Valuing recreational services in marine protected areas (MPAs)

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Abstract

Natural and anthropogenic stressors threaten marine ecosystems. However, the conservation costs involved in protecting such systems, particularly in marine protected areas (MPAs), make this a challenging task. Using a global survey of international studies using a contingent valuation method, we found the majority of recreational users to be willing to pay for the improvement of coral reefs in MPAs. Specifically, the importance of MPAs in conservation against coral reef threats is widely acknowledged; however, the valuation estimations from this study suggest that to some extent the recreational benefits are over-shadowed by the total financing and administration of MPAs for all type of goods and/or services. For the case of recreational use, one suggestion is to refine the MPA planning and pricing strategies by increasing the present entrance fees to manage MPAs efficiently. This is particularly pertinent at this time, when multiple threats are affecting the ocean, particularly for vulnerable habitats such as coral reefs on which marine life and local and global communities depend.

Key words: coral ecosystem, contingent valuation, pricing strategies, marine protected areas, climate change

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INTRODUCTION

Nearly 70% of the Earth's surface is ocean and the conservation and/or protection of its ecosystems is essential, particularly as human needs are met both directly and indirectly by these ecosystems. Vulnerable marine ecosystems are protected when specific areas of the marine environment are demarcated as marine protected areas (MPAs). The MPA's role in conserving ecosystems is a socio-economic and environmental necessity (Hughes et al., 2003). Importantly, shielding vulnerable ecosystems such as coral reefs from natural and/or anthropogenic stressors may improve their ecological state. As pointed out by Halpern (2003), the values for four biological measures, namely density, biomass, organism size and diversity, were observed to be higher for 89 reserve areas than non-reserve areas.

In comprehending the value of these MPAs, it is important to understand their role and the reliance placed by users on such programs. Indeed, the benefits obtained from MPAs are understated by the levy or fee charged toward their use. In some cases these benefits are unknown and a sound grasp of their value is needed to enable comparison with the cost of the establishment, maintenance and recovery of marine ecosystems. Specifically, such information is helpful to decision makers and planners in determining fee restructuring options such as entrance fees. As pointed out by Brown (2001), the most useful fee structuring system should take into account fee levels, the operational costs of the protected area, and the willingness to pay (WTP) for protected areas of visitors.

Moreover, the role of divers in MPAs is important in terms of their potential impact, as pointed out by Davis and Tisdell (1995), particularly the concentration of divers on sites found in MPAs. In this vein, we conduct a global survey of divers with the main objective of eliciting the WTP values for the improvement of a coral reef ecosystem in an MPA. We solicit divers' attitudes and profiles in supporting fee-based MPAs. Furthermore, we compare the benefit to MPAs with the finance and administrative costs. Specifically, uncovering the user's perceptions and profiles in relation to attitudes toward an increase in entrance fee will provide insights into optimum pricing

structures for managers and planners linked to the MPA. We acknowledge the importance of obtaining total values of benefits from all type of users; however, in this study, one type of user, namely recreational scuba divers, is interviewed to demonstrate one potential benefit and associated cost that relevant in fee restructuring for MPAs located in developing countries.

The distinction between developed and developing countries with reference to MPAs was reported in the earlier works of Lindberg and Enriquez (1994), who have shown that in developing countries the proportion of dependence on entrance fees as a revenue source is slightly higher than in developed countries. Other studies, such as that of Green and Donnelly (2003), have pointed out that WTP for scuba diving in developing countries is higher than the fees currently charged by MPAs. For such countries, where a greater proportion of coral reefs are located, a pricing tool is required to assist managers in setting optimum entrance fees. However, this is a challenging task as MPA sites vary with location. Consequently, obtaining specific user information, such as activity experiences, attitudes, educational levels and skills, may provide more information to aid in pricing strategies.

Furthermore, the maintenance and recovery costs of MPAs in most developing countries are under-funded, with most of them facing direct and indirect costs. Some of the direct costs related to the establishment and running of MPAs include capital, administrative (management), and operational (maintenance) costs. The indirect costs include the opportunity costs of activities such as fishing, coastal development, and access to local communities, etc. Operating costs may vary in terms of the marine site, particularly for islands compared to MPAs located in surrounding land. For the former, the costs are higher due to the ocean coverage involved; hence, the maintenance, monitoring equipment and infrastructure tend to be costly. Indeed, the size of MPAs is relevant as economies of scale matter; as noted by McCrea-Strub et al. (2011), establishing smaller MPAs is more costly than setting up larger ones. Regardless of size, the decision-making process in MPA planning tends to be difficult because both direct and indirect costs are site specific and in turn

depend on governmental and/or political motivations as well socio-economic and environmental concerns.

