cape, there are no mechanisms on the ground to enforce this regulation. That is, there are no on-site marine rangers or marine police to monitor the area for illegal fishery or harvesting of marine creatures within the FPA. Furthermore, there are no maps, signboards or markers to identify the fisheries prohibited areas. Consequently, illegal fishing and coral harvesting have been observed, reported many times and still persist at Cape Rachado FPA (Mr. Andrew Sebastian, personal communication, April 9, 2013).

The beaches adjacent to the cape, such as the Blue Lagoon Beach and Teluk Kemang beach are managed by the city council of Port Dickson. Both these beaches, attracts thousands of visitors especially during the weekends and public holidays. The coastline is brimming with hotels to accommodate the visitors/tourists. The public beaches are provided with public pay toilets with showers, and also local food stalls and shops that mainly sell snacks, beach wear and watersports items.

Signboards are erected at the beaches by the city council, illustrating activities that are prohibited at the beach. Some of the prohibited activities at the beaches include, littering and setting up camp fires (Figure 4-1). Waste collection and cleaning at the beach was sub-contracted to SWM Environment Sdn Bhd by the city council (Mr. Gopinath Nagaraj, personal communication, May 8, 2013).

Figure 4-1 Sign board with a list of prohibited activities at beach (left panel), trash bin provided at Teluk Kemang Beach (right panel)

Figure 4-2 Beach cleaners collecting seaweed debris along Blue Lagoon Beach

During the site inspection visit, trash bins were observed on both Blue Lagoon and Teluk Kemang Beach (Figure 4-1), and cleaners were observed collecting litter and washed up sea weed debris (Figure 4-2) on the beaches. Despite the effort to keep the beach clean, lots of litter mainly composed of empty plastic bottles, polystyrene cups and food containers were observed across both beaches (Figure 4-3). Plastic litter that end up in the sea are extremely harmful to the marine life. Larger fishes can get entangled in plastic debris, ingestion of plastic bags can lead to suffocation of marine creatures and the accumulation of toxic chemicals released by plastic waste in the food chain could be potentially harmful to the ecosystem and even humans (Boerger, Lattin, Moore, & Moore, 2010). Indiscriminate littering at the beaches, indicate the lack of awareness and concern towards environment on the part of the visitors to these beaches.

Figure 4-3 Types of litter observed along Blue Lagoon and Teluk Kemang Beach

Literature available on Cape Rachado, shows that this coral reef is under stress by increased sedimentation caused by land clearance activities, and also increased disposal of untreated sewage has made the coastal waters unsafe for humans (section 2.4). Flood water drain was observed at Blue Lagoon Beach not more than 2 – 3 m into the lagoon (Figure 4-4), during the site inspection visit. The waters near Cape Rachado, appear highly murky, confirming the high level of sedimentation reported in previous studies (Chark et al., 1979; Lee et al., 2004). Mr. Faedzul Rahman of Malaysian Nature Society also noted that due to high sedimentation, visibility is extremely low at this reef (personal communication, April 9, 2013).

Figure 4-4 Murky water conditions at Blue Lagoon (upper panel), flood water drain to the lagoon observed at Blue Lagoon Beach (lower panel)

The most recent study on the coral reef at Cape Rachado was in 2004, which concluded that the reef was in poor condition. Comparison of the results from this study against earlier coral reef studies (Goh & Sasekumar, 1980; Phang, 1995) at Cape Rachado also indicates a decline in live coral coverage (section 02.4). As studies that look into the coral reef ecosystem at Cape Rachado are few, a scuba diver who frequents this reef was also consulted to provide the present status of the reef. Mr. Sazali Bin Sakiran of Malaysian Divers Group (MDG) noted that the number of fishes and corals that he observed on the reef has reduced over the years, possibly due to sediment run-off into the waters from on-going construction works near the coastline (Personal communication, May 19, 2013). This observation supports the findings of previous studies that were conducted in this reef.

Presently, recreational use of Cape Rachado FPA is free of charge i.e. visitors can swim, snorkel or scuba dive at Cape Rachado reef for free. However, an entrance fee of MYR 1.00 is currently charged to all visitors to Cape Rachado Forest Reserve. During the site inspection visit, it was observed that recreational anglers are allowed to enter and leave the forest reserve, with their fishing gear and fish at the FPA (Figure 4-5). This could be due to lack of correspondence between the two authorities responsible for managing the FPA and the forest reserve. The split in jurisdiction and lack of correspondence is identified as a key constraint to effective management of marine protected areas in Malaysia (Mr Gopinath Nagaraj, personal communication, May 8, 2013). Improving coordination between the various authorities mandated to manage these various inter-connected areas, is key to effective management of environmental resources.

Figure 4-5 Recreational anglers at Cape Rachado Forest Reserve with fishing rod and catch (upper panel), Ticket booth to enter Cape Rachado Forest Reserve (lower panel)

4.1.1 Improved coral reef management scenario

Cape Rachado reef suffers from a high level of sedimentation, untreated sewage disposal, indiscriminate littering by tourists, illegal coral harvesting and fishing. The recreational use of Cape Rachado reef, is currently free of charge, and no measures are in place to manage coral reef. Furthermore no regular coral reef monitoring is done, making it very difficult to determine the changes to the reef. From the available literature and site inspection, it is clear that this area is only declared as a fisheries prohibited area on paper.

The following management measures were proposed to address these key issues identified;

1. Enforcing the existing FPA regulations
2. Increasing awareness on FPA and coral reef ecosystem
3. Monitoring the health of reef regularly
4. Identification of ways to improve water quality at the site

This scenario was explained to the responders during the contingent valuation survey, with the help of illustrations (Appendix A).

4.2 Contingent valuation survey

This section presents the results of the CV survey to estimate the WTP of local tourists and/or visitors to Cape Rachado and the adjacent beaches along the Port Dickson coastline, for the improved coral reef management scenario at Cape Rachado FPA, described earlier.

4.2.1 Response to CV survey and data analysis method

A total of 211 people responded to the contingent valuation survey. The target sample size was to obtain 200 respondents from the face-to-face survey, and 100 respondents from the online self-administered survey. A total of 163 people responded to the face-to-face survey, and 48 people responded to the online survey.

The first step was to identify responses with three or more missing data variables, and discarding them. After discarding the responses with more than three missing values, the final sample size consisted of 210 respondents.

4.2.2 Socio-economic profile of sample respondents

This section describes the socio-economic profile of the sample. Table 4-1 gives percentages and standard deviation of the main socio-economic variables for both face-to-face interview survey and online self-administered survey. In order to determine whether the sample was representative of the local tourist population, comparisons were made against the domestic tourist survey carried out in 2011 and 2012 by the Department of Statistics Malaysia (2012).

Number of male responders to both, face-to-face interview survey and the online survey was higher compared to female responders. However, gender was more or less equally distributed in the domestic tourist populations (Department of Statistics, Malaysia, 2012, p. 33), indicating that the sample for this study has an over-representation of males. In terms of the age variable, the majority of the sample responders to both survey types fell into the age groups 20 - 29 and 30 – 39. Likewise, the majority of local tourists in the years 2011 and 2012 also fell into the age group 25 to 39 (Department of Statistics, Malaysia, 2012, p. 33).

More than half of the responders to the face-to-face survey had only completed their secondary/high school, and a quarter of the face-to-face responders have completed their undergraduate degree. In comparison a higher proportion of the responders to the online survey had either completed their undergraduate or postgraduate degrees. But overall sample is comparably representative of local tourists in terms of the education variable; survey done in 2012 showed that more than half of the domestic tourist population had only completed their secondary/high school, and approximately 21% had completed their tertiary education (Department of Statistics, Malaysia, 2012, p. 34).

Majority of responders to the face-to-face and the online survey were employed, and had a monthly income range between of MYR 1000 – MYR 2000 and MYR 2000 – MYR 5000 respectively. Approximately half of the domestic tourists are reported to be employed, and the majority fell into the monthly income group of MYR 1001 – MYR 3000 (Department of Statistics, Malaysia, 2012, p. 35).

The sample has a higher proportion of males compared to females. However in respect to other variables such as age group, education and income groups the sample was comparably similar to domestic tourist population as per recent domestic tourist surveys. Hence it can be concluded that the sample was representative in respect to these variables.

Table 4-1 Socio-economic profile of in-person survey responders

Variable	Description	Face-to-face % (n = 163)	Online % (n = 47)	Combined% (n = 210)
Gender	Male	63.8	76.6	66.7
	Female	36.2	33.3	33.3
Age range	Under 20	10.4	2.1	8.6
	20 to 29	47.2	48.9	47.62
	30 to 39	21.5	27.7	22.86
	40 to 49	12.3	17.0	13.3
	50 to 59	7.4	2.1	6.19
	60 to 69	1.2	2.1	1.43
Education level	Secondary school	34.3	-	26.7
	High school	33.1	10.6	28.1
	Undergraduate	25.2	51.1	30.9
	Postgraduate	5.5	38.3	12.9
	Other	1.8	-	1.4
Employment status	Employed	81.6	57.4	76.2
	Unemployed	3.1	6.4	3.8
	Student	11.7	27.7	15.2
	Home duties	1.8	6.4	2.9
	Retired	1.8	2.1	1.9
Monthly Income	No income	11.7	8.5	10.9
	Less than MYR 1000	12.9	6.4	11.4
	MYR 1000 – 2000	38.7	17.0	33.8
	MYR 2000 – 5000	28.8	53.2	34.3
	More than MYR 5000	8.0	14.9	9.5

4.3 Attitudinal and behavioural characteristics of the sample

Table 4-2 summarizes some of the attitudinal and behavioural characteristics of the sample. Majority of the responders to both the face-to-face interview survey and the online survey had visited Port Dickson more than three times. Hence, it can be said that the majority of sample responders are familiar with the area.

Responders to the survey were asked to tick the purpose of their visit to Port Dickson, from the following four choices; relaxation/picnic, water sports/diving/snorkelling, business and others. The responders were given the choice to select more than one from the list. From the responses it can be observed that the highest proportion of the responders to the survey visited for relaxation/picnic (Figure 4-6). It can be observed that the proportion of responders, who visited Port Dickson for watersports/diving/snorkelling were higher in the case of online survey compared to the face-to-face interview survey. This is also reflected in the higher proportion of certified scuba divers that responded to the online survey compared to the face-to-face interview survey.

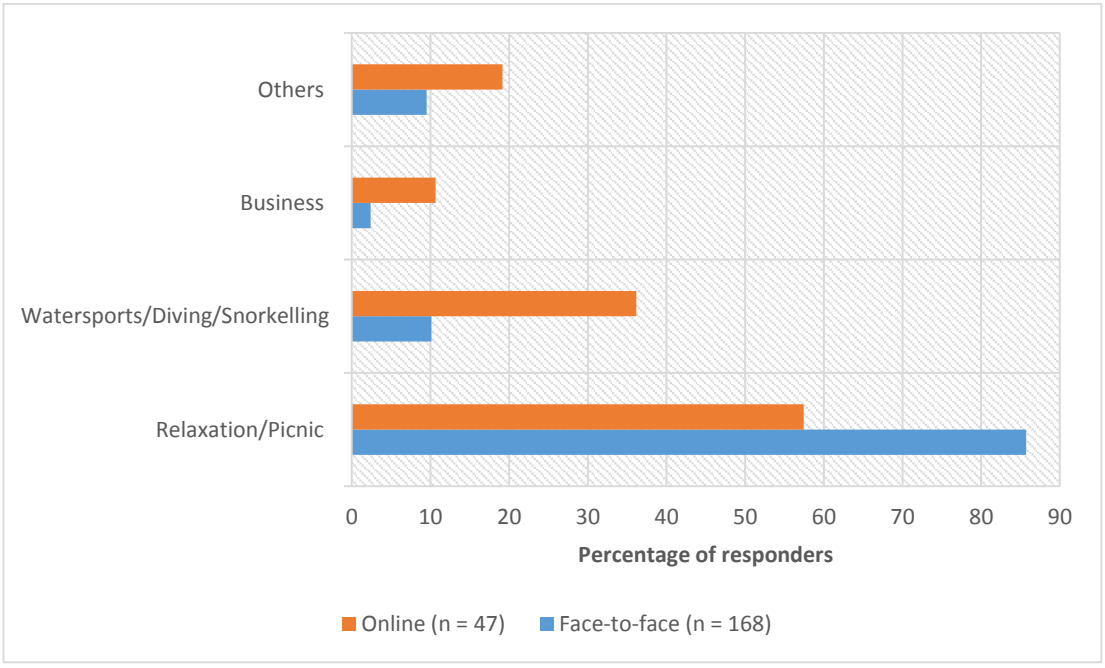

Figure 4-6 Responders purpose of the visit to Port Dickson

The number of responders that were more inclined to be environmentally concerned was identified by asking whether they belonged to any environmental organization, participates in environmental/conservation activities or makes donations to environmental conservation programmes/causes. If a responder ticks any of these categories they were identified as inclined to be environmentally concerned. Overwhelming majority of the responders to the face-to-face survey did not tick any of these categories, however more than half of the responders to the online survey were identified as inclined to be environmentally concerned.

Only a very small fraction of responder to the face-to-face survey were identified as scuba divers, in contrast to more than half of the online responders identified as scuba divers. Majority of scuba divers in both samples have been divers for between one to five years at the time of the survey.

Table 4-2 Behavioural and attitudinal characteristics of the sample

Variable	Description	Face-to-face %	Online %	Combined %
Visit to Port Dickson	Once	16.6	12.8	15.71
	Twice	14.7	14.9	14.76
	Thrice	7.4	2.1	6.19
	More than three times	61.3	70.2	63.33
Environmental Concern	Concerned	7.4	66.0	20.5
	Not concerned	92.6	34.0	79.5
Scuba Diver	Yes	6.7	59.6	18.6
	No	93.3	40.4	81.4
Dive certification*	Open Water	42.9	28.6	31.4
	Advanced open water	14.3	42.9	37.1
	Master Scuba diver	42.9	3.6	11.4
	Other	-	25.0	20.0
Number of years diving	Less than one year	36.4	7.1	15.4
	One to five years	63.6	92.9	91.67
	More than five years	-	-	-

**For the face to face survey 5 responders identified as certified scuba divers, and 28 responders to the online survey identified as certified scuba divers*

Scuba divers who had dived at Cape Rachado and other reefs in Malaysia were asked, how the live coral, fish life and overall quality of Cape Rachado reef compared to their experience at other reefs, the following summarizes the responses to this question:

1) Poor and low in quality compared to other reefs.
2) Low visibility due to murky water condition, coral life is low and hard to see fishes.
3) It is not fair to compare to other reefs, given the murky water conditions at Cape Rachado.

Responders to both surveys were asked what they thought were the major threats to the corals reefs. This was an open ended question, and responders were given the choice to state more than one threat. Figure 4-7, summarizes the responses to this question. The responses were categorized into seven groups;

1. **Not aware**: responders are not aware of the threats to coral reefs
2. **Human**: activities by human such as harmful fishing practices, coral harvesting, sand mining, fin damage to coral caused by snorkelers and divers and lack of awareness on coral reefs
3. **Coastal development**: construction of resorts and other infrastructure near the coastline
4. **Littering**: this was added as a separate category as a high proportion of responders identified littering as a major threat to reefs
5. **Pollution**: oil spillages and disposal of untreated sewerage into the lagoon
6. **Climate change**: global warming and climate change

Approximately 14% of the responders to the face to face survey were not aware of threats to the reefs, and 21% of online responders were not aware of threats to reefs. Majority of responders to face-to-face survey identified pollution and littering as a major threat to coral reefs. While for the online survey majority identified pressure from humans, pollution and climate change as major threats.

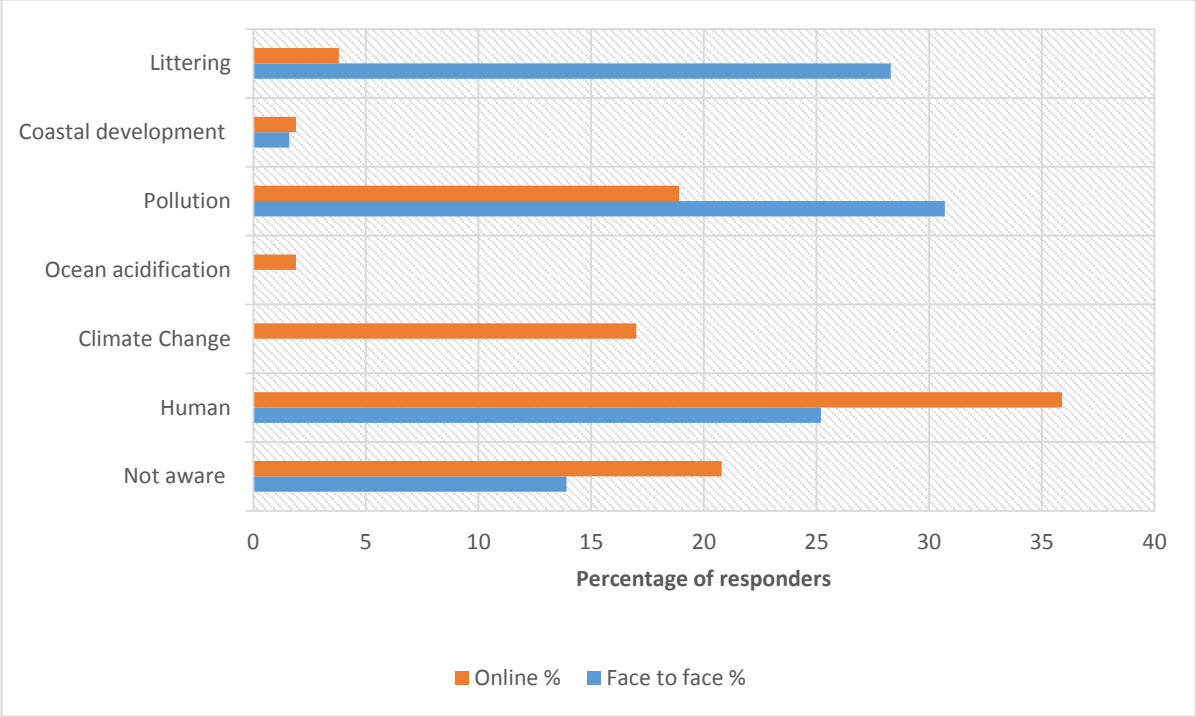

Figure 4-7 Threats to coral reefs identified by sample

4.4 WTP for the scenario

All respondents were asked for their maximum WTP for the improved management scenario, in the form of a conservation fee from a range of values from MYR 0.00 to MYR 100.00. This section, provides responses to the WTP elicitation question.

4.4.1 WTP responses and analysis

All the 163 responders to the face-to-face survey answered the WTP elicitation question, however only 45 of the 47 responders to the online survey answered the WTP elicitation question. Figure 4-8 and Figure 4-9 shows the responses to the WTP question for the face-to-face survey and the online survey. Shapiro-Wilk test for normality of the WTP conservation fee distribution for the face-to-face survey gave a p-value of 0.365 and for the online survey gave a p-value of 0.381. Both these p-values are greater than 0.05, indicating that the WTP conservation fee responses for both survey types were normally distributed.

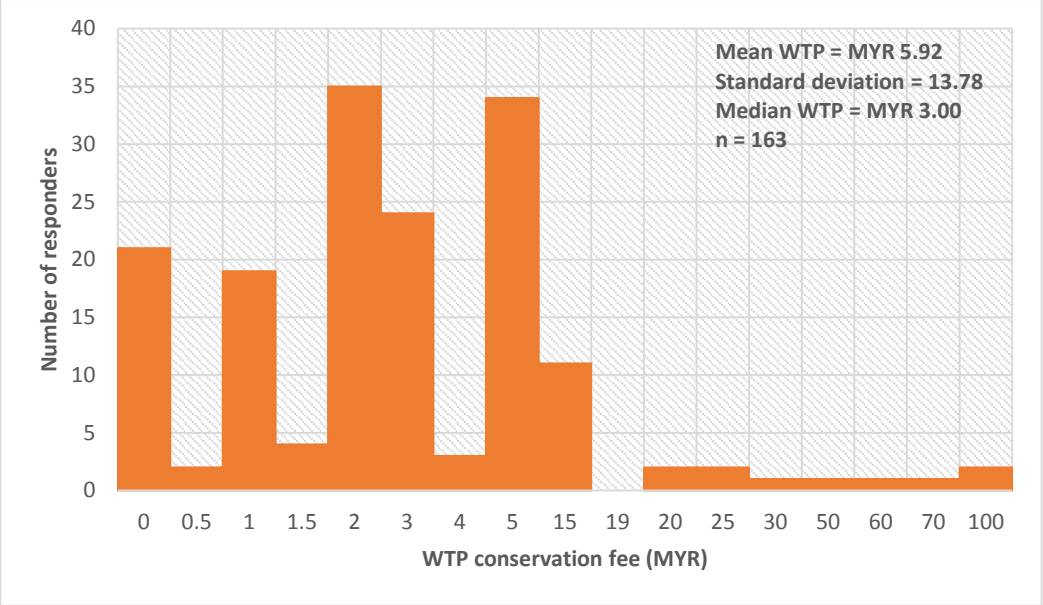

Figure 4-8 Frequency distribution of WTP conservation fee (face-to-face survey)

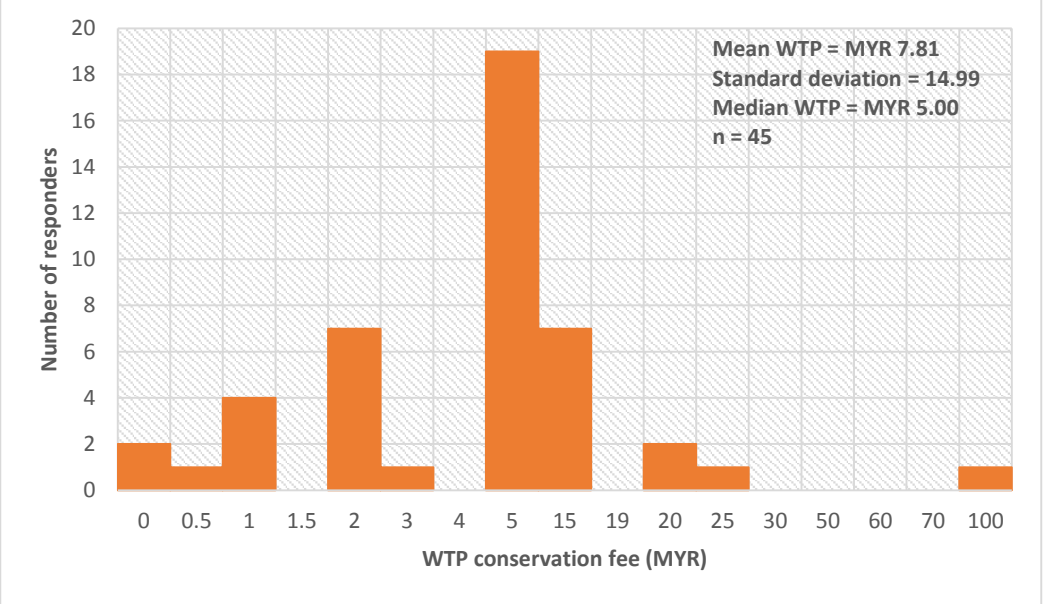

Figure 4-9 Frequency distribution of WTP conservation fee (online survey)

Approximately, 12.85% of the responders to the face-to-face survey and 4.44% of the online survey responders were not willing to pay a conservation fee to support the improved coral reef management scenario. In contingent valuation literature, zero bids are classified as either "true zero" values or "protest bids". Responders who give a zero bid despite, actually having a positive WTP towards the good are classified as protest bids, this maybe because they object to certain aspect of the scenario such as the payment collection mechanism (Carson, 2000).

In order to determine whether the zero bids were true zero values or protest bids, responders were asked why they were not willing to pay. The following summarizes the responses to the follow-up question;

1. Government, resorts, business owners and locals of Port Dickson should pay for coral reef conservation effort.
2. Do not trust that the money will be used for this programme.
3. Concerned that tourist will not visit this area if a fee is charged.
4. This is a public area, hence no fees should be charged for the use of this area
5. Cannot afford to pay due to current financial situation.
6. This site is not a suitable site for diving.

Responses that reflect points 1 and 2 were categorized as protest bids and the rest as true zero values. As show in Figure 4-10, the majority of zero bids were protest bids.

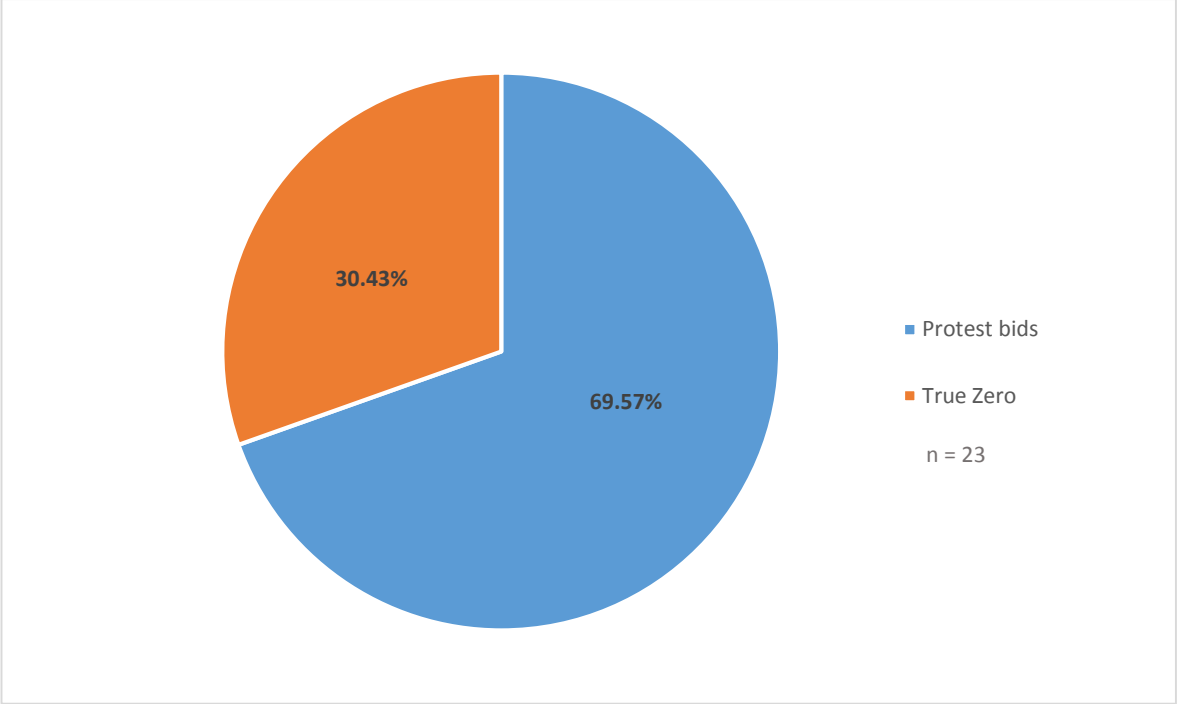

Figure 4-10 Zero bid distribution by type

An independent-samples t-test was conducted to determine whether mean WTP estimated using two survey types were statistically different. There was no significant difference between mean WTP of the face-to-face survey (mean = 5.92, standard deviation = 13.78) and the mean WTP of online survey (mean = 7.81, standard deviation = 14.99); t (206) = - 0.799, p = 0.425. Since there is no significant statistical difference between WTP of two survey types, both data sets were combined for the following calculation. Appendix C provides a comparison of mean WTP with respect to different variable categories.

The mean and median WTP a conservation fee was calculated by including and excluding the protest bids (Table 4-3). Mean WTP calculated without the protest bids was slightly higher, however it can be observed that the median WTP including and excluding protest bids were the same at MYR 3.00. Hence, for further calculations median WTP is used.

Table 4-3 Comparison of mean and median WTP conservation fee, with and without protest bids

Bid type	Sample size	Median WTP	Mean WTP	Standard deviation
Including protest bids	208	3.00	6.33	14.03
Excluding protest bids	192	3.00	6.86	14.48

4.5 Calculation of Benefits

The benefits that would be obtained by levying conservation fee on visitors to the beaches in Port Dickson and Cape Rachado, is calculated using the following formula;

$$B_t = Number\ of\ visitors_t \times median\ WTP \quad (4.4)$$

Where,

B_t : - benefits from revenues generated from levying a conservation fee on visitors to the beaches in Port Dickson in year *t*

Number of visitors$_t$: - total number of local visitors to Port Dickson in year *t*, and

Median WTP :- median willingness to pay by visitors the conservation fee

As stated earlier, no official records are kept on the number of local visitors to the beaches in Cape Rachado or Port Dickson. The data published by the Department of Statistics Malaysia provides the total number of local visitors to Negeri Sembilan. The number of local tourists/visitors to Negeri Sembilan in 2010 was approximately 1.4 million (Department of Statistics Malaysia, 2010, p. 31) and 2012 was 3.5 million (Department of Statistics, Malaysia, 2012, p. 31). It is reported that about 69% of visitors/tourists to Negeri Sembilan are those visiting Port Dickson (Samad, Rahman, & Rahman, 2011, p. 41). To keep the estimate conservative, the following assumptions were made: the total number of local visitors to Port Dickson was constant at 690,000 per year and at least half (345,000) visits the beaches in Port Dickson or Cape Rachado. The median WTP with protest bids included for the whole sample was MYR 3.00, as shown in section 4.4.1. Table 4-4 shows the calculation of the potential value estimate for funding the improved coral reef management scenario.

Table 4-4 Annual potential value estimate for funding improved coral reef management scenario

Number of visitors	Median WTP	Potential value
345,000	MYR 3.00	MYR 1,035,000.00

5 DISCUSSION

This section provides a distillation of key findings of the study and discusses potential policy implications for management of fisheries prohibited areas in Malaysia.

5.1 Key research findings

The study demonstrates that the main threats to the coral reef at Cape Rachado are driven by the rapid and poorly planned tourism development at Port Dickson. Threats to the reef includes increased sedimentation of waters around the cape from land clearing activities, increased disposal of sewage, pressures on the reef by visitors/tourists to the site. As no enforcement measures are in place, fishing and harvesting of corals take place despite the prohibition. In addition, as coral reef monitoring is not done at Cape Rachado, the changes to the reef or the effectiveness of declaring the area as a fisheries prohibited area, or any measure taken to manage the reef cannot be properly assessed.

The FPA at Cape Rachado, comes under the jurisdiction of the Department of Fisheries, the cape comes under the state of Malacca and the management of the forest reserve on the cape under the Forestry Department of Malacca and the beaches associated with the FPA comes under the jurisdiction of Port Dickson City Council. The coral reef will be affected by any changes to these areas; for example increased land clearance and development along the coast would result in increased sedimentation and pressure on the coral reef. To ensure effective coral reef management, it is highly recommended to be integrated with management of associated watersheds and coastal areas, as these area inter-connected areas, changes to one area will inevitably impact the other (Richmond et al., 2007). Hence, there is a strong need to coordinate and integrate the various plans of different Departments and Councils to reduce adverse impacts on the coral reef at Cape Rachado FPA.

During the contingent valuation survey, it was observed that most of the respondents were not aware that the area was declared as a fisheries prohibited area. This is understandable as no signs or markers are placed to demarcate the area as a fisheries prohibited area. There is a need to educate and increase awareness regarding the FPA, its purpose and activities that are prohibited within the FPA. In addition to this, there is also a need to increase awareness on the fragile nature of coral reefs and proper behaviour at such an environment.

The improved coral reef management scenario devised for the FPA, addresses these issues and comprises of the following;

1) Setting up a mechanism for on-site enforcement of fisheries prohibited areas regulation.
2) Formulating and implementing programmes to increase awareness of visitors to Cape Rachado and Port Dickson on the FPA and fragile nature of coral reef ecosystem.
3) Formulating and implementing a regular coral reef monitoring programme of Cape Rachado.
4) Identification of pollution sources and ways to improve the water quality at Cape Rachado.

Figure 5-1 shows the proposed implementation structure of the management scenario, along with brief summary of key players and benefits of the scenario. The Coral Reef Management Unit (CRMU), is proposed to be housed under the Department of Fisheries Malaysia and comprised of members from the city councils of Port Dickson and Malacca, Stakeholder group (NGOs, local schools, hoteliers, dive operators and scientists), the Department of Marine Parks Malaysia, and the Department of Environment. Specific actions proposed by CRMU can be implemented in liaison with NGOs, hotels, resorts, local schools and scientific community. Collaboration with all relevant stakeholders is key to the success of a coral reef management plan.

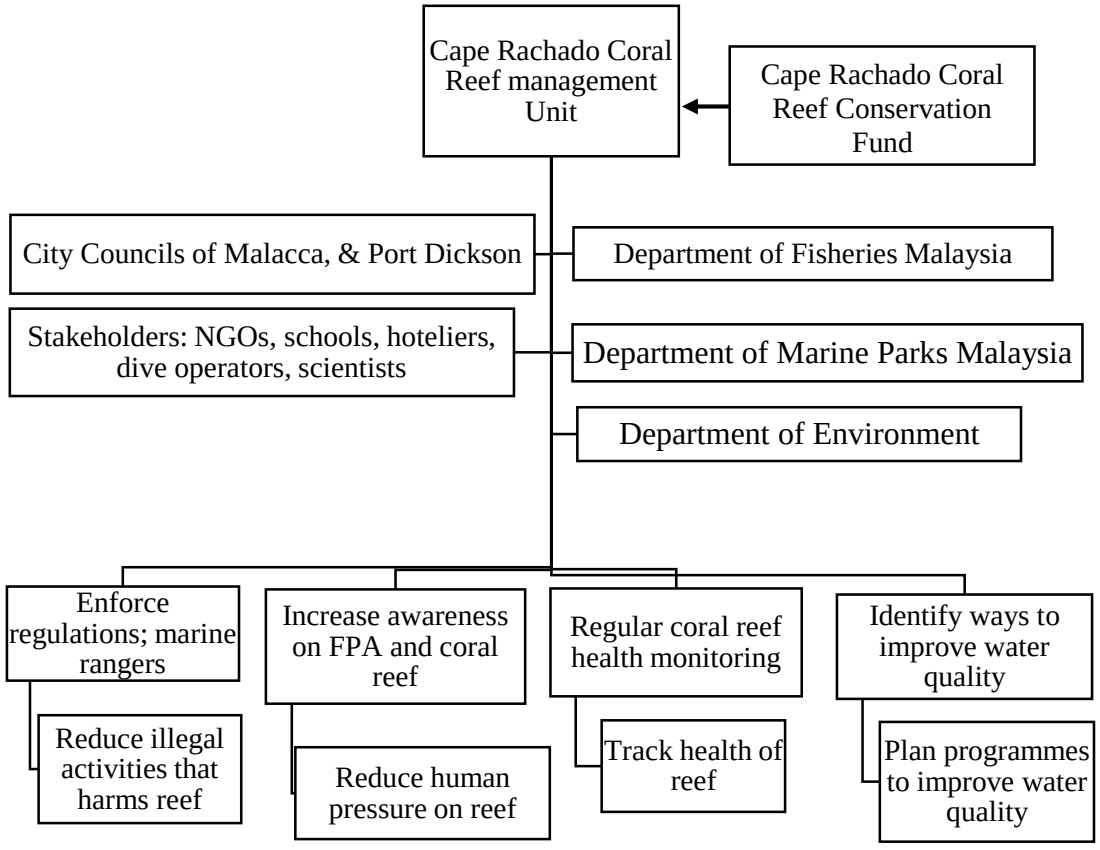

Figure 5-1 Outline of the improved coral reef management scenario

The first step in the scenario was setting up a funding mechanism for coral reef management. Malaysia has the legal instruments and experience in setting up similar conservation trust funds; for example a fee is charged for entrance into Cape Rachado Forest reserve, similarly a conservation fee should be charged for entrance to marine parks in the country. The target sample for this contingent valuation survey are local visitors/tourists, hence they should be familiar with concept of conservation fees. To fund the improved management scenario, visitors to the Cape Rachado beaches will be required to pay a conservation fee that will be credited into Cape Rachado Coral Reef Conservation Fund.

Lack of enforcement of existing FPA regulation, opens up the area for illegal fishing and harvesting of corals and other sea creatures. In the improved scenario, a mechanism was proposed to be set-up on the ground to enforce the existing FPA regulations. This will include stationing of marine rangers within the FPA, to regularly monitor the area for illegal activities and prevent such activities. The aim was to reduce fishing and harvesting of corals and sea creatures that take place within the FPA, hence reducing pressure exerted on the reef. This measure is expected, to improve fish and coral life at Cape Rachado FPA.

There is a need to increase environmental awareness among people that uses these beaches, especially on the consequences of indiscriminate littering on this fragile ecosystem, and proper behaviour in a coral reef environment to minimize damage to the corals. In addition, there is also a need to raise awareness on the FPA at Cape Rachado, its purpose and activities that are prohibited within the FPA. The improved coral reef management scenario includes, setting up markers on-site clearly marking the FPA along a list of activities that are prohibited.

In addition, a well-organized programme targeted at visitors and locals residing near the cape was planned to be conducted, to increase awareness on coral reef ecosystem and proper behaviour at a coral reef to minimize damage to corals. This is expected to reduce illegal activities, harmful behaviour such as littering that occurs at Cape Rachado FPA, reducing pressure on the reef.

Good water quality is important to improve fish and coral life at the reef. As described earlier, this reef is subject to high level of sedimentation and also sewage disposal near the area. Hence, there is a need to identify the sources of sedimentation and sewage, and assess measures that can be taken to reduce sedimentation and impact of sewage disposal. The outcomes of these assessments will help to formulate proper, effective plans to reduce water pollution and improve the quality of water at this area.

Lack of coral reef monitoring, makes it impossible to determine the effectiveness of any management measure. Formulating and implementing a proper coral reef monitoring programme will help monitor the health of the reef and also make managers better informed in using their limited resources, and take appropriate management measures.

The results of the contingent valuation survey shows that majority of responders were willing to pay a conservation fee, to support the improved coral reef management scenario at the cape. Hypothetically if the median WTP of MYR 3.00 estimated from the sample, can be fully captured, based on the conservatively estimated 345,000 annual visitors, approximately MYR 1.03 million could be potentially generated per year.

5.2 Policy implications of research findings

Fisheries Prohibited Area at Cape Rachado is only declared on paper, with virtually no measures to protect or enforce regulations within this area. The study confirms the need to allocate more resources and improve management of this area, without which the reef will further deteriorate with the rapid rate of development and increasing number of tourists that visits this area.

Lack of finances is identified as the key impediment for implementing coral reef management programme. The results of the CV survey shows that substantial amount can be generated through a conservation fee to fund an improved coral reef management programme for Cape Rachado FPA. The average annual costs of managing a marine protected area such as Sugud Island Marine Conservation Area in Sabah (SIMCA) (467 km^2 area) is reported at MYR 350,000.00 (Lydia et al., 2007). Introducing a conservation fee, can be a viable option to fund a coral reef management programme at Cape Rachado.

The majority of responders who stated that they were not willing to pay a conservation fee; when probed further, they stated that they did not trust that the money collected would be exclusively used for coral reef management. Therefore prior to introduction of a conservation fee, there is a need to further explore ways to improve trust and mechanism via which a fee can be charged.

As previously stated, most of the responders to the CV survey were not aware that the reef at Cape Rachado was declared as an FPA, nor the activities that are prohibited within this area. This indicates a need to spend more effort and resources to raise awareness of FPAs, this is an important step in reducing illegal activities within FPAs. In future government should consider investing more in awareness raising and education of the public regarding FPAs, roles. In the future, it is also important to integrate management of FPAs and its adjacent coastal areas. As shown in this study, these are inter-connected areas, and changes in one area influence the other.

The lack of regular coral reef monitoring makes it difficult to determine the changes to the reef, since it was declared a fisheries prohibited area. Properly implemented coral reef monitoring, is required for the success of any coral reef management programme. Given the limited resources to manage coral reefs, proper monitoring will help identify key issues that require to be addressed making the management programme more focussed.

The Department of Marine Parks Malaysia, has the experience in managing over 42 marine parks across Malaysia. This includes managing the Marine Trust Fund, maintaining records of visitors, collaboration with Marine Police in preventing illegal activities within marine parks. Department of Fisheries should consider collaborating with Department of Marine Parks Malaysia in managing and monitoring of the coral reefs at FPAs, as Department of Marine Parks has the experience and capacity to manage corals reefs. Hence, including Department of Marine Parks in CRMU is vital for the success of any coral reef management effort.

Department of Environment, is also important to be included in the CRMU, as they are responsible for setting wastewater quality standards and monitoring the water quality. One key component of the improved management scenario, involves identification of ways to improve the seawater quality at Cape Rachado.

5.3 Limitation of study

In the initial study design, a full baseline assessment of coral reef at Cape Rachado was proposed, however considering safety issues the status was deduced using available literature and consultation with environmental experts and scuba diver that were familiar with problems and condition of the reef. This only provides a limited picture of the reef, a full baseline assessment of live coral coverage and fish population of the reef would have provided a more accurate picture of the current status of the reef.

There are no official records kept, on the number of visitors to the beaches in Port Dickson and Cape Rachado. This is an important detail in estimation of total economic benefit from a conservation fee. In this study the number of local visitors had to be estimated from the total number of local visitors to Negeri Sembilan.

If the records of the number of visitors were available, the economic benefit estimation will be more accurate and likely higher considering number of visitors estimated very conservatively for the calculation.

The contingent valuation surveys had to be conducted only on weekends, as it is when most visitors are found on the beaches. As a result, several trips had to be made back and forth to Port Dickson on weekends. The number of respondents per trip varied from 7 to 10 respondents. In future studies it is recommended to have a team of trained enumerators stationed at the survey site, this would help increase the responses and the sample size.

6 CONCLUSION

In this study, the present status of the coral reef that occurs at Cape Rachado FPA was reviewed, along with existing coral reef management measures for this area. Based on the findings, a preliminary improved coral reef management scenario was outlined. Contingent valuation method was used to estimate the WTP of local visitors/tourists at this site for this improved coral reef management scenario.

Review of existing situation at Cape Rachado FPA, revealed that coral reef is deteriorating with increased coastal development and tourism along the Port Dickson coast. They key threats, to the reef are from increased sediment run-off from rapid land clearance and construction works along the coast, increased disposal of wastewater and sewage from hotels, resorts etc. along the coast, and littering by tourists that uses the beaches associated with the FPA. Furthermore, despite the prohibition of fishing within this area there are no measures in place to prevent illegal fishing or harvesting of marine creatures. In other words, the FPA exists only on paper.

The developed improved coral reef management scenario, comprised of preliminary steps that can be taken to address the key issues that were identified in this study. This included setting up of coral reef conservation trust fund, and a coral reef management unit for Cape Rachado under the Department of Fisheries Malaysia. This unit is proposed to comprise of members from the Department of Fisheries, Marine Parks, Environment, the city councils of Port Dickson and Malacca, which will execute development plans in liaison with relevant stakeholders such as local NGOs, schools, hotels, resorts and the scientific community. The scenario focuses on four main areas; enforcement of existing fisheries prohibition regulation, increasing awareness of tourists and locals on the FPA and coral reefs, coral reef monitoring, and improving the seawater quality of this area.

The median WTP for the improved coral reef management scenario was estimated at MYR 3.00 from the CV survey, and the survey shows that approximately 87% (face-to-face interview survey) and 95% (online survey) were willing to pay for the improved coral reef management scenario. The estimates from the CV study shows significant economic benefits, of improving coral reef management at Cape Rachado FPA.

6.1 Recommendations for future research

Detailed coral reef study is required at Cape Rachado FPA, to establish the current status of the reef. This information, will be vital for any coral reef management programmes that may be implemented at this area.

There is a need for detailed studies, to determine the best mechanism that should be used to collect the conservation fee, to ensure success of a full-fledged coral reef management programme for this area. The results of such a study will also provide important information for management of other fisheries prohibited areas in Malaysia.

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APPENDIX A: CONTINGENT VALUATION QUESTIONNAIRE

Introduction

My name is Mohamed Faizan, I am a student at University Malaya, doing Master of Technology (Environmental Management). I am currently doing a research to improve the management of coral reefs in Malaysia. You can help the research by participating in this survey. The survey will take between 15 to 20 minutes. All information that you provide will be treated confidentially. To ensure anonymity your name or any other form of identification will not be asked in the survey.

Form number: _ _ _ _ _ _ _ _ _ Date: _ _ / _ _ / _ _ _ _

Part A: Visit and experience at Port Dickson and/or Cape Rachado

A1. How many times have your visited Cape Rachado and/or beaches in Port Dickson including this visit?

A2. What is the purpose of your current visit?

a. Relaxation ☐
b. Snorkelling/Diving/Watersports ☐
c. Business ☐
d. Others (specify) ☐

A3. Have you or do you plan to go snorkelling during your visit? Yes ☐ No ☐

A4. Have you or do you plan to go diving during your visit? Yes ☐ No ☐

A5. Do you dive? Yes ☐ No ☐

A6. Are you a certified diver? Yes ☐ No ☐

A7. How many years have you been diving? Yes ☐ No ☐

A8. During your dive here, were you briefed on ways to avoid damage to the coral reefs? Yes ☐ No ☐

A9. Have you dived in any other reef besides Cape Rachado? Yes ☐ No ☐

(*If Yes go to A10, otherwise skip to Section B*)

A10. How does the quality of Cape Rachado reef compare to other reefs?

Part B: Background Information

This section provides background information on current status of the coral reef that occurs at Cape Rachado. Cape Rachado is listed as Fisheries Prohibited Area. The reef is also reported as the only reef that supports hard corals on the southern part of Straits of Malacca.

Literatures available suggest that the reef is in poor condition with low live coral cover. The main reason for this decline in reef status is linked to constant sedimentation and siltation of the area from land clearance activities for coastal development. In addition, coastal development has also increased the amount of waste water which is directly released into the lagoons adding into the pollution of the waters.

Even though the area is declared as a Fisheries Prohibited Area; no active management can be observed on-site:

1. No marine rangers are on-site to enforce the regulations (e.g. stop fishing and collection of shells etc.)
2. No regular coral reef monitoring to study the health of the reef system
3. The Fisheries Prohibited Area is not clearly marked with marker buoys, and no maps are present on-site to show the exact area

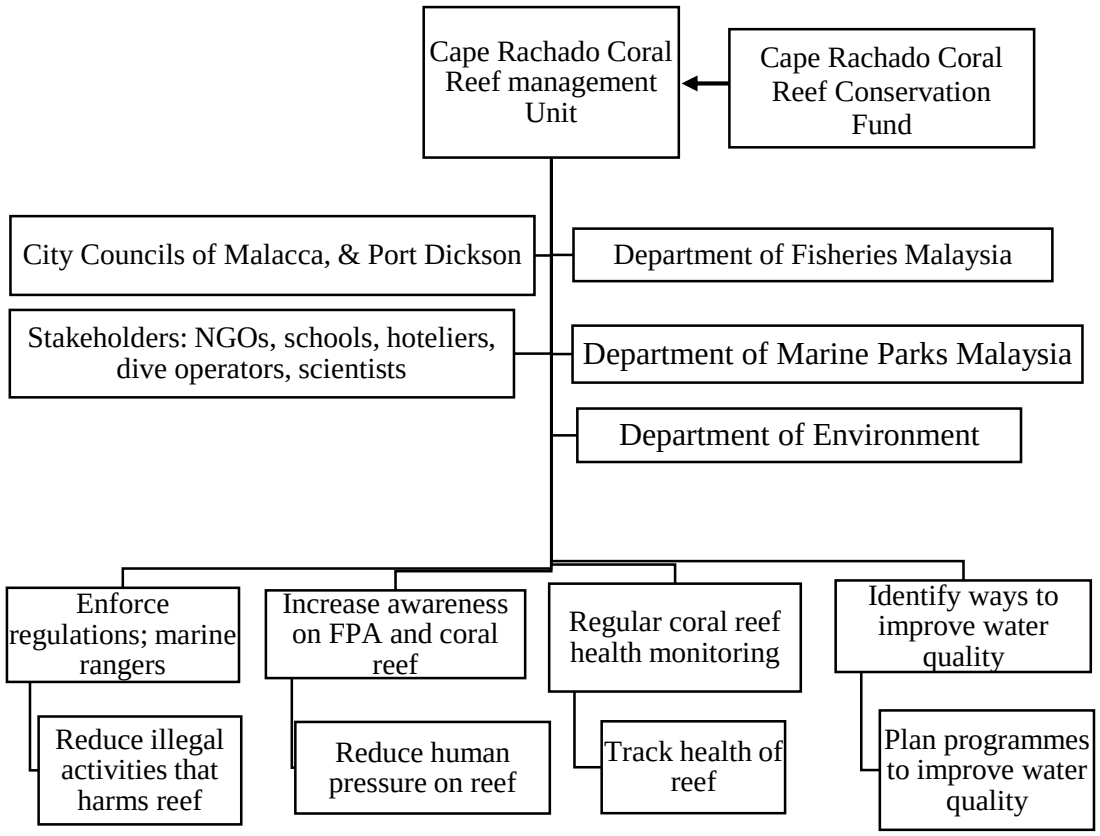
Lack of active management is partially to be blamed for the current status of the reef. The following is an outline of steps to improve the status of the reef.

1. Setup a coral reef management office for Cape Rachado
2. Enforce the regulations through regular monitoring of the area using marine rangers
3. Awareness raising activities for locals, students and visitors on the coral ecosystem and Fisheries Prohibited Area
4. Identify ways to reduce sediment run-off to the reef area (such as tree planting along the coastal area).
5. Formulate and implement a proper coral reef monitoring programme for Cape Rachado

Implementation of this coral reef management plan is expected to reduce pressure on the coral reef system, improve its health and increase the number of fishes in the area.

It is proposed that a Conservation Fund be established to fund the management activities for Cape Rachado. This fund will be managed by Department of Fisheries Malaysia in co-ordination with city councils of Port Dickson and Malacca.

The following organization chart shows the implementation structure of the coral reef management scenario,

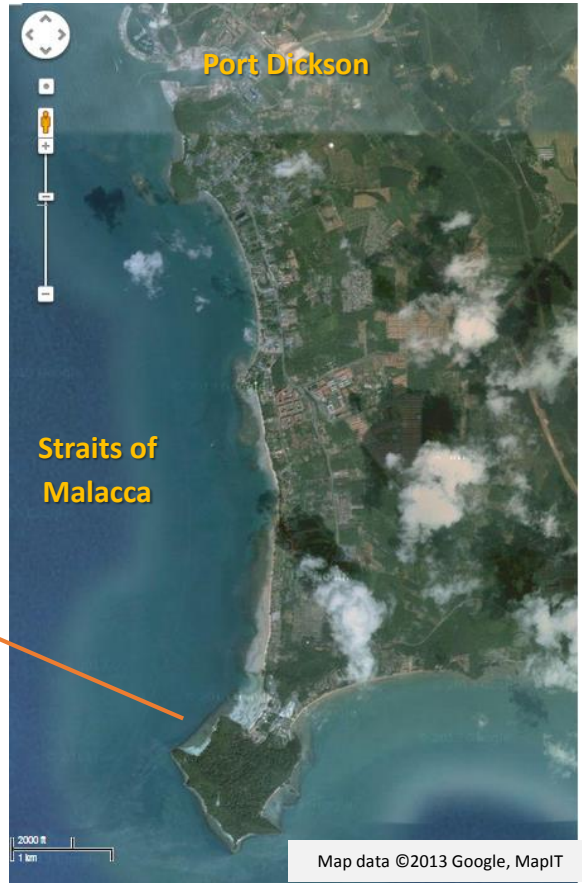


Threats to coral reefs

Low water quality

Littering on beach

Illegal fishing



Part C: Willingness to Pay

This section is regarding your views on paying for implementation of coral reef management plan for the Fisheries Prohibited Area of Cape Rachado. One proposed method to raise funds is to collect a conservation fee from all visitors to Cape Rachado and beaches in Port Dickson. This would be a onetime payment for your visit. Before responding to the question, please bear in mind that you have other uses for your income and that you are paying for other things during your visit to Port Dickson. Also bear in mind that there are many other places in Malaysia that you can visit without paying such a fee.

C1. If you could be certain that the funds obtained from the conservation fee would be used only for management of the coral reef at Cape Rachado, what is the maximum you will be willing to pay per visit to Port Dickson from the following range?

(*If answer is MYR 0, go to C3*)

MYR 0 ☐
MYR 0.50 ☐
MYR 1.00 ☐
MYR 1.50 ☐
MYR 2.00 ☐
MYR 3.00 ☐
MYR 4.00 ☐
MYR 5.00 ☐
MYR 10.00 ☐
MYR 15.00 ☐
MYR 20.00 ☐
MYR 25.00 ☐
MYR 30.00 ☐
MYR 40.00 ☐
MYR 50.00 ☐
MYR 60.00 ☐
MYR 70.00 ☐
MYR 80.00 ☐
MYR 90.00 ☐
MYR 100.00 ☐

C2. What is the main reason that you will be willing to pay the selected amount?

C3. You have indicated that you would not be willing to pay the fee. What is the main reason for this?

Part D: Demographic and awareness

This section includes questions on your views about coral reefs and some demographic information, this information helps in analysis of the survey.

D1. What do you think are the major threats coral reefs?

D2. Do you belong to any environmental or conservation organizations? Yes ☐ No ☐

D3. Are you involved in any conservation projects? Yes ☐ No ☐

D4. Apart from membership fees do you make donations to any environmental or conservation groups/causes/activities? Yes ☐ No ☐

D5. Gender Male ☐ Female ☐

D6. Select the age range you belong to:

a. Under 20 ☐
b. 20 to 39 ☐
c. 40 to 49 ☐
d. 50 to 59 ☐
e. 60 to 69 ☐
f. 70 and over ☐

D7. What is the highest level of education you have obtained?

a. Secondary School ☐
b. High School ☐
c. Undergraduate degree ☐
d. Postgraduate degree ☐
e. Other (specify) ☐ _ _ _ _ _ _ _ _ _ _ _ _ _ _

D8. What is your current occupation? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

D9. From the following monthly income ranges, what best describes your?

a. No income ☐
b. MYR 1000 – 2000 ☐
c. MYR 2000 – 5000 ☐
d. MYR 2000 – 5000 ☐
e. More than MYR 5000 ☐

APPENDIX B: RESULTS OF CV QUESTIONNAIRE PRE-TESTING

Variable	Description	Number of responders
Response rate	Yes	7
	No	3
Gender	Male	4
	Female	3
Age	Under 20	-
	20 to 29	4
	30 to 39	2
	40 to 49	1
	50 to 59	-
	60 to 69	-
	70 and over	-
Education	Secondary school	-
	High school	4
	Undergraduate	3
	Postgraduate	-
Employment status	Employed	5
	Unemployed	-
	Student	2
	Home duties	-
	Retired	-
	Other	-
Monthly income	No income	2
	Less than MYR 1000	1
	MYR 1000 – 2000	1
	MYR 2000 – 5000	2
	More than MYR 5000	
Environmental concern	Concerned	-
	Not Concerned	7
Scuba diver	Yes	-
	No	7
WTP response	Not willing to pay	1
	MYR 2	3
	MYR 5	1
	MYR 10	1
	MYR 20	1

APPENDIX C: COMPARISON OF WTP FOR DIFFERENT VARIABLE GROUPS

Variable	Description	Sample size	Mean WTP (MYR)	Standard deviation
Gender	Male	138	6.57	14.45
	Female	70	5.86	13.26
Age	Under 20	27	6.7	6.49
	20 to 29	98	6.23	15.10
	30 to 39	48	6.89	14.57
	40 to 49	28	6.79	12.21
	50 to 59	13	9.61	18.48
	60 to 69	3	2.00	2.65
	70 and over	-	-	-
Education	Secondary school	56	8.99	20.68
	High school	59	4.35	8.08
	Undergraduate	63	5.79	13.72
	Postgraduate	27	6.74	6.49
Employment status	Employed	159	6.41	13.92
	Unemployed	8	2.65	2.19
	Student	31	7.35	17.94
	Home duties	3	3.67	1.52
	Retired	4	3.25	2.36
	Other	3	8.00	10.39
Monthly income	No income	23	2.57	2.92
	Less than MYR 1000	24	6.75	19.99
	MYR 1000 – 2000	71	5.64	12.46
	MYR 2000 – 5000	70	8.54	16.78
	More than MYR 5000	20	4.88	4.13
Environmental concern	Concerned	43	9.01	16.61
	Not Concerned	165	5.63	13.25
Scuba diver	Yes	38	9.61	15.78
	No	170	5.59	13.56
Survey type	Face-to-face	163	5.92	13.78
	Online	45	7.81	14.99

APPENDIX D: DATA AND CALCULATION FOR TABLE 4-3

Standard deviation was calculated using the following formula:

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Where; **σ** = Standard Deviation, **x** = Bid amount, $\bar{x}$ = sample mean, and **n** = sample size

Standard Deviation of sample including protest bids

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

$$\sigma = \sqrt{\frac{40766.19}{208 - 1}}$$

$$\sigma = \sqrt{196.94}$$

$$\sigma = \mathbf{14.03}$$

Standard Deviation of sample excluding protest bids

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

$$\sigma = \sqrt{\frac{40071.81}{192 - 1}}$$

$$\sigma = \sqrt{209.80.}$$

$$\sigma = \mathbf{14.48}$$

Table A.D.1 WTP values including protest bids

Respondent	**Bids**	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{208}$	$(x - \bar{x})^2$
1	5.00	6.33	1.76711
2	2.00	6.33	18.74307
3	25.00	6.33	348.594
4	5.00	6.33	1.76711
5	3.00	6.33	11.08442
6	0.00	6.33	40.06038
7	2.00	6.33	18.74307
8	5.00	6.33	1.76711
9	5.00	6.33	1.76711
10	2.00	6.33	18.74307
11	10.00	6.33	13.47384
12	5.00	6.33	1.76711
13	1.00	6.33	28.40173
14	5.00	6.33	1.76711
15	0.00	6.33	40.06038
16	3.00	6.33	11.08442
17	1.00	6.33	28.40173
18	2.00	6.33	18.74307
19	2.00	6.33	18.74307
20	1.50	6.33	23.3224
21	5.00	6.33	1907.128
22	10.00	6.33	13.47384
23	2.00	6.33	18.74307
24	1.00	6.33	28.40173
25	20.00	6.33	186.8873
26	1.00	6.33	28.40173
27	2.00	6.33	18.74307
28	2.00	6.33	18.74307
29	5.00	6.33	1.76711
30	70.00	6.33	4053.955
31	1.00	6.33	28.40173
32	3.00	6.33	11.08442
33	0.00	6.33	40.06038
34	0.50	6.33	33.98105
35	2.00	6.33	18.74307
36	5.00	6.33	1.76711
37	3.00	6.33	11.08442
38	60.00	6.33	2880.541
39	0.50	6.33	33.98105
40	2.00	6.33	18.74307
41	1.50	6.33	23.3224
42	5.00	6.33	1.76711
43	0.00	6.33	40.06038

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{208}$	$(x - \bar{x})^2$
44	5.00	6.33	1.76711
45	0.00	6.33	40.06038
46	0.00	6.33	40.06038
47	10.00	6.33	13.47384
48	0.00	6.33	40.06038
49	50.00	6.33	1907.128
50	2.00	6.33	18.74307
51	3.00	6.33	11.08442
52	15.00	6.33	75.18057
53	0.00	6.33	40.06038
54	10.00	6.33	13.47384
55	5.00	6.33	1.76711
56	4.00	6.33	5.425764
57	2.00	6.33	18.74307
58	3.00	6.33	11.08442
59	0.00	6.33	40.06038
60	10.00	6.33	13.47384
61	5.00	6.33	1.76711
62	10.00	6.33	13.47384
63	2.00	6.33	18.74307
64	0.00	6.33	40.06038
65	20.00	6.33	186.8873
66	4.00	6.33	5.425764
67	10.00	6.33	13.47384
68	5.00	6.33	1.76711
69	2.00	6.33	18.74307
70	2.00	6.33	18.74307
71	5.00	6.33	1.76711
72	0.00	6.33	40.06038
73	3.00	6.33	11.08442
74	2.00	6.33	18.74307
75	30.00	6.33	560.3008
76	100.00	6.33	8774.195
77	100.00	6.33	8774.195
78	25.00	6.33	348.594
79	0.00	6.33	40.06038
80	2.00	6.33	18.74307
81	5.00	6.33	1.76711
82	5.00	6.33	1.76711
83	3.00	6.33	11.08442
84	5.00	6.33	1.76711
85	5.00	6.33	1.76711
86	5.00	6.33	1.76711
87	5.00	6.33	1.76711
88	3.00	6.33	11.08442

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{208}$	$(x - \bar{x})^2$
89	2.00	6.33	18.74307
90	3.00	6.33	11.08442
91	3.00	6.33	11.08442
92	2.00	6.33	18.74307
93	5.00	6.33	1.76711
94	1.00	6.33	28.40173
95	0.00	6.33	40.06038
96	1.00	6.33	28.40173
97	2.00	6.33	18.74307
98	3.00	6.33	11.08442
99	5.00	6.33	1.76711
100	2.00	6.33	18.74307
101	3.00	6.33	11.08442
102	2.00	6.33	18.74307
103	3.00	6.33	11.08442
104	1.00	6.33	28.40173
105	0.00	6.33	40.06038
106	5.00	6.33	1.76711
107	5.00	6.33	1.76711
108	5.00	6.33	1.76711
109	5.00	6.33	1.76711
110	3.00	6.33	11.08442
111	1.00	6.33	28.40173
112	3.00	6.33	11.08442
113	10.00	6.33	13.47384
114	0.00	6.33	40.06038
115	2.00	6.33	18.74307
116	0.00	6.33	40.06038
117	10.00	6.33	13.47384
118	5.00	6.33	1.76711
119	2.00	6.33	18.74307
120	1.00	6.33	28.40173
121	3.00	6.33	11.08442
122	2.00	6.33	18.74307
123	3.00	6.33	11.08442
124	1.00	6.33	28.40173
125	4.00	6.33	5.425764
126	5.00	6.33	1.76711
127	2.00	6.33	18.74307
128	5.00	6.33	1.76711
129	0.00	6.33	40.06038
130	3.00	6.33	11.08442
131	2.00	6.33	18.74307
132	5.00	6.33	1.76711
133	1.00	6.33	28.40173

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{208}$	$(x - \bar{x})^2$
134	1.00	6.33	28.40173
135	2.00	6.33	18.74307
136	2.00	6.33	18.74307
137	3.00	6.33	11.08442
138	1.00	6.33	28.40173
139	1.00	6.33	28.40173
140	1.00	6.33	28.40173
141	3.00	6.33	11.08442
142	1.00	6.33	28.40173
143	1.00	6.33	28.40173
144	2.00	6.33	18.74307
145	2.00	6.33	18.74307
146	0.00	6.33	40.06038
147	2.00	6.33	18.74307
148	1.50	6.33	23.3224
149	3.00	6.33	11.08442
150	0.00	6.33	40.06038
151	2.00	6.33	18.74307
152	2.00	6.33	18.74307
153	1.50	6.33	23.3224
154	5.00	6.33	1.76711
155	2.00	6.33	18.74307
156	1.00	6.33	28.40173
157	10.00	6.33	13.47384
158	3.00	6.33	11.08442
159	5.00	6.33	1.76711
160	0.00	6.33	40.06038
161	5.00	6.33	1.76711
162	3.00	6.33	11.08442
163	0.00	6.33	40.06038
164	5.00	6.33	1.76711
165	5.00	6.33	1.76711
166	1.00	6.33	28.40173
167	5.00	6.33	1.76711
168	10.00	6.33	13.47384
170*	0.50	6.33	33.98105
171	5.00	6.33	1.76711
173*	5.00	6.33	1.76711
174	2.00	6.33	18.74307
175	5.00	6.33	1.76711
176	3.00	6.33	11.08442
177	0.00	6.33	40.06038
178	5.00	6.33	1.76711
179	5.00	6.33	1.76711
180	25.00	6.33	348.594

Respondent	**Bids**	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{208}$	$(x - \bar{x})^2$
181	10.00	6.33	13.47384
182	5.00	6.33	1.76711
183	5.00	6.33	1.76711
184	10.00	6.33	13.47384
185	2.00	6.33	18.74307
186	10.00	6.33	13.47384
187	5.00	6.33	1.76711
188	2.00	6.33	18.74307
189	1.00	6.33	28.40173
190	0.00	6.33	40.06038
191	10.00	6.33	13.47384
192	5.00	6.33	1.76711
193	20.00	6.33	186.8873
194	2.00	6.33	18.74307
195	5.00	6.33	1.76711
196	5.00	6.33	1.76711
197	2.00	6.33	18.74307
198	20.00	6.33	186.8873
199	5.00	6.33	1.76711
200	5.00	6.33	1.76711
201	10.00	6.33	13.47384
202	5.00	6.33	1.76711
203	5.00	6.33	1.76711
204	2.00	6.33	18.74307
205	10.00	6.33	13.47384
206	1.00	6.33	28.40173
207	2.00	6.33	18.74307
208	1.00	6.33	28.40173
209	5.00	6.33	1.76711
210	100.00	6.33	8774.195
	$\sum x = 1316.5$		**$\sum (x - \bar{x})^2 = 40766.19$**

Table A.D-2: WTP values excluding protest bids

Respondent	**Bids**	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{192}$	$(x - \bar{x})^2$
1	5.00	6.86	3.447598
2	2.00	6.86	23.58822
3	25.00	6.86	329.1768
4	5.00	6.86	3.447598
5	3.00	6.86	14.87468
6	0.00	6.86	47.01531
7	2.00	6.86	23.58822
8	5.00	6.86	3.447598
9	5.00	6.86	3.447598
10	2.00	6.86	23.58822
11	10.00	6.86	9.87989
12	5.00	6.86	3.447598
13	1.00	6.86	34.30176
14	5.00	6.86	3.447598
16	3.00	6.86	14.87468
17	1.00	6.86	34.30176
18	2.00	6.86	23.58822
19	2.00	6.86	23.58822
20	1.50	6.86	28.69499
21	5.00	6.86	3.447598
22	10.00	6.86	9.87989
23	2.00	6.86	23.58822
24	1.00	6.86	34.30176
25	20.00	6.86	172.7445
26	1.00	6.86	34.30176
27	2.00	6.86	23.58822
28	2.00	6.86	23.58822
29	5.00	6.86	3.447598
30	70.00	6.86	3987.067
31	1.00	6.86	34.30176
32	3.00	6.86	14.87468
33	0.00	6.86	47.01531
34	0.50	6.86	40.40854
35	2.00	6.86	23.58822
36	5.00	6.86	3.447598
37	3.00	6.86	14.87468
38	60.00	6.86	2824.203
39	0.50	6.86	40.40854
40	2.00	6.86	23.58822
41	1.50	6.86	28.69499
42	5.00	6.86	3.447598
43	0.00	6.86	47.01531
44	5.00	6.86	3.447598

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{192}$	$(x - \bar{x})^2$
47	10.00	6.86	9.87989
49	50.00	6.86	1861.338
50	2.00	6.86	23.58822
51	3.00	6.86	14.87468
52	15.00	6.86	66.31218
54	10.00	6.86	9.87989
55	5.00	6.86	3.447598
56	4.00	6.86	8.16114
57	2.00	6.86	23.58822
58	3.00	6.86	14.87468
60	10.00	6.86	9.87989
61	5.00	6.86	3.447598
62	10.00	6.86	9.87989
63	2.00	6.86	23.58822
65	20.00	6.86	172.7445
66	4.00	6.86	8.16114
67	10.00	6.86	9.87989
68	5.00	6.86	3.447598
69	2.00	6.86	23.58822
70	2.00	6.86	23.58822
71	5.00	6.86	3.447598
73	3.00	6.86	14.87468
74	2.00	6.86	23.58822
75	30.00	6.86	535.6091
76	100.00	6.86	8675.661
77	100.00	6.86	8675.661
78	25.00	6.86	329.1768
79	0.00	6.86	47.01531
80	2.00	6.86	23.58822
81	5.00	6.86	3.447598
82	5.00	6.86	3.447598
83	3.00	6.86	14.87468
84	5.00	6.86	3.447598
85	5.00	6.86	3.447598
86	5.00	6.86	3.447598
87	5.00	6.86	3.447598
88	3.00	6.86	14.87468
89	2.00	6.86	23.58822
90	3.00	6.86	14.87468
91	3.00	6.86	14.87468
92	2.00	6.86	23.58822
93	5.00	6.86	3.447598
94	1.00	6.86	34.30176
96	1.00	6.86	34.30176
97	2.00	6.86	23.58822

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{192}$	$(x - \bar{x})^2$
98	3.00	6.86	14.87468
99	5.00	6.86	3.447598
100	2.00	6.86	23.58822
101	3.00	6.86	14.87468
102	2.00	6.86	23.58822
103	3.00	6.86	14.87468
104	1.00	6.86	34.30176
105	0.00	6.86	47.01531
106	5.00	6.86	3.447598
107	5.00	6.86	3.447598
108	5.00	6.86	3.447598
109	5.00	6.86	3.447598
110	3.00	6.86	14.87468
111	1.00	6.86	34.30176
112	3.00	6.86	14.87468
113	10.00	6.86	9.87989
114	0.00	6.86	47.01531
115	2.00	6.86	23.58822
117	10.00	6.86	9.87989
118	5.00	6.86	3.447598
119	2.00	6.86	23.58822
120	1.00	6.86	34.30176
121	3.00	6.86	14.87468
122	2.00	6.86	23.58822
123	3.00	6.86	14.87468
124	1.00	6.86	34.30176
125	4.00	6.86	8.16114
126	5.00	6.86	3.447598
127	2.00	6.86	23.58822
128	5.00	6.86	3.447598
130	3.00	6.86	14.87468
131	2.00	6.86	23.58822
132	5.00	6.86	3.447598
133	1.00	6.86	34.30176
134	1.00	6.86	34.30176
135	2.00	6.86	23.58822
136	2.00	6.86	23.58822
137	3.00	6.86	14.87468
138	1.00	6.86	34.30176
139	1.00	6.86	34.30176
140	1.00	6.86	34.30176
141	3.00	6.86	14.87468
142	1.00	6.86	34.30176
143	1.00	6.86	34.30176
144	2.00	6.86	23.58822

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{192}$	$(x - \bar{x})^2$
145	2.00	6.86	23.58822
147	2.00	6.86	23.58822
148	1.50	6.86	28.69499
149	3.00	6.86	14.87468
151	2.00	6.86	23.58822
152	2.00	6.86	23.58822
153	1.50	6.86	28.69499
154	5.00	6.86	3.447598
155	2.00	6.86	23.58822
156	1.00	6.86	34.30176
157	10.00	6.86	9.87989
158	3.00	6.86	14.87468
159	5.00	6.86	3.447598
161	5.00	6.86	3.447598
162	3.00	6.86	14.87468
164	5.00	6.86	3.447598
165	5.00	6.86	3.447598
166	1.00	6.86	34.30176
167	5.00	6.86	3.447598
168	10.00	6.86	9.87989
170*	0.50	6.86	40.40854
171	5.00	6.86	3.447598
173*	5.00	6.86	3.447598
174	2.00	6.86	23.58822
175	5.00	6.86	3.447598
176	3.00	6.86	14.87468
178	5.00	6.86	3.447598
179	5.00	6.86	3.447598
180	25.00	6.86	329.1768
181	10.00	6.86	9.87989
182	5.00	6.86	3.447598
183	5.00	6.86	3.447598
184	10.00	6.86	9.87989
185	2.00	6.86	23.58822
186	10.00	6.86	9.87989
187	5.00	6.86	3.447598
188	2.00	6.86	23.58822
189	1.00	6.86	34.30176
190	0.00	6.86	47.01531
191	10.00	6.86	9.87989
192	5.00	6.86	3.447598
193	20.00	6.86	172.7445
194	2.00	6.86	23.58822
195	5.00	6.86	3.447598
196	5.00	6.86	3.447598

Respondent	Bids	$\bar{x} = \frac{\sum x}{n} = \frac{1316.5}{192}$	$(x - \bar{x})^2$
197	2.00	6.86	23.58822
198	20.00	6.86	172.7445
199	5.00	6.86	3.447598
200	5.00	6.86	3.447598
201	10.00	6.86	9.87989
202	5.00	6.86	3.447598
203	5.00	6.86	3.447598
204	2.00	6.86	23.58822
205	10.00	6.86	9.87989
206	1.00	6.86	34.30176
207	2.00	6.86	23.58822
208	1.00	6.86	34.30176
209	5.00	6.86	3.447598
210	100.00	6.86	8675.661
	$\sum x = 1316.5$		**$\sum (x - \bar{x})^2 = 40071.81$**

APPENDIX E: DATA SOCIO-ECONOMIC VARIABLES OF SAMPLE

Table A.E.1 Data for Gender, Age, Education, Work and Income

Respondent	Survey type	Gender[4]	Age[5]	Education[6]	Work[7]	Income[8]
1	Online	1	2	4	3	0
2	Online	1	2	4	3	2
3	Online	2	2	3	1	2
4	Online	1	3	2	2	3
5	Online	1	4	4	3	3
6	Online	1	2	3	1	3
7	Online	1	2	3	1	3
8	Online	2	3	4	1	3
9	Online	1	2	3	3	3
10	Online	2	3	3	1	3
11	Online	1	3	3	1	3
12	Online	2	3	4	1	3
13	Online	1	2	3	1	2
14	Online	1	4	3	1	3
15	Online	1	6	2	5	3
16	Online	2	4	4	1	4
17	Online	1	2	4	3	2
18	Online	2	2	3	3	0
19	Online	1	2	3	2	1
20	Online	1	2	3	1	3
21	Online	1	2	3	1	2
22	Online	2	3	3	6	3
23	Online	1	2	3	3	1
24	Online	2	2	3	1	2
25	Online	1	2	3	1	3
26	Online	1	2	3	1	3
27	Online	1	4	4	3	3
28	Online	2	2	3	3	2
29	Online	1	1	4	1	4
30	Online	1	3	4	1	3
31	Online	1	2	3	1	3
32	Online	1	3	4	1	3
33	Online	1	2	2	3	0
34	Online	2	4	2	1	3
35	Online	1	4	4	6	3
36	Online	1	3	4	1	4

[4] 1 = Male, and 2 = Female

[5] 1 = <20, 2 = 20-29, 3 = 30-39, 4 = 40-49, 5 = 50-59, 6 = 60-69, and 7 = 70 and above

[6] 1 = Secondary School, 2 – High School, 3 = Undergraduate, 4 = Postgraduate, and 5 = Other

[7] 1 = Employed, 2 = Unemployed, 3 = Student, 4 = Home Duties, and 5 = Retired

[8] 0 = No income, 1 = < MYR1000, 2 = MYR1000-2000, 3 = MYR2000-5000, and 4 = >MYR5000

Respondent	Survey type	Gender[4]	Age[5]	Education[6]	Work[7]	Income[8]
37	Online	2	3	3	1	3
38	Online	1	3	3	1	4
39	Online	1	4	3	1	4
40	Online	1	2	4	3	2
41	Online	1	4	2	6	3
42	Online	1	5	4	1	4
43	Online	1	3	4	1	3
44	Online	1	3	4	1	4
45	Online	1	2	4	2	0
46	Online	1	2	3	3	3
47	Online	1	2	3	3	1
48	Face-to-Face	1	2	1	1	2
49	Face-to-Face	1	2	2	1	2
50	Face-to-Face	2	2	1	1	3
51	Face-to-Face	2	2	1	1	2
52	Face-to-Face	2	2	4	1	3
53	Face-to-Face	2	1	3	3	0
54	Face-to-Face	1	3	2	1	4
55	Face-to-Face	1	3	3	1	4
56	Face-to-Face	2	2	4	1	3
57	Face-to-Face	1	2	2	3	0
58	Face-to-Face	1	4	2	1	4
59	Face-to-Face	1	4	1	5	3
60	Face-to-Face	1	2	4	1	3
61	Face-to-Face	2	3	3	1	3
62	Face-to-Face	1	3	2	1	4
63	Face-to-Face	1	2	3	2	0
64	Face-to-Face	1	4	3	1	3
65	Face-to-Face	1	2	3	1	3
66	Face-to-Face	1	2	3	2	0
67	Face-to-Face	1	3	3	1	4
68	Face-to-Face	1	2	3	2	0
69	Face-to-Face	2	1	1	3	0
70	Face-to-Face	1	4	1	1	3
71	Face-to-Face	1	2	1	1	1
72	Face-to-Face	1	3	1	1	3
73	Face-to-Face	2	2	3	1	3
74	Face-to-Face	2	2	3	3	0
75	Face-to-Face	1	2	2	1	2
76	Face-to-Face	1	2	3	1	3
77	Face-to-Face	1	5	1	1	3
78	Face-to-Face	1	4	1	1	2
79	Face-to-Face	1	3	5	1	3
80	Face-to-Face	1	2	2	2	0
81	Face-to-Face	2	2	3	1	2

Respondent	Survey type	Gender[4]	Age[5]	Education[6]	Work[7]	Income[8]
82	Face-to-Face	1	3	2	1	3
83	Face-to-Face	2	3	3	1	3
84	Face-to-Face	1	2	1	1	2
85	Face-to-Face	1	4	2	1	3
86	Face-to-Face	1	1	3	3	0
87	Face-to-Face	1	1	3	3	0
88	Face-to-Face	2	2	3	3	0
89	Face-to-Face	2	3	3	1	3
90	Face-to-Face	1	4	2	1	2
91	Face-to-Face	2	2	5	1	2
92	Face-to-Face	2	2	3	3	0
93	Face-to-Face	1	3	3	1	4
94	Face-to-Face	2	3	2	1	3
95	Face-to-Face	2	2	3	3	0
96	Face-to-Face	2	2	3	1	3
97	Face-to-Face	2	3	5	1	3
98	Face-to-Face	2	4	3	1	2
99	Face-to-Face	2	3	4	1	4
100	Face-to-Face	2	2	2	2	0
101	Face-to-Face	1	3	2	1	2
102	Face-to-Face	2	2	2	1	2
103	Face-to-Face	2	4	1	4	0
104	Face-to-Face	1	2	2	1	1
105	Face-to-Face	2	3	3	1	2
106	Face-to-Face	2	2	2	3	0
107	Face-to-Face	1	2	3	1	3
108	Face-to-Face	2	3	3	1	3
109	Face-to-Face	1	5	4	1	4
110	Face-to-Face	2	1	2	3	0
111	Face-to-Face	2	2	3	3	0
112	Face-to-Face	1	3	2	1	2
113	Face-to-Face	2	2	3	3	0
114	Face-to-Face	2	2	3	1	2
115	Face-to-Face	1	4	1	1	2
116	Face-to-Face	1	3	1	1	4
117	Face-to-Face	1	2	2	1	2
118	Face-to-Face	1	3	2	1	3
119	Face-to-Face	2	2	3	1	2
120	Face-to-Face	2	4	2	1	3
121	Face-to-Face	2	4	2	4	1
122	Face-to-Face	1	4	1	1	2
123	Face-to-Face	2	3	1	1	3
124	Face-to-Face	1	2	1	1	2
125	Face-to-Face	1	2	1	1	3
126	Face-to-Face	1	2	1	1	3

Respondent	Survey type	Gender[4]	Age[5]	Education[6]	Work[7]	Income[8]
127	Face-to-Face	1	4	1	1	3
128	Face-to-Face	1	2	3	1	3
129	Face-to-Face	1	5	2	1	3
130	Face-to-Face	2	5	2	1	3
131	Face-to-Face	2	5	2	4	1
132	Face-to-Face	2	4	2	1	2
133	Face-to-Face	2	2	2	1	3
134	Face-to-Face	2	5	2	1	4
135	Face-to-Face	2	5	1	5	1
136	Face-to-Face	2	5	3	1	3
137	Face-to-Face	2	3	2	1	1
138	Face-to-Face	2	4	2	1	1
139	Face-to-Face	1	4	2	1	2
140	Face-to-Face	1	1	2	3	1
141	Face-to-Face	1	1	2	1	1
142	Face-to-Face	1	3	1	1	3
143	Face-to-Face	1	6	2	1	4
144	Face-to-Face	1	5	1	1	3
145	Face-to-Face	1	4	2	1	3
146	Face-to-Face	1	3	2	1	2
147	Face-to-Face	1	2	2	1	2
148	Face-to-Face	1	1	2	1	2
149	Face-to-Face	1	1	2	3	1
150	Face-to-Face	1	3	3	1	4
151	Face-to-Face	1	2	3	1	4
152	Face-to-Face	1	3	2	1	2
153	Face-to-Face	1	2	3	1	1
154	Face-to-Face	1	3	1	1	2
155	Face-to-Face	1	2	1	1	2
156	Face-to-Face	1	2	1	1	2
157	Face-to-Face	1	1	1	3	1
158	Face-to-Face	1	1	1	3	1
159	Face-to-Face	1	1	1	3	1
160	Face-to-Face	1	2	1	1	2
161	Face-to-Face	1	3	3	1	1
162	Face-to-Face	1	4	4	1	3
163	Face-to-Face	1	3	2	1	3
164	Face-to-Face	1	5	2	1	3
165	Face-to-Face	1	3	2	1	2
166	Face-to-Face	1	3	2	1	3
167	Face-to-Face	1	2	1	1	2
168	Face-to-Face	1	3	1	1	2
169	Face-to-Face	2	2	1	1	2
170	Face-to-Face	2	2	1	1	2
171	Face-to-Face	2	2	2	1	2

Respondent	Survey type	Gender[4]	Age[5]	Education[6]	Work[7]	Income[8]
172	Face-to-Face	1	2	1	1	2
173	Face-to-Face	1	1	1	1	2
174	Face-to-Face	1	2	1	1	2
175	Face-to-Face	1	3	2	1	3
176	Face-to-Face	1	2	1	1	2
177	Face-to-Face	1	1	1	1	2
178	Face-to-Face	1	2	1	1	2
179	Face-to-Face	1	2	1	1	2
180	Face-to-Face	1	2	1	1	2
181	Face-to-Face	1	1	1	1	2
182	Face-to-Face	1	3	2	1	3
183	Face-to-Face	1	2	1	1	2
184	Face-to-Face	1	2	1	1	2
185	Face-to-Face	1	2	1	1	2
186	Face-to-Face	1	2	1	1	2
187	Face-to-Face	1	2	1	1	2
188	Face-to-Face	1	2	3	1	3
189	Face-to-Face	1	2	1	1	2
190	Face-to-Face	1	2	1	1	2
191	Face-to-Face	2	2	2	1	2
192	Face-to-Face	2	1	1	1	2
193	Face-to-Face	2	2	4	3	1
194	Face-to-Face	1	2	2	1	2
195	Face-to-Face	2	2	1	1	2
196	Face-to-Face	2	4	2	1	2
197	Face-to-Face	2	5	1	5	1
198	Face-to-Face	2	2	3	1	1
199	Face-to-Face	2	2	2	1	2
200	Face-to-Face	1	2	2	1	2
201	Face-to-Face	2	1	1	1	1
202	Face-to-Face	2	2	4	1	3
203	Face-to-Face	1	2	1	1	1
204	Face-to-Face	1	2	4	1	2
205	Face-to-Face	1	2	2	1	2
206	Face-to-Face	1	3	3	1	2
207	Face-to-Face	2	6	2	1	3
208	Face-to-Face	2	2	3	1	3
209	Face-to-Face	1	2	3	1	2
210	Face-to-Face	1	5	1	3	1

APPENDIX F: DATA BEHAVIOURAL CHARACTERISTICS OF SAMPLE

Table A.F.1 Online and face-to-face survey data

Respondent	Survey type	Visits[9]	Env. Concern[10]	Scuba diver[11]	Dive cert.[12]	Years diving[13]
1	Online	2	0	0	0	0
2	Online	4	1	1	1	2
3	Online	4	1	0	0	0
4	Online	4	1	1	3	2
5	Online	4	1	1	4	2
6	Online	4	0	1	1	2
7	Online	1	0	0	0	0
8	Online	2	1	0	0	0
9	Online	4	0	0	0	0
10	Online	4	1	1	2	2
11	Online	4	0	1	1	1
12	Online	4	1	1	2	2
13	Online	4	1	1	1	2
14	Online	4	0	1	1	2
15	Online	4	1	1	4	2
16	Online	4	1	1	2	2
17	Online	3	1	0	0	0
18	Online	2	0	0	0	0
19	Online	1	1	0	0	0
20	Online	1	0	0	0	0
21	Online	1	0	0	0	0
22	Online	4	0	1	2	2
23	Online	4	1	0	0	0
24	Online	1	0	0	0	0
25	Online	4	1	0	0	0
26	Online	2	1	1	2	2
27	Online	4	1	1	4	2
28	Online	4	1	0	0	0
29	Online	4	1	1	2	2
30	Online	4	1	0	0	0
31	Online	4	1	1	2	2
32	Online	4	1	1	4	2
33	Online	2	0	0	0	0
34	Online	4	1	0	0	0

[9] 1 = Once, 2 = Twice, 3 = Thrice, and 4 = More than thrice

[10] 0 = Not concerned, 1 = Concerned

[11] 0 = Not a scuba diver, 1 = Scuba diver

[12] 1 = Open water, 2 = Advanced Open Water, 3 = Dive Master, and 4 = Others (0 values ignored as they are not applicable)

[13] 1 = Less than one year, 2 = One to five years, and 3 = More than five years (0 values ignored as they are not applicable)

Respondent	Survey type	Visits[9]	Env. Concern[10]	Scuba diver[11]	Dive cert.[12]	Years diving[13]
35	Online	4	1	1	1	2
36	Online	4	1	1	2	2
37	Online	4	0	1	2	2
38	Online	2	1	1	2	2
39	Online	4	1	1	4	2
40	Online	4	1	1	4	2
41	Online	4	1	1	4	2
42	Online	1	0	1	1	2
43	Online	4	0	1	2	2
44	Online	4	1	0	0	0
45	Online	4	1	1	2	2
46	Online	4	0	1	1	1
47	Online	2	1	0	0	0
48	Face-to-Face	1	0	0	0	0
49	Face-to-Face	1	0	1	0	1
50	Face-to-Face	1	0	0	0	0
51	Face-to-Face	1	0	0	0	0
52	Face-to-Face	1	0	0	0	0
53	Face-to-Face	1	1	0	0	0
54	Face-to-Face	1	0	0	0	0
55	Face-to-Face	2	0	0	0	0
56	Face-to-Face	4	0	0	0	0
57	Face-to-Face	4	0	0	0	0
58	Face-to-Face	1	0	0	0	0
59	Face-to-Face	2	0	0	0	0
60	Face-to-Face	4	0	1	0	2
61	Face-to-Face	3	0	0	0	0
62	Face-to-Face	4	0	0	0	0
63	Face-to-Face	4	0	0	0	0
64	Face-to-Face	4	0	0	0	0
65	Face-to-Face	2	0	0	0	0
66	Face-to-Face	2	0	0	0	0
67	Face-to-Face	2	0	0	0	0
68	Face-to-Face	4	0	0	0	0
69	Face-to-Face	1	0	0	0	0
70	Face-to-Face	4	0	0	0	0
71	Face-to-Face	3	0	0	0	0
72	Face-to-Face	3	0	0	0	0
73	Face-to-Face	3	0	0	0	0
74	Face-to-Face	1	0	0	0	0
75	Face-to-Face	1	0	0	0	0
76	Face-to-Face	2	1	1	0	2
77	Face-to-Face	4	0	1	3	2
78	Face-to-Face	1	0	0	0	0

Respondent	Survey type	Visits[9]	Env. Concern[10]	Scuba diver[11]	Dive cert.[12]	Years diving[13]
79	Face-to-Face	1	1	0	0	0
80	Face-to-Face	2	0	0	0	0
81	Face-to-Face	2	1	0	0	0
82	Face-to-Face	4	0	0	0	0
83	Face-to-Face	3	0	0	0	0
84	Face-to-Face	2	0	0	0	0
85	Face-to-Face	4	0	1	3	2
86	Face-to-Face	4	0	0	0	0
87	Face-to-Face	2	0	0	0	0
88	Face-to-Face	3	0	0	0	0
89	Face-to-Face	2	0	0	0	0
90	Face-to-Face	4	0	0	0	0
91	Face-to-Face	4	1	0	0	0
92	Face-to-Face	1	0	0	0	0
93	Face-to-Face	4	0	0	0	0
94	Face-to-Face	2	1	0	0	0
95	Face-to-Face	2	0	0	0	0
96	Face-to-Face	4	1	1	0	2
97	Face-to-Face	1	0	0	0	0
98	Face-to-Face	2	0	0	0	0
99	Face-to-Face	1	0	0	0	0
100	Face-to-Face	4	0	0	0	0
101	Face-to-Face	4	0	1	0	1
102	Face-to-Face	1	0	0	0	0
103	Face-to-Face	3	0	0	0	0
104	Face-to-Face	4	0	0	0	0
105	Face-to-Face	4	0	0	0	0
106	Face-to-Face	1	1	0	0	0
107	Face-to-Face	4	1	1	2	2
108	Face-to-Face	1	0	0	0	0
109	Face-to-Face	2	1	0	0	0
110	Face-to-Face	1	0	0	0	0
111	Face-to-Face	2	0	0	0	0
112	Face-to-Face	4	0	1	3	2
113	Face-to-Face	1	0	0	0	0
114	Face-to-Face	4	0	0	0	0
115	Face-to-Face	1	1	1	0	1
116	Face-to-Face	4	0	0	0	0
117	Face-to-Face	2	0	0	0	0
118	Face-to-Face	2	0	0	0	0
119	Face-to-Face	2	0	0	0	0
120	Face-to-Face	1	0	0	0	0
121	Face-to-Face	4	0	0	0	0
122	Face-to-Face	4	0	0	0	0

Respondent	Survey type	Visits[9]	Env. Concern[10]	Scuba diver[11]	Dive cert.[12]	Years diving[13]
123	Face-to-Face	4	0	0	0	0
124	Face-to-Face	4	0	0	0	0
125	Face-to-Face	4	0	0	0	0
126	Face-to-Face	4	0	0	0	0
127	Face-to-Face	4	0	0	0	0
128	Face-to-Face	2	0	0	0	0
129	Face-to-Face	4	0	0	0	0
130	Face-to-Face	4	0	0	0	0
131	Face-to-Face	4	0	0	0	0
132	Face-to-Face	4	0	0	0	0
133	Face-to-Face	4	0	0	0	0
134	Face-to-Face	4	0	0	0	0
135	Face-to-Face	4	0	0	0	0
136	Face-to-Face	4	0	0	0	0
137	Face-to-Face	1	0	0	0	0
138	Face-to-Face	1	0	0	0	0
139	Face-to-Face	4	0	0	0	0
140	Face-to-Face	4	0	0	0	0
141	Face-to-Face	3	0	0	0	0
142	Face-to-Face	4	0	0	0	0
143	Face-to-Face	4	0	0	0	0
144	Face-to-Face	4	0	0	0	0
145	Face-to-Face	4	0	0	0	0
146	Face-to-Face	4	0	0	0	0
147	Face-to-Face	4	0	0	0	0
148	Face-to-Face	4	0	0	0	0
149	Face-to-Face	2	0	0	0	0
150	Face-to-Face	4	0	0	0	0
151	Face-to-Face	4	0	0	0	0
152	Face-to-Face	4	0	0	0	0
153	Face-to-Face	4	0	0	0	0
154	Face-to-Face	4	0	0	0	0
155	Face-to-Face	4	0	0	0	0
156	Face-to-Face	1	0	0	0	0
157	Face-to-Face	2	0	0	0	0
158	Face-to-Face	2	0	0	0	0
159	Face-to-Face	4	0	0	0	0
160	Face-to-Face	4	0	0	0	0
161	Face-to-Face	4	0	0	0	0
162	Face-to-Face	4	0	0	0	0
163	Face-to-Face	4	0	0	0	0
164	Face-to-Face	4	0	0	0	0
165	Face-to-Face	4	0	0	0	0
166	Face-to-Face	4	0	0	0	0

Respondent	Survey type	Visits[9]	Env. Concern[10]	Scuba diver[11]	Dive cert.[12]	Years diving[13]
167	Face-to-Face	4	0	0	0	0
168	Face-to-Face	4	0	0	0	0
169	Face-to-Face	4	0	0	0	0
170	Face-to-Face	4	0	0	0	0
171	Face-to-Face	4	0	0	0	0
172	Face-to-Face	4	0	0	0	0
173	Face-to-Face	4	0	0	0	0
174	Face-to-Face	4	0	0	0	0
175	Face-to-Face	1	0	0	0	0
176	Face-to-Face	4	0	0	0	0
177	Face-to-Face	4	0	0	0	0
178	Face-to-Face	2	0	0	0	0
179	Face-to-Face	3	0	0	0	0
180	Face-to-Face	3	0	0	0	0
181	Face-to-Face	4	0	0	0	0
182	Face-to-Face	4	0	0	0	0
183	Face-to-Face	4	0	0	0	0
184	Face-to-Face	4	0	0	0	0
185	Face-to-Face	4	0	0	0	0
186	Face-to-Face	4	0	0	0	0
187	Face-to-Face	4	0	0	0	0
188	Face-to-Face	4	0	1	0	1
189	Face-to-Face	4	0	0	0	0
190	Face-to-Face	4	0	0	0	0
191	Face-to-Face	4	0	0	0	0
192	Face-to-Face	4	0	0	0	0
193	Face-to-Face	4	0	0	0	0
194	Face-to-Face	4	0	0	0	0
195	Face-to-Face	3	0	0	0	0
196	Face-to-Face	4	0	0	0	0
197	Face-to-Face	4	0	0	0	0
198	Face-to-Face	3	0	0	0	0
199	Face-to-Face	4	0	0	0	0
200	Face-to-Face	4	0	0	0	0
201	Face-to-Face	4	0	0	0	0
202	Face-to-Face	4	0	0	0	0
203	Face-to-Face	4	0	0	0	0
204	Face-to-Face	4	0	0	0	0
205	Face-to-Face	4	1	0	0	0
206	Face-to-Face	4	0	0	0	0
207	Face-to-Face	4	0	0	0	0
208	Face-to-Face	4	0	0	0	0
209	Face-to-Face	4	0	0	0	0
210	Face-to-Face	4	0	0	0	0