A contingent valuation study of scuba diving benefits: Case study in Mu Ko Similan Marine National Park, Thailand

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Abstract

Coral reefs, a major source of marine tourism, are under threat worldwide due to human activities. There is an urgent need for information that could be used to promote efficient marine park management. In this study the economic benefits associated with scuba diving in Mu Ko Similan Marine National Park, Thailand, is estimated using a single- and double-bounded dichotomous choice contingent valuation survey design. The results indicate that divers are willing to pay about US$27.07–62.64 per person per annum on average, resulting in aggregate benefits of between US$932,940 and US$2.1 million per annum. The present value of these aggregate benefits ranges between US$31 and US$71 million, using a social discount rate of 3%. The policy implications for park management are discussed. © 2008 Elsevier Ltd. All rights reserved.

Keywords: Ecotourism; Marine protected areas; Scuba diving; Contingent valuation method; Dichotomous choice

1. Introduction

Around the world today, tourism is emerging as a growth industry. One aspect of tourism which is making a significant contribution to the global economy is marine tourism or ecotourism. Orams (1999) defines marine tourism as recreational activities that involve travel away from one’s place of residence and which have as their host or focus the marine environment.\textsuperscript{1} Coral reefs are a major source of attraction for marine-based activities such as scuba diving and snorkeling. In addition to providing aesthetic beauty and habitat for numerous marine species, coral reefs provide valuable ecosystem services such as coastal protection, provision of genetic resources, and pharmaceuticals. Unfortunately, coral reefs around the world now face considerable threats from human activities such as mining, construction, over fishing, and water pollution. Global warming, a direct result of human activities, also poses a significant threat. Globally, coastal reefs are declining at an alarming rate. It is estimated that about 10% of all coral reefs are degraded beyond recovery, while about 30% are in critical condition and may die within 10–20 years (CoRIS, 2005). Ecologists predict that at the current rate of degradation, 60% of the world’s coral reefs may die by 2050 (CoRIS, 2005). Coral reefs in Southeast Asia, where the most species-rich ecosystems can be found, face the most severe threats. It is estimated that 80% of these reefs are under high or medium risk (Bryant, Burke, McManus, & Spalding, 1998). Marine tourism presents a policy dilemma because it has both positive and negative impacts on society. On the one hand, it generates significant incomes for regional and national economies. However, on the other hand, it contributes to the destruction of valuable marine resources. In the last three decades, a number of approaches for managing marine resources have been proposed. One of these is the creation of marine protected areas (MPAs).\textsuperscript{2}

\textsuperscript{1}The marine environment can be defined as those waters which are saline and tide-affected.

\textsuperscript{2}An MPA may be defined as any area of the marine environment that has been given special status in order to provide lasting protection on part
MPAs have been acknowledged in several international agreements (e.g. Agenda 21, Convention on Biological Diversity, 1992; United Nations Conference for Economic Development (UNCED), 1993) as a priority mechanism for the sustainable development of coastal and marine resources.

A few studies have addressed the ‘user-pay’ issue by proposing appropriate user fees for diving (Arin & Kramer, 2002; Davis & Tisdell, 1997; Dixon, Scura, & Hof, 1995; Sloan, 1987). These studies have valued marine resources, with particular reference to coral reef quality (except for Davis and Tisdell (1997), which valued dive experience with whale sharks) using a number of non-market valuation techniques. Table 1 presents a selection of studies that have used diving fees or diving costs as a proxy for the value of MPAs and other well-known dive sites.

A recent study which is closely related to the current one is that of Seenprachawong (2003) who used the contingent valuation method (CVM) and TCM to estimate the willingness-to-pay (WTP) for improved coral reef abundance and consumer surplus for visits to Phi Phi Marine National Park, Thailand. His estimates for mean WTP were US$17.15 for overseas tourists and US$7.17 for Thai tourists. The estimated economic value of visits to Phi Phi Marine National Park was US$1.387 million.

Most MPAs charge an entrance fee for visits. However, in most cases, the fee is nominal and does not reflect the level of consumer surplus or benefits. The objective of this paper is to estimate the WTP for scuba diving and the economic benefits of scuba diving in Mu Ko Similan Marine National Park in Thailand. This is done by means of a contingent valuation study based on the single- and double-bounded dichotomous choice survey design. The information resulting from the study would be useful for efficient park management and development of appropriate policies. For example, given that marine resources in Thailand are now under increasing pressure from sustained use, the results of this study could be used to determine an appropriate level of entrance fees. This fee could be used as a tool to control the number of visitors so as to minimize coral reef damage. Furthermore, revenues generated from the fees could be used to improve coral reef conservation efforts.

The remainder of the paper is organized as follows. Section 2 outlines the methodology used, including the survey design and econometric model. The third section provides a general discussion of the study’s results, and the final section concludes with the summary and policy implications.

2. Methodology

2.1. Survey site

Mu Ko Similan Marine National Park, or known by tourists as the Similan Islands, is a group of nine tropical islands located along the western coastline of the Andaman Sea, approximately 80 km northwest of Phuket, in the Indian Ocean (Fig. 1). This group of islands covers an area of 128 km², 14 km² of which is land (Mu Ko Similan Marine National Park, 2003). This site was chosen for this
study because it is the most popular marine national park in Thailand.

Over 50,000 people visit the park each year (Mu Ko Similan Marine National Park, 2003). The park generates the highest revenue compared to other marine national parks in Thailand (National Park, Wildlife and Plant Conservation Department, (DNP), 2003). Park revenue generally comes from three main sources: entrance fees, service charges (such as snorkelling and scuba diving fees) and accommodation charges. Thai tourists pay a cheaper rate than overseas tourists. Overseas tourists are charged up to five or 10 times higher for entrance fees. All revenue raised by each park goes directly into the government’s coffer. Each year, principal funding for each park is appropriated from the government to finance protected areas. The budget is normally allocated on the basis of coverage area and management needs (Sethapun, 2000) rather than the number of tourists or the actual revenue generated by each park. This results in problems whereby parks with heavy tourism activity do not obtain sufficient funding for management and control.

Coral reefs in the Similan Islands are deep water coral as they can grow 30 m below the ocean surface as visibility allows enough sun light to reach that depth for algae growth. Most other coral reefs in Thailand are medium water coral which can only grow below 8–15 m in depth. The hard corals found in the Similan Islands are deep water species of mostly staghorn coral types (Acropora echinata) and the smaller cauliflower shaped types (Seriatopora hystrix). Many other species of marine life co-exist within the coral reef. Examples include Gorgonian sea fans, flower-like soft coral, several species of crabs, spiny painted lobster, squid, sponges, sea cucumbers and giant clams (DNP, 2004).

Normally, the best months for tourism in the Similan Islands are from early November to late April because of the calmer weather conditions. Conditions are best for scuba diving from December to January when underwater visibility often reaches up to 40 m or more. The number of visitors usually peak in December and again in April due to the Christmas holidays and the Thai New Year’s holiday in April. During the peak season, the average number of visitors can exceed 350 people per day. Tourism in the Similan Islands has been increasing substantially, with a near five-fold increase in the total number of visitors from 10,921 in 1999 to 50,049 in 2003 (Mu Ko Similan Marine National Park, 2003). This is believed to be due to the successful marketing campaigns by the Tourism Authority of Thailand called Amazing Thailand, which ran from 1998 to 2003, along with the devaluation of the Thai Baht. The rise in the number of international scuba divers was the main contributing factor to this dramatic increase which

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3 Personal communications from personal interviews with scuba diving tour operators and park officials of Mu Ko Similan Marine National Park.
has resulted in more than a twenty-fold increase in revenue, from US$22,144 to US$457,389, within that period. The 2004 ‘Boxing Day Tsunami’ inflicted significant damage on the marine park and caused a reduction in the number of tourists visiting the Similan Islands. However, there are indications of recovery and the Tourism Authority of Thailand has embarked on a domestic and international publicity campaign to increase the number of tourists.

2.2. The valuation approach

The CVM was utilized in this study. In line with the recommendations of the National Oceanic and Atmospheric Administration’s panel of economic experts (Arrow et al., 1993), we used the dichotomous choice CVM (DCCVM) or referendum questionnaire format to elicit respondents’ WTP for scuba diving. One of the merits of this method is that the ‘take it or leave it’ scenario utilized in this approach is quite similar to that encountered by consumers in their usual market transactions. Furthermore, the referendum format used in the DCCVM is realistic and is commonly used to assess community attitudes to the provision of public goods. However, like any other method, it also suffers from a number of biases. Firstly, the method is still hypothetical in nature and therefore subject to hypothetical bias common with the CVM. Secondly, biases such as starting point bias, shift effects, anchoring effects and framing effects are inherent in the double-bounded dichotomous choice method. Thirdly, the method is liable to ‘yea saying’ if a respondent believes the interviewer favours a yes answer. Finally, a large number of observations are typically required in DCCVM studies in order to identify a distribution of resource values with any degree of accuracy. Various suggestions have been made for dealing with the weaknesses of the method. These include making efforts to ensure that respondents take the questions seriously. It has been recommended that the survey instrument must include additional questions to verify that respondents have done so. Also, it has been suggested that the survey instruments should contain questions designed to test for the presence of the various biases (Arrow et al., 1993).

The DCCVM involves offering respondents bid amounts which respondents can either accept or refuse. In the single-bounded DCCVM method, respondents are presented with one bid value to which they can respond with either a ‘yes’ or a ‘no’. The probability of obtaining a ‘yes’ or ‘no’ response can be represented by

\[
\text{Prob}_{\text{no}} = \pi^n = G(BID; \theta), \\
\text{Prob}_{\text{yes}} = \pi^y = 1 - G(BID; \theta),
\]

where \(G(BID; \theta)\) is some statistical distribution function with parameter vector \(\theta\), which can be estimated using a qualitative choice model such as the logit model. The logit model can have two forms, the log-logistic cumulative density function

\[
G(BID; \theta) = \frac{1}{1 + e^{-\theta(BID)}}
\]

or the logistic cumulative density function,

\[
G(BID; \theta) = \frac{1}{1 + e^{-\theta(BID)}}
\]

where \(\theta = (a, b)\) and \(a\) and \(b\) are the intercept and slope coefficients to be estimated, respectively. \(G(BID; \theta)\) is the cumulative density function of the individual’s true maximum WTP because utility maximization implies that an individual will say ‘yes’ to \(BID\) only if \(BID\) is less than or equal to their maximum WTP, and will say ‘no’ if \(BID\) exceeds this value (Hanemann, 1984). The log-likelihood function for this set of responses, following Hanemann, Loomis, and Kanninen (1991), is

\[
\ln L^s(\theta) = \sum_{i=1}^{N} \left( d_i^y \ln \pi^y (BID_i) + d_i^n \ln \pi^n (BID_i) \right)
\]

\[
= \sum_{i=1}^{N} \left( d_i^y \ln [1 - G(BID_i; \theta)] + d_i^n \ln G(BID_i; \theta) \right),
\]

where \(d_i^y\) is unity if the \(i\)th response is ‘yes’ and zero otherwise, whereas, \(d_i^n\) is unity if the \(i\)th response is ‘no’ and zero otherwise.

In the double-bounded dichotomous choice format, respondents are presented with a two-sequence bid offer. First, they are asked whether they would ‘accept’ or ‘reject’ the first bid, after which the second bid amount is then offered. The second bid may be higher or lower than the initial bid depending on the respondent’s response to the first bid. Therefore, the double-bounded DCCVM could have four possible outcomes: both answers are ‘yes’; both answers are ‘no’; a ‘yes’ followed by a ‘no’; or a ‘no’ followed by a ‘yes’. For formulas on the likelihoods of these outcomes, readers are referred to Hanemann et al. (1991).

2.3. Survey design

The target population for this study was scuba divers visiting Mu Ko Similan Marine National Park. The main survey was preceded by a pilot survey which was conducted in January 2004. The information obtained was used to modify the design of the bids and other aspects of the questionnaire. As was the case in the pilot survey, the sampling frame in the main survey comprised adult certified scuba divers of any nationality aged between 18 and 60 years who had paid for the trip themselves. Scuba divers who were on the trip and working in capacities such as dive leaders, dive masters, and dive instructors, were excluded from the survey because their expenses had been paid for by the tour operators. Certified scuba divers taking scuba diving lessons to increase their qualifications were also excluded from the survey. The sample consisted of 500 respondents. According to recent park statistics from 2001
Table 2
Alternative bid levels for the double bounded dichotomous choice CVM survey instrument (US dollars)

<table>
<thead>
<tr>
<th>First bid</th>
<th>Lower bid</th>
<th>Upper bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2.5</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>25</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>37.5</td>
<td>20</td>
<td>62.5</td>
</tr>
<tr>
<td>50</td>
<td>37.5</td>
<td>75</td>
</tr>
</tbody>
</table>

to 2003, the ratio of Thai scuba divers to overseas scuba divers has been approximately 34:66. Therefore, 34% of the respondents chosen to participate were Thai and the remaining 66% were from overseas. The quota sampling technique was used to select the respondents from each stratum. This sampling technique was chosen because of its simplicity and efficiency compared to simple random sampling.

The survey questionnaire contained questions regarding the respondent’s social, economic and demographic characteristics such as age, gender, income, level of education and country of residence. Other questions sought to ascertain the respondents’ scuba diving experience and their personal motivations for visiting Mu Ko Similan Marine National Park. The final part contained questions on WTP. Respondents were asked to accept or reject several proposed scuba diving fee or bid levels shown in Table 2.

Before the survey, respondents were reminded that the proposed fee or bid levels were hypothetical and that their responses would not affect the fee structure currently charged by the park. This was designed to eliminate the problem of ‘strategic bias’ in which the respondent deliberately overstates or understates his or her true bid in order to influence the outcome. Once the interviewer was certain that the respondent understood the hypothetical scenario, he/she presented the first bid to the respondent as follows:

According to Thai regulations, you will be charged a diving fee of US$ 5/day to dive in Similan Islands. Are you willing to pay US$ 5/day to dive in Similan Islands?

The respondents were reminded that this amount was on top of all other diving costs. If the respondent accepted the bid, he or she was then offered a higher amount. However, if the bid was rejected, a lower amount was offered. If the respondent was unwilling to accept both the initial and the lower bid, the next question was to enquire about the reasons for the rejection. The respondents were asked to choose from the following: (1) I don’t think I should have to pay; (2) They don’t charge diving fees anywhere else; (3) I’m only willing to pay a small amount; (4) I need more information before I decide to pay; and (4) other reasons (please state). This was to make sure that their refusal to accept any bid level was not a result of ‘protest’ behaviour. Respondents who selected reasons (1) and (2) were considered as protest bidders and were excluded from the sample. The final sample size was 421 scuba divers, which is an 84% response rate.

2.4. Model specification

It is assumed that the scuba diver will accept a proposed bid level and still maximize his/her utility under the following condition,

\[ v(1, Y - BID; S) + \varepsilon_1 \geq v(0, Y; S) + \varepsilon_0, \]

and will reject it if otherwise. In the equation above, \( v \) is the indirect utility function, \( Y \) is the average annual income after tax and other expenses in thousand dollars, \( BID \) is the bid offer, \( S \) represents other socio-economic characteristics affecting individual preferences including their personal motivations, while \( \varepsilon_0 \) and \( \varepsilon_1 \) are the identically, independently distributed (i.i.d.) random variables with zero means.

The utility difference between a ‘yes’ and a ‘no’ response (\( \Delta y \)) can be defined as

\[ \Delta y = v(1, Y - B; S) - v(0, Y; S) + (\varepsilon_1 - \varepsilon_0). \]

When faced with binary choice situations, the logit model is preferred to the probit model because the former is based on the cumulative distribution whereas the latter is based on the normal distribution and is numerically more complicated to estimate (Hill, Griffiths, & Judge, 2001). For this reason, the logit model was used in the study.

For an individual who is faced with the choice of whether to ‘accept’ or ‘reject’ a hypothetical bid level, the probability (\( P_i \)) that he/she will accept a bid offer (\( BID \)) for the single-bounded model can be expressed in logarithmic or log-logistic form as

\[
\text{Prob(}yes\text{)} = F_\eta \Delta y \\
= (1 + e^{-\Delta y})^{-1} \\
= \frac{1}{1 + e^{-(x+\beta_1\ln BID+\beta_2\ln S+\beta_3\ln PM)}} \tag{7}
\]

and the double-bounded model expressed in the linear or logistic form as

\[
\text{Prob(}yes\text{)} = F_\eta \Delta y \\
= (1 + e^{-\Delta y})^{-1} \\
= \frac{1}{1 + e^{-(x+\beta_1 BID+\beta_2 S+\beta_3 PM)}} \tag{8}
\]

where \( F_\eta \) is a cumulative distribution function, \( \beta_i \) represents the coefficients of the bid (\( BID \)), socio-economic variables (\( S \)), and personal motivation (\( PM \)) variables, respectively, and \( x \) is the intercept. It is expected on \( \text{a priori} \) grounds that the probability of accepting a bid level would...
Six statistical models were estimated in this study, of which three were single-bounded DCCVMs, and the other three double-bounded DCCVMs. The study is interested in capturing the level of WTP of the combined group of scuba divers and the separate WTPs (i.e. Thai and overseas divers), as well as comparing the WTP estimates of the single- and double-bounded DCCVMs. The six models are

Model 1: Single-bounded DCCVM: Combined group
Model 2: Single-bounded DCCVM: Overseas respondents only
Model 3: Single-bounded DCCVM: Thai respondents only
Model 4: Double-bounded DCCVM: Combined group
Model 5: Double-bounded DCCVM: Overseas respondents only
Model 6: Double-bounded DCCVM: Thai respondents only

The log-logistic functional form was fitted to the single-bounded DCCVM because it provides a better fit; whereas, a linear logistic functional form provides a better fit for the double-bounded DCCVM. Therefore, models 1–3 are logarithmic and 4–6 are linear. The stepwise regression approach was used to delete insignificant variables. However, economic theory was used to guide the overall variable selection. Thus, some variables were kept in the model for comparison. The final models selected for the three single- and three double-bounded DCCVM are presented in Tables 4 and 5, respectively.

It can be seen from Table 4 that the variable ln BID for models 1–3 and BID for models 4–6 are all statistically significant at the 1% level. In addition to the high level of significance, all of the respective coefficients have the expected negative signs indicating a negative relationship with the dependent variable RESP. In other words, the higher the scuba diving fee, the less likely respondents would be willing to pay. The coefficient on AGE is negative and significant at the 5% level only in model 6 for Thai divers. This indicates that for Thai respondents, the probability of accepting the bid will decrease as the age of the respondent increases. This may be explained by the fact that older scuba divers have been accustomed to scuba diving without having to pay a fee, hence, are less willing to accept new fee regulations.

The variable THA is significant at the 5% level in both the single- and double-bounded model. THA is designed to capture the effects on the probability of the respondents’ accepting a proposed fee level if they were Thai. Since the coefficient of this variable is significant, the analysis indicates that Thai and overseas divers have different probabilities of accepting a proposed fee and may have different levels of WTP. CONSER is significant at the 5% level for models 3 and 6, and is positive for all six models. The positive relationship indicates that a respondent who has financially supported or belonged to a conservation group will have a higher probability of accepting a higher fee level. The income variable has the expected positive sign in all six models but is only significant in models 3 and 6 (i.e. models for Thai divers only), implying that income is a significant factor affecting the WTP of local divers but not necessarily that of foreign divers.

In all of the models, it can be seen that a diver with more dive experience has a lower probability of accepting a given bid level than a diver with less experience. This result can be explained using the concept of diminishing marginal utility. That is, divers with less experience are more likely to pay more because they still have a high utility for diving.

### Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESP</td>
<td>Dependent variable, takes the value 1 if respondent is WTP the proposed bid amount, 0 if they refuse to pay.</td>
</tr>
<tr>
<td>BID</td>
<td>Hypothetical amounts of scuba diving fee proposed to each respondent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Socio-economic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>INC</td>
<td>Average annual income after tax and other expenses in US dollars</td>
</tr>
<tr>
<td>GEND</td>
<td>Gender, 1, if respondent is male, 0 otherwise</td>
</tr>
<tr>
<td>EDU</td>
<td>Formal education in years</td>
</tr>
<tr>
<td>AGE</td>
<td>Age in years</td>
</tr>
<tr>
<td>CONSER</td>
<td>1, if respondent belongs to or has financially supported any conservation groups, 0 otherwise</td>
</tr>
<tr>
<td>DIVE</td>
<td>Number of dives logged in the past 5 years</td>
</tr>
<tr>
<td>THA</td>
<td>1, if respondent is a Thai national, 0 otherwise</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal motivations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>REA1</td>
<td>1, if the trip is motivated by the site being near to where the respondent lives, 0 otherwise</td>
</tr>
<tr>
<td>REA2</td>
<td>1, if the trip is motivated by the competitive pricing of diving at this site, 0 otherwise</td>
</tr>
<tr>
<td>REA3</td>
<td>1, if the trip is motivated by the recommendation of others (word of mouth), 0 otherwise</td>
</tr>
<tr>
<td>REA4</td>
<td>1, if the trip is motivated by the beauty of the site, 0 otherwise</td>
</tr>
<tr>
<td>REA5</td>
<td>1, if the trip is motivated by the respondent’s interest in trying out new scuba diving sites, 0 otherwise</td>
</tr>
</tbody>
</table>

The definitions of the variables used in the model are provided in Table 3. The variables income (INC), gender (GEND), age (AGE) and the level of formal education (EDUC) are included to capture the scuba diver’s socio-economic background. Income (INC) is measured as average annual income after deduction of tax and other expenses, measured in thousands of US dollars. The variable CONSER is a dummy variable to indicate whether the scuba diver is active in environmental conservation activities. The number of dives the scuba diver has logged in the past 5 years (DIVE) is designed to capture whether divers who have more diving experience or dive more frequently are likely to be willing to pay more. Personal motivation dummy variables (REA1–REA5) are included to capture respondents’ motivations for visiting the site.

## 3. Empirical results

The variables income (INC), gender (GEND), age (AGE) and the level of formal education (EDUC) are included to capture the scuba diver’s socio-economic background. Income (INC) is measured as average annual income after deduction of tax and other expenses, measured in thousands of US dollars. The variable CONSER is a dummy variable to indicate whether the scuba diver is active in environmental conservation activities. The number of dives the scuba diver has logged in the past 5 years (DIVE) is designed to capture whether divers who have more diving experience or dive more frequently are likely to be willing to pay more. Personal motivation dummy variables (REA1–REA5) are included to capture respondents’ motivations for visiting the site.
whereas divers with more experience are unlikely to agree to pay additional charges due to diminishing marginal returns from scuba diving. The only statistically significant personal motivation variable is REA1. This variable attempts to explain the relationship between the respondents’ WTP and one of the characteristics of the site, which is whether the site is near where the respondent lives. It is positive for all models, indicating that people who live closer to the site are more likely to accept the bid offer.

### 3.1. Estimation of WTP and economic benefits

This study has assumed WTP to be a non-negative random variable and this assumption is satisfied by the condition in (1). The constrained mean WTP for both the single-bounded log-logistic DCCVM and double-bounded logistic DCCVM were calculated using methods proposed by Hanemann (1989) and Hanemann et al. (1991). The expressions for the constrained mean and median WTPs are presented in Table 6.

Table 7 presents results for the mean and median WTP estimates for both the single- and double-bounded models. The average WTP for the combined sample using the single-bounded model is THB2,606 (US$62.64) while that for the double-bound model is about half at THB1,126 (US$27.07). This difference is consistent with the findings of Hanemann et al. (1991). Looking at the results for the two groups of divers, it can be seen that in general overseas divers are willing to pay more than Thai divers. For example, in the single-bounded DCCVM model, WTP for overseas divers is THB2,670 (US$64.18) whereas that of Thai divers is THB1,831 (US$44.02). In the double-bounded DCCVM model, the difference was found to be statistically not significant. We used the bootstrap method to test for any difference between WTP for the two groups. The 90% confidence intervals for Thai and overseas scuba divers (in US$) were (9.54, 64.16) and (23.58, 30.79), respectively. The overlap of the two confidence intervals suggests that there is no statistically significant difference between the two groups.

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### Table 4

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1 combined sample</th>
<th>Model 2 overseas divers</th>
<th>Model 3 Thai divers</th>
</tr>
</thead>
<tbody>
<tr>
<td>In BID</td>
<td>−1.3721**</td>
<td>−1.4191**</td>
<td>−1.3590**</td>
</tr>
<tr>
<td></td>
<td>(0.1627)</td>
<td>(0.1963)</td>
<td>(0.3196)</td>
</tr>
<tr>
<td>THA</td>
<td>−0.7303**</td>
<td>−0.6511**</td>
<td>−0.1899</td>
</tr>
<tr>
<td></td>
<td>(0.2968)</td>
<td>(0.2649)</td>
<td>(0.5128)</td>
</tr>
<tr>
<td>CONSER</td>
<td>0.2467</td>
<td>0.0559</td>
<td>1.2094**</td>
</tr>
<tr>
<td></td>
<td>(0.2367)</td>
<td>(0.2827)</td>
<td>(0.5060)</td>
</tr>
<tr>
<td>ln INC</td>
<td>0.2687*</td>
<td>0.0609</td>
<td>0.9500**</td>
</tr>
<tr>
<td></td>
<td>(0.1431)</td>
<td>(0.1755)</td>
<td>(0.3160)</td>
</tr>
<tr>
<td>ln DIVE</td>
<td>−0.5803**</td>
<td>−0.3065</td>
<td>−1.5811**</td>
</tr>
<tr>
<td></td>
<td>(0.2118)</td>
<td>(0.2455)</td>
<td>(0.5132)</td>
</tr>
<tr>
<td>REA1</td>
<td>1.3427**</td>
<td>1.2689*</td>
<td>1.2528**</td>
</tr>
<tr>
<td></td>
<td>(0.4023)</td>
<td>(0.7240)</td>
<td>(0.5868)</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>2.3705**</td>
<td>3.1070**</td>
<td>−0.2181</td>
</tr>
<tr>
<td></td>
<td>(0.3797)</td>
<td>(0.7404)</td>
<td>(1.008)</td>
</tr>
<tr>
<td>McFadden R²</td>
<td>0.20293</td>
<td>0.1850</td>
<td>0.3034</td>
</tr>
<tr>
<td>Log L</td>
<td>−254.1992</td>
<td>−169.3889</td>
<td>−57.9763</td>
</tr>
<tr>
<td>( \chi^2 ) (goodness-of-fit)</td>
<td>119.2108*</td>
<td>76.89813*</td>
<td>50.50996*</td>
</tr>
</tbody>
</table>

\( N = 424 \)

Standard errors in parentheses.

*Significant at \( p \leq 10\% \).

**Significant at \( p \leq 5\% \).

### Table 6

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model Single-bounded (logistic)</th>
<th>Double-bounded (logistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constrained mean WTP</td>
<td>( e^{-\beta} \times p/\sin(p/\beta) )</td>
<td>( \ln(1 + e^{-p/\beta}) )</td>
</tr>
<tr>
<td>Median WTP</td>
<td>( e^{-\beta} )</td>
<td>( e^{-\beta} )</td>
</tr>
</tbody>
</table>

\( \alpha^* \) is the adjusted intercept.

\( \beta \) is the slope coefficient.

Parameter estimates taken from Tables 3 and 4.
The present study has estimated the average WTP for scuba diving in Mu Ko Similan Marine National Park to range between US$27.07 and US$62.64 per driver per annum, which is generally within the ball park compared to similar studies. The differences in the WTP estimates may be explained in terms of differences in the CVM scenarios and the bid elicitation mechanisms. Dixon et al. (1995) estimated the WTP to maintain dive quality in the Bonaire Marine Park in the Caribbean to be US$17.40 per diver per year (in 1991 dollars). They used the payment card elicitation method with values ranging from US$20 to US$100. In a study of snorkelling in the Florida Keys, Park, Bowker, and Leeworthy (2002) obtained WTP estimates of US$49.52 per diver per year, using a combination of the CVM and TCM. In a more closely related study to the present one in terms of location, Seenprachawong (2003) estimated average WTP to restore coral reef condition for Phi Phi Islands, a popular scuba diving site in Thailand with similar characteristics to Mu Ko Similan Marine National Park. Seenprachawong’s estimates for mean WTP by Thais and overseas divers were US$7.17 and 7.15 per annum, respectively. The relatively lower estimates for both groups is minimal, the Park may be able to apply a uniform pricing fee of US$27.55 (the WTP level of overseas divers) to translate these annual benefits into the present values of the asset, we discounted the benefits accruing using an estimate of the social discount rate. A social discount rate is appropriate here because the park is a public good. Social discount rates are known to be lower than market interest rates. Given a market interest rate of 6% for Thailand in 2003–04 (World Bank, 2006), an estimate of 3% was used for the social discount rate. Using this rate, the present value of scuba diving benefits in Mu Ko Similan Marine National Park is estimated to be between US$31 and US$71 million.

4. Conclusions and policy implications

The aim of this study was to estimate the WTP for scuba diving and the economic benefits of scuba diving in Mu Ko Similan Marine National Park in Thailand. Given concerns about increasing coral reef damage by park visitors, the results of the study could be useful to park management in setting appropriate entrance fees. The results indicate that divers are willing to pay about US$27.07–62.64 per person per annum, resulting in aggregate benefits of between US$932,940 to US$2.1 million per annum. The present value of these aggregate benefits is between US$31–71 million, using a social discount rate of 3%.

The WTP estimates indicate that overseas divers are willing to pay more than Thai divers. The park management could use discriminatory pricing to capture the consumer surplus for both Thai and overseas divers. On the other hand, because the difference in WTP of the two groups is minimal, the Park may be able to apply a uniform pricing fee of US$27.55 (the WTP level of overseas divers) for convenience. Additionally, the estimated WTP level from the study is significantly higher than the current scuba diving fee level of THB200 (US$4.8) per day. Mu Ko Similan Marine National Park management could increase scuba diving fees more than fivefold. If scuba diving fee charges were increased to THB 1125 (US$27.04), the mean

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<tr>
<td></td>
<td>Model 1 combined sample</td>
<td>Model 2 overseas divers</td>
</tr>
<tr>
<td>Mean</td>
<td>26.06</td>
<td>26.70</td>
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WTP found in the study, Mu Ko Similan Marine National Park would have an economic gain of THB 38,793,592 (US$932,520) per year. This demonstrates that the park could obtain a significant revenue gain through changes in tourism charges alone without having to increase the pressure on the environment by increasing the number of visitors to meet the costs of running and maintaining the park. Also, the fee could be used as a tool to control the number of visitors in order to minimize coral reef damage. Funding for sustainable marine-tourism management programs would also be financially feasible if the current scuba diving fee were to be increased. This would help solve issues of financial constraints that many national parks experience when budgeting for environmental conservation programs such as monitoring of illegal activities.

In terms of possible biases and various effects associated with the dichotomous choice double-bounded format, this study has found that using follow-up questions can indicate to what effect some of these effects have been minimized. However, as indicated earlier, the DCCVM is unlikely to completely eliminate the biases associated with the CVM. Future work is likely to concentrate on combining the CVM and TCM to obtain more efficient estimates and to further minimize the biases of the CVM.

Acknowledgement

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References