Our main objective in this study is to explore the potential benefits related to MPAs in improving a reef ecosystem. In this regard, a valuation exercise to determine whether recreational users are supportive of MPAs located in developing countries was undertaken with global divers. Moreover, we take into account previous studies to examine whether there are any revenues obtained from MPAs in cases where information on benefits, costs, and entrance fee and visitation rates are available. The key contribution of this work is to support relevant policy actions for resource managers in managing the cost of MPAs and considering some of the perceived benefits and attitudes held by users in relation to such programs. In sum, this study enriches previous MPA valuation studies through a global survey specifically requesting WTP for those MPAs located in developing countries.[1]

This paper is divided into five major sections: this introduction to the importance of MPAs is followed by a literature review of various valuation studies associated with MPAs, data description, empirical results and discussion, and concluding remarks, respectively.

CVM STUDIES RELATED TO RECREATIONAL SERVICES IN MPAS

The focus of the review of valuation literature related to MPAs in recreational services, namely scuba diving, is solely on the contingent valuation method (CVM), the stated method of preference that is similar to this study. A previous synthesis of valuation studies related to diving and/or access fees in MPAs was undertaken by Peters and Hawkins (2009). Nevertheless, this study supersedes their research by providing a more recent review of other related studies, as shown in Table 1; these studies have found that some MPAs arguably charge differential fees for locals and foreigners.

[1] To carry out a global assessment of the benefit of MPAs, we acknowledge the importance of specifying the site details and quality of marine life in specific sites. However, due to budgetary and time constraints, we were unable to design a hypothetical scenario that describes all global MPA sites. Consequently, we provided a general hypothetical scenario without defining the site or quality levels of marine life.

Table 1 Recent selected CVM studies related to MPAs

Country	MPA Name	Author(s)	Data year	Fee type	Differential fee (Yes/No)
Kenya	Mombasa Marine National Park	Ransom & Mangi	2010	per day	Yes
Netherlands Antilles	Bonaire National Marine Park	Uyarra et al.	2010	per year	No
Netherlands Antilles	Bonaire National Marine Park	Thur	2010	per year	No
Malaysia	Pulau Payar	Yacob et al.	2009	per day	No
Malaysia	Pulau Redang	Yacob et al.	2009	per day	No
Malaysia	Payar Marine Park	Ahmed & Hanley	2009	per day	No

In Ahmed and Hanley (2009), a CVM with a single and double bounded question was presented face to face to divers on site. Around 338 usable responses were used in the final analysis to examine the WTP to reduce damages to the coral reef in Payar Marine Park, Malaysia. Their empirical analysis for the single bounded question used both probit and logit models, and for the double bounded question considered log-logistic and log-normal models. For the former, the logit models showed WTP at around US$18.31 to avoid further damage caused by increased tourism activities in the park. Moreover, the SED covariates that were significant and influenced WTP are as follows: employed (positive), more crowding in the park (positive), foreign visitors (positive), and bid amount (negative). Similarly, all the covariates found to be significant in the single bounded instance were also significant for the double bounded question, except for the crowding effect in the park. WTP for the double bounded case was estimated at around US$17.22 for the log-logistic model and US$15.98 for the log-normal model. In sum, they concluded that differential pricing should be used, as shown by the higher WTP for foreign visitors than for domestic visitors.

Yacob et al. (2009) used a CVM with a dichotomous choice question – in other words, a single “take it or leave it” bid offer – to estimate the value of ecotourism in two marine parks, Pulau Redang and Pulau Payar, in Malaysia. Approximately 215 respondents in Pulau Redang and 153 respondents in Pulau Payar were interviewed face to face. They estimated WTP for both local and international tourists above the current fee. The current entrance fee is US$1.32 for adults, irrespective of whether they are locals or international visitors. The analysis used both probit and

logit models, where for the logit, the WTP annually for Pulau Redang was US$2.06 and US$2.8 for local and international visitors respectively. For Pulau Payar, the WTP for local and international visitors was around US$1.92 and US$ 2.1 respectively. In their estimation, some SED covariates influenced the WTP such as: price (negative), income (positive), and local (negative only for Pulau Redang). In sum, they suggest such estimates provide guidelines to decision makers in understanding the welfare benefits accrued from ecotourism and conservation efforts.

Thur (2010) used a mail survey in a CVM study looking at the incremental amount divers would be willing to pay above the current access fee of US$10 to enter the Bonaire Marine National Park in the Netherlands Antilles. The survey consisted of three types of question format: payment card, a dichotomous choice, and a choice of three questions. It was sent to 299 US divers with a response rate of 75%. The mean annual WTP varied according to question format, ranging from US$61 to US$134. The study does not mention any SED covariates, although the author argued that doubling the current user fee of US$10 in the park would not impact visitation rates. The author suggests that revenues generated from MPA fees could be used for non-MPA purposes, particularly for vulnerable local communities who have been deprived of the use of the marine ecosystem in *lieu* of conservation. However, the author cautions that the use of these funds for non-MPA activities apart from conservation work should be conveyed explicitly to users, especially those who are willing to pay more for the entrance fees.

In the case of Uyarra et al. (2010), the study comprises a CVM with an open-ended question requesting the maximum WTP towards the entrance fee to Bonaire Marine Park in the Netherlands Antilles. Approximately 471 tourists in the Bonaire airport departure lounge were interviewed face to face, generating 393 usable responses. About 47% divers in the sample reported that they would be willing to pay more per year to access the site. The final estimation shows that the maximum amount of WTP above the current yearly price of US$25 is US$8.50. Some SED covariates found to be significant for WTP varied between two groups: those who were satisfied with the current fee and those willing to pay higher fees. For the former group, the significant SED variables included:

price of holiday (negative), awareness of the park (positive), and satisfaction with the park conditions (positive). The latter group included significant SED variables such as: age (negative), repeated visitor (positive), and good value for holiday (positive). In addition, they observed that WTP in the park has decreased compared to earlier estimates in 1991 and 2002 which were at US$38.1 and US$73 (only US divers) respectively. In conclusion, they argue that there is room to charge extra fees to access the park, although the dissemination of information to users on how the fees are used in the park would be important to bolster incremental fees.

In Ransom and Mangi's (2010) CVM study in Kenya, a face-to-face interview with an open-ended question elicited a maximum WTP above the current price of US$10 (for foreigners), US$5 (for Kenyan residents) and US$2 (for Kenyan citizens) to access Mombasa Marine Park and Reserve. The respondents included scuba divers, as well as both local and foreign visitors taking trips in glass bottom boats. There were approximately 285 respondents, with only 221 usable responses. An ordinary least squares (OLS) analysis showed that SED covariates positively influenced WTP, such as income, the recycling of household goods, and participation in all-inclusive visits to the Marine Park. Those covariates that negatively influenced WTP for locals included age, whereas for foreigners it was those who took part in scuba diving. The WTP for foreign divers in the park was an additional US$5.9 per visit above the current price to support reef quality improvements. Moreover, for Kenyan citizens who used glass bottom boats, their WTP was less (at US$2.2) compared to foreigners (US$8.4). The authors were unclear whether the visitation rates would be affected with an increase in the access fee, although the WTP values imply that users would accept an increase in park/reserve entrance fees.

The summary findings of these previous valuation studies have shown that there is support for incremental increases in the entrance or use fees in specific MPAs. Furthermore, the multi-tiered fee structure confirms that heterogeneous group of users differ in WTP. However, distinct characteristics and site specifics make it difficult to compare the fee types and WTP estimates across regions. Arguably, one reason for the WTP differences is the survey design, especially the

question format and questionnaire mode across study sites. For the restructuring of fees, the economic state of the individual country tends to influence the arrangements. Take the case of a low income country such as Kenya where, according to UN data, the GDP per capita (in 2010) was US$801.8 and where the fee charged was US$10 per visit (WTP US$6), compared to a high income economy such as Netherlands Antilles with a GDP per capita (in 2010) (UN 2011), of around US$20 321.1 where the fee charged was US$25 per year (WTP US$9) Consequently, we undertake a novel attempt to solicit WTP as well explain the gaps, if any, in terms of global users' attitudes and/or perceptions in diverse regions and whether there is strong support for incremental fees for MPAs located in developing countries. Importantly, for such countries two vital sectors, namely tourism and fishing, are dependent on the health of reef ecosystems and other marine life, and in such countries, the primary objective of MPAs is to conserve them.

DATA DESCRIPTION AND VALUATION METHODOLOGY

The survey elicited global responses where most respondents were from North America, as well as from Europe, Central Asia, East Asia and the Pacific, as shown in Table 2. The mean age of the respondents was 35 years old or more, except in South Asia where it was 29 years old. Moreover, the respondents from South Asia, Sub-Saharan Africa, and the Middle East and North Africa (MENA) reported higher income levels than expected. Two plausible explanations for this are that scuba diving is a gender biased and expensive activity and, as such, the respondents were predominantly male and high earners in these regions. In addition, the sample sizes in these regions were low in terms of representing the population.

Almost all those who were interviewed were divers (nearly 98% of the total); as a result, we decided to compare this sample to the population of divers using the Professional Association of Diving Instructors (PADI) statistics. Some of our sample characteristics of divers compared to the population characteristics of PADI divers were relatively similar. For instance, according to PADI (2013), 34% were female compared to 66% of males. In our sample, however, the proportion of

females is around 43% whereas males represent 57%. Also, the median age of divers in the PADI sample was estimated at 30 years old for males and 27 years old for females. Our study identified the average median age for both genders as equal at 35 years old. Plausible explanations for these differences could be related to the fact that the PADI numbers include all those who are certified whereas our sample included both certified and non-certified (although the latter is only about 3% of the total responses). Also, other diving organizations/institutions issue certificates apart from PADI, such as Scuba Diving International (SDI), the National Association of Underwater Instructors (NAUI), and Scuba School International (SSI), and these were not accounted for in the comparison exercise.

Table 2 Sample details of the survey responses

Regions	Number of countries/ territories	Number of islands	Gender (male)	Age	Average income (yearly)	sample size (n)	n/total sample size (%)
North America (incl. Canada)	2	0	0.52	41	75 694	196	38.21
Australia (incl. New Zealand)	2	2	0.63	38	81 127	32	6.24
Sub-Saharan Africa	3	0	0.82	41	83 769	12	2.34
Latin America & Caribbean	13	4	0.50	35	34 804	32	6.24
South Asia	1	0	0.71	29	45 000	7	1.36
Europe & Central Asia	24	1	0.56	35	48 363	133	25.93
East Asia & Pacific	9	4	0.61	35	29 293	84	16.37
Middle East & North Africa	4	0	0.82	38	46 536	17	3.31
Total	58	11	0.57	38	57 705	513	100

Table 3 shows the descriptive statistics of the covariates used in the final analysis: These represent the socio-economic and demographic (SED) information of the respondent, as well as attitudes toward and/or perceptions of the management of the MPA. Some of the *a priori* expectations we hypothesized whilst estimating the WTP values show that there might be positive or negative influences and in other cases the direction might be ambiguous, such as those relating to people working indoors (or outdoors) or those who wish (or not) to see sharks.

Table 3 Descriptive statistics for explanatory variables used in the final analysis

Variable name	Description	No. of observations	Mean	Std. Dev.	Min.	Max.	*A priori* expectations
q0054_0001_00~f	refused to give income information, yes, dummy	492	0.10	0.30	0	1	-
q0055cat2	age between 20–29, categorical	492	0.30	0.46	0	1	+
q0015genconc1	climate change coral in general, very concerned, yes, dummy	597	0.02	0.15	0	1	-
q0014cat3	effect of human activities on earth's climate, large effect, yes, dummy	595	0.78	0.42	0	1	+
q0058cat2	donated money to charity, no, dummy variable	492	0.34	0.47	0	1	-
q0043mpa1	trust management fund MPA, yes, dummy variable	561	0.75	0.43	0	1	+
q0047_0001cat1	influence of selecting dive site: ocean health, yes, dummy variable	478	0.43	0.50	0	1	+
q0033cat2	dived in MPA, no, dummy variable	597	0.16	0.37	0	1	-
q0039_q440001sa	strongly agree to charge high fee for environment in developing countries, yes, dummy	573	0.39	0.49	0	1	+
q0039_q440002sa	strongly agree to charge low fee for environment in developing countries, yes, dummy	573	0.03	0.17	0	1	-
q0039_q440003sa	strongly agree didn't think about fees and environment in developing countries, yes, dummy	573	0.42	0.49	0	1	+/-
q0003nodive3	number of times diving trip/year, categorical, 21–50 times	597	0.23	0.42	0	1	+
q0052_classty~2	indoor job activities, dummy variable	492	0.73	0.44	0	1	+/-
q0002cert2	number of years since dive certificate, categorical 0–5 years	587	0.46	0.50	0	1	+
q0004_0002sha~7	shark least interested to view, dummy variable	597	0.15	0.36	0	1	+/-

Note: Total sample size varied with final estimations

Figure 1 shows that majority of the respondents' primary activities include scuba diving as well as swimming and snorkeling. The top three stated activities show that the most popular were associated with the scenic beauty of the ocean where divers visited reef sites, except for swimming which may applicable both under and/or above water and may not imply divers visiting coral sites.

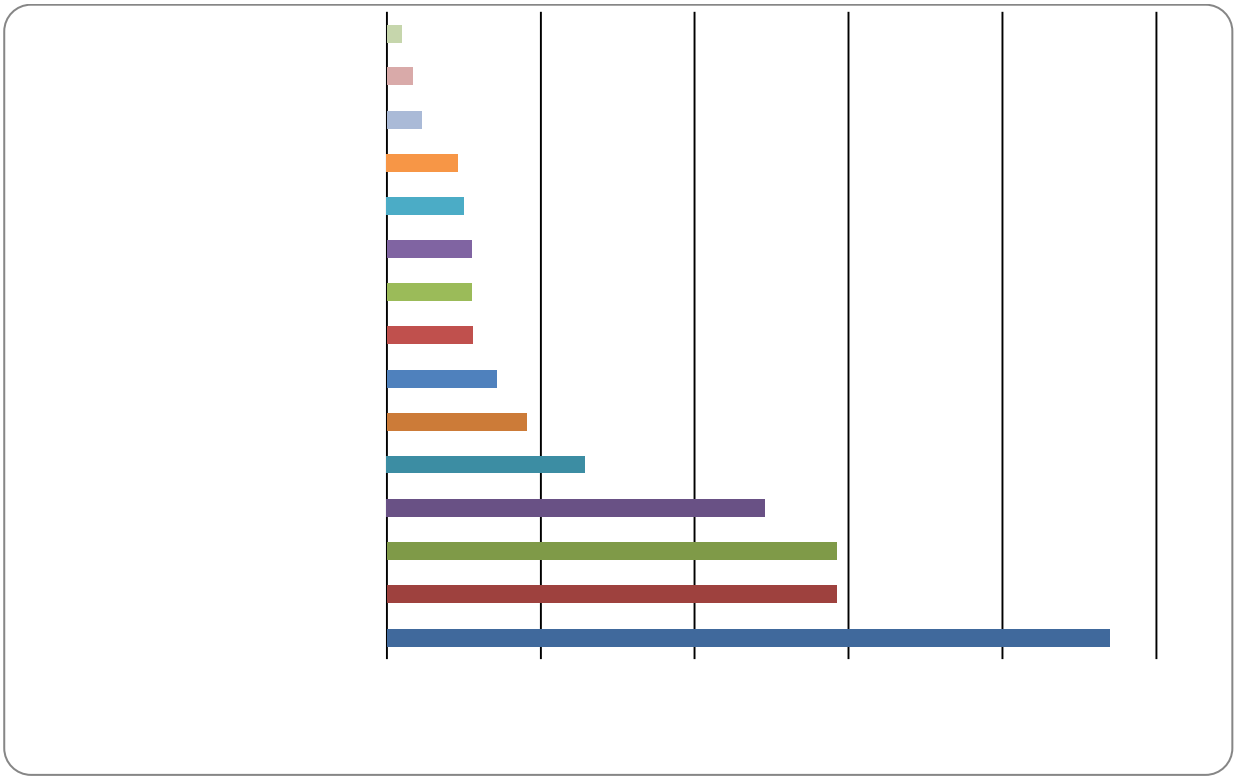

Fig. 1 Main water-based activities in the past 12 months

The divers' views concerning MPAs show that nearly all respondents were aware of MPAs and had experienced diving in such places (see Table 4); moreover, some of the respondents had received coral reef education, although not exclusively in MPAs. In addition, nearly 80% strongly believed that divers had an active role in ocean conservation, although this was positively associated to those who had received coral reef education with a low correlation coefficient of 0.13.

Table 4 Views towards MPAs: percentage of respondents agreeing with each statement

Variable	Description of the statement	% of respondents
Diving in MPAs	Dived in MPAs before	80
Believe in MPAs	Believe MPAs help to recover coral	85
Heard about MPAs	Previously heard about MPAs	90
Received coral reef education	Spent time in education on coral reefs before diving	78
Divers' role in ocean conservation	Divers play an active role in ocean conservation	83

Note: N= 597; total sample size varied with final estimations

Generally, a valuation methodology eliciting WTP is the stated preferred method, where a hypothetical scenario valuing an environmental good and/or program is described to respondents and they are requested to pay for a change such as an improvement in the environmental good and/or services. In our case, a CVM was used in which a hypothetical scenario[2] was described related to an MPA in a developing country context. Respondents were requested to select the amount they would be willing to pay above the current price of the entrance fee of US$10 to preserve and improve an intact, healthy coral reef ecosystem; in other words, the elicited WTP is above this fee for every entrance.

Certain details were omitted from the hypothetical scenario, one being the age of the MPAs. As pointed out by Selig and Bruno (2010), older MPAs are more effective in preventing coral loss compared to newer ones. Moreover, we did not specify the MPA coverage because of the difficulties in determining the present level and future projections of both the natural and anthropogenic stressors that can influence the size of MPAs. With regard to the payment vehicle,

[2] The hypothetical scenario reads: “Imagine you are taking a diving trip for a few days in a developing country where a marine protected area (MPA) exists. Currently, the authority charges an access fee of US$10 a day to enter the diving site and is considering an increase in this price. Please do not agree to pay an amount if you think you can't afford it, if you feel that there are more important things for you to spend your money on, or if you are not sure whether you are prepared to pay or not. If you are almost certain you would pay the amount of money, please select "YES" next to the amount, assuming part of the money is going to a coral reef habitat fund managed by the local MPA administrators to preserve and improve an intact, healthy coral reef ecosystem. What is the maximum you would be willing to pay a day? (select one).”

we considered an entrance fee[3] to finance the MPA. There are other ways to obtain funds from both government and non-profit organizations. However, most MPAs charge an entrance fee, as pointed out by Green and Donnelly (2003), who found that around 53 fee-based MPAs exist in the Caribbean; of these, about 64% charge individual fees ranging from US$1 to US$50.

The valuation exercise employed a payment card where the respondents were shown a scale of payments as follows: (nothing), 5, 10, 20, 30, 50, 80 and 100, and were requested to select the maximum amount they would be willing to pay.[4] These values were pre-tested and found to be reasonable through in-depth interviews with divers at an international scuba diving exhibition held at the *Borsa Internazionale del Turismo* (BIT**)** on February 16–19, 2012, in Milan, Italy.

Figure 2 shows the number of divers who were willing to pay for the improvement of the coral reef ecosystem in the MPAs. The horizontal line represents the bids on the payment card/ladder whereas the vertical dimension is the cumulative frequency of responses representing a WTP amount equal to or greater than that bid value. Clearly, as illustrated close to 50% of the respondents are willing to pay nearly US$20 above the current entrance fee of US$10 a day.

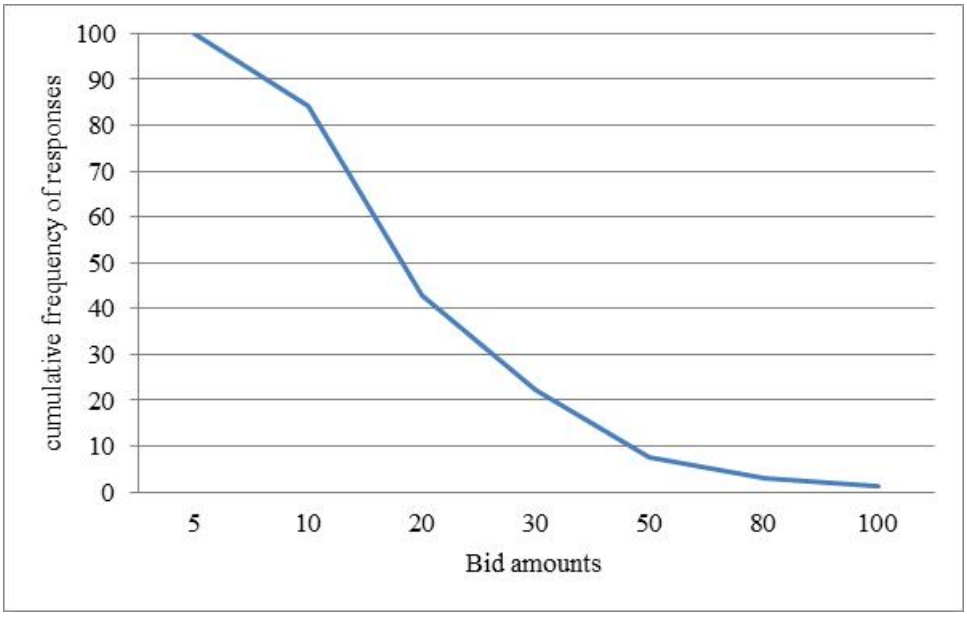

Fig. 2 Distribution of WTP responses to improve the coral reef ecosystem

[3] Apart from fees or charges, other gains can be obtained from concessions, royalties and sales revenues, licenses and permits, and taxes, as well as leases, rent and voluntary donations; however, we refrained from suggesting this to respondents in order to reduce the cognitive burden of information.

[4] Because this was a global survey, the respondent had the choice to select various currency types, i.e., US Dollars, Euros, British Pounds Sterling and Australian Dollars. All amounts were later converted to US dollars.

The total number of WTP responses was 581; some 16 respondents opted to pay nothing. The latter responses were examined further and two of the reasons for not wishing to pay were as follows: not trusting the institute (40%), followed by those who said there was insufficient information (20%) in the valuation exercise.

DISCUSSION OF RESULTS AND POLICY IMPLICATIONS

Our empirical results, based on an interval regression, confirmed some of our *a priori* expectations, namely that respondents' SED profiles and perceptions toward the MPA affect WTP. Table 5, shows some results related to the SED profiles of the divers, such as: those with indoor jobs were willing to pay more for the coral reef improvement than those with outdoor jobs.[5] This is possibly linked to the type of job and connection with nature, where those who are not in daily contact with nature are more willing to pay than those who are in daily contact with nature.

Furthermore, those who believed the management would maintain the quality of the coral reef by using the funds were likely to be more willing to pay than those who did not trust the management. With regard to the divers' profiles, the divers' age had a positive effect on WTP; in particular, those between the ages of 20 and 29 years were willing to pay more. Conversely, divers who had dived between 21 and 50 trips annually and had held a diving certificate for a maximum of five years were less willing to pay.

What is more, diving involves a scenic viewing experience of a collection of marine life. Our examination of those who were more or less inclined to view sharks, rays, and corals and other invertebrates whilst diving showed that there was a positive WTP for those who evinced less desire to see sharks than other marine life, such as big fish (groupers), rays, sea turtles, marine mammals, marine plants, and corals and other invertebrates. At first, this seems puzzling, particularly when one considers that, as pointed out by Whatmough et al. (2011), there have been significant changes

[5] An indoor job refers to job functions that are confined inside a building such as administration, finance, and customer services.

in divers' attitudes and perceptions towards sharks and rays since the 1950s with the decrease in adventure-seeking hunters and an increase in nature-appreciating observers; however, their results are based on the case of Australia and related MPAs. As our global study related to a developing country context, it may be the case that those diving in Australia expect and want to see sharks, whereas those diving in other waters want to see a greater diversity of marine life. All in all, this type of information is relevant for funding to protect and/or manage specific species in diverse MPAs sites.

Table 5 Interval data model results for improving the coral reef in the MPA (without protests)

Variable	Coef.	Std. Err.	z	P>|z|
q0054_0001~f	-0.43	2.265	-0.19	0.851
q0055cat2	5.34***	1.418	3.77	0.000
q0015genco~1	-7.18	6.666	-1.08	0.282
q0014cat3	1.59	1.709	0.93	0.353
q0058cat2	-0.91	1.391	-0.65	0.514
q0043mpa1	3.35**	1.570	2.13	0.033
q0047_0001~1	-1.50	1.311	-1.14	0.254
q0033cat2	-1.89	1.804	-1.05	0.294
q0039_q4~1sa	2.64*	1.407	1.88	0.061
q0039_q4~2sa	-11.56**	4.824	-2.4	0.017
q0039_q4~3sa	-2.35*	1.336	-1.76	0.078
q0003nodive3	-3.35**	1.516	-2.21	0.027
q0052_clas~2	2.84*	1.465	1.94	0.052
q0002cert2	-3.66***	1.332	-2.75	0.006
q0004_0002~7	3.70**	1.799	2.06	0.040
_cons	9.31***	2.456	3.79	0.000
/lnsigma	2.	0.039	66.15	0.000
Sigma	13.00	0.504		
N	455			
ll(null)	-861.1345			
ll(model)	-831.0353			

Notes: Levels of significance indicated at *10%; ** 5%; *** 1%
Observation summary: 64 left-censored observations
0 uncensored observations
5 right-censored observations
386 interval observations

Furthermore, the correlation coefficient of a strong desire to see two forms of marine life – specifically sharks, and coral and other invertebrates – was negative at -0.2425. Moreover, variables that were significant and positively (negatively) associated with WTP estimates were related to pro(anti)-environmental actions in relation to developing countries where respondents' opinions related to these countries charging more (less) for more (less) environmental protection. Nevertheless, those who were not sure about such charges were less likely to pay for coral reef improvement.

The WTP estimates shown in Table 6 were computed using three prediction methods with minimum and maximum bounds. In sum, all three prediction approaches were comparable and taking the linear prediction suggests that the mean WTP for the improvement of the reef ecosystem in the MPA is around US$13. In other words, recreational divers were likely to pay this amount above the current entrance fee of US$10. Comparing these estimates to the previous reviewed studies, Thur's (2010) study comes closer to this study because of the payment card and the diving tag fee of US$10; however, he reports a high WTP at US$61–US$134. These differences in WTP can be ascribed to several reasons: the type of payment vehicle (entrance fee as opposed to a diving tag, as in Thur, 2010), site-specific details (no specifics except MPAs located in developing countries, as opposed to specific details related to the Bonaire Marine Park in Thur, 2010), hypothetical scenario description (for the preservation and improvement of a healthy coral reef ecosystem as opposed to access to diving in Thur, 2010), and period of payment (a daily charge as opposed to an annual fee in Thur, 2010). All in all, assuming an MPA were to adopt this new entrance fee of US$23 (including the WTP above the current fee of a total of US$10), it is a relatively reasonable amount for an entrance fee when compared to Wielgus et al.'s (2010) estimates of around US$38+/-US$46 as mean fee charged by 59 global MPAs to international visitors for diving.

Table 6 WTP in US$ for the coral recovery in the MPA (excluding protests)

Prediction method	Observation	Mean	Std. Dev.	Min	Max
Linear prediction	455	13.29	5.15	-5.75	26.13
ystar (a, b) truncated	455	13.55	11.46	-7.24	80.00
e(a, b): conditional expected value method	455	13.29	13.53	-10.38	82.85

Note[1] negative signs do not imply negative WTP responses; rather, signs are generated due to the prediction method

To compute the aggregate benefit for the MPAs, we accounted for the number of divers globally who are certified by PADI as most respondents who answered this questionnaire were involved in diving and nearly 99% of the total respondents were certified divers. From the 1970s to 2012, the total number of PADI certifications reported was 21 258 914. One notable decline was in 2009 when the growth rate declined at -6%, the second dip since the first in 1974 at -17%. One plausible reason for this fall may be associated with the global financial crisis, as this may have had an impact on individuals' disposable income and/or savings. The total benefits, which include the valid WTP (excluding protests) at US$13 and the current price of US$10 multiplied by the annual PADI certificates, are around US$21 million. However, these results should be interpreted with caution, particularly since these figures represent the total entry level and continuing education diving certifications for all PADI offices globally, although divers may have multiple certifications and this does not include introductory scuba diving experiences or non-diving certifications. Moreover, diving agencies other than PADI issue diving certificates and hence the actual number of divers who are active, in-active and holding multiple certifications from the different agencies are not taken into account in these benefits.

The usefulness of recreational benefit to the cost–benefit analysis (CBA) and fee structuring of an MPA implies that identified MPAs and respective costs and WTP should be examined together with other visitation figures. Since the survey did not indicate a specific MPA site, there was no information on visitation numbers, the cost of operations or maintenance. In lieu of this, we present a case to illustrate this argument, as shown in Table 7 which illustrates some complete MPA costs, numbers of visitors, entrance fees for multiple users, and the respective WTP from the

previous valuation literature. Nearly all the revenues derived from entrance fees are insufficient to meet the operational needs of the MPAs. This is confirmed by Wielgus et al.'s (2010) study in which they reported that only 10% of the total 59 international MPAs surveyed in relation to diving had sufficient budgets.

Importantly, these results confirm that the generation of revenues is dependent on the number of tourists to such sites. Brown (2001) suggested that protected areas with high visitation rates should set fees at the highest possible level, which would raise significant revenues and manage visitors to the site. The latter factor is important in controlling over-crowding and reducing stress on coral ecosystems. One of the primary issues in terms of not increasing or implementing an entrance fee among MPAs is the concern that users may shift to other MPA sites. Consequently, the demand decreases in certain MPA sites and the costs of maintenance increases resulting in high operational costs.

Other challenging tasks in managing MPA costs are related to the opportunity costs for local communities and the managing institutions in charge of the MPA funds. For local communities, the opportunity costs of MPAs are particularly pertinent for those households dependent for their livelihood on ecosystems closer to these MPAs. No doubt there are associated costs unaccounted for by primary studies that affect the socio-economic and cultural benefits to these residents. Take, for example, the case of Tanzania, where Silva's (2006) study of over 600 households in MPA villages found that they were less likely to fish reef species, thus impacting their levels of consumption compared to their counterparts. In sum, factoring in local community costs is essential, particularly when the total economic benefits of such programs are reported as higher than the total economic costs.

Table 7 Summarized fees, WTP and costs for selected MPAs

MPA Name	Author	Fee US$ (Res)	Fee US$ (Nres)	WTP[1]/ person/ yr (Nres)	WTP[1]/ person/ yr (Res)	WTP[1]/ person/ yr (Both)	Annual Res Visitor (Vr)	Annual Nres Visitor (Vnr)	Annual Visitor (Vtot=Vr) [2]	Total Revenue (TR=Vr *fee)	Total Benefit (TB=Vr *WTP)	Net Benefit (NB=TB -TC)	Profit (TR-TC)
Montego Bay Marine	Dharmaratne et al. (2000)	0.25	0.25			2.24			138 743	3 901	311 010	226 010	-81 099
Bonaire National Marine	Dixon et al. (1993)	NA	10			27.25		18 700	26 153	111 595	712 728	42 728	-558 405
Seychelles islands	Mathieu et al. (2003)	NA	10		2.79		11 521	28 479	40 000	67 445	32 168	-155 014	-119 737
Baa Atoll	Mohamed (2007)	25	50	1.47					21 954	77 734	19 300	-154 361	-95 927
Bonaire National Marine	Parsons & Thur (2008)	NA	10	35.35			16 860	28 000	44 860	63 220	989 929	719 929	-206 780
Mombasa Marine Park	Ransom & Mangi (2010)	1.54	10	0.11	0.03		7 518	17 708	26 821	2 711	2 273	-150 110	-149 672
Bonaire National Marine	Uyarra et al. (2010)	NA	10		12.73			60 000		227 917	503 924	233 924	-42 083

Notes:

1. Fees were adjusted according to Purchasing Power Parity (PPP) varied by the study year as well as willingness to pay (WTP); mean values were adjusted according to PPP varied according to the study year.
2. In the case that the annual numbers of total visitors between residents and non-residents were not found, the ratio was split between 0.4 and 0.6 respectively.

With regard to managing MPA funds as found in most developing countries, the MPAs are under the remit of a state objective for improving marine life (including reefs); however, governance issues at the national level impede the participation of local authorities and stakeholders in the management body. Similarly, this also applies to the disbursement of revenues to and from MPAs by the state, where funds are collected from one site and pooled into one source and thereby distributed to all other protected areas across the country. Thus, to solve the governance and funding issues in relation to local communities and to endorse local initiatives implies that, at the national level, the authority has to devolve its powers to local authorities. However, this requires strong political will among leaders and politicians to change the status quo, especially in the developing country context.

CONCLUSION

The recreational WTP estimates associated to diving activities in MPAs implies that the valuation estimates is useful and relevant in measuring the proportion of benefit derived from these sites. Indeed, MPAs represent an environmental gain in ameliorating anthropogenic activities such as pollution, sedimentation and over-fishing. However, such programs require funds to manage them. Therefore, a complementary set of actions, namely communication and decision-making tools, such as pricing strategies, are needed to finance such programs. Indeed, one way forward in meeting funding objectives is to increase recreational fees to meet these costs to support the conservation efforts. This study confirms that WTP estimates from the recreational services such as diving bolster the increase of the entrance fee and may reduce MPAs costs depending on the number of total users.

Moreover, as pointed out by Sanchirico et al. (2002), the potential costs and benefits of MPA depend not only on extractive users (commercial and recreational fishing), but also on non-extractive users (divers, eco-tourists), and management. As found in this study, the estimation of

both net benefits and revenues from MPAs is a challenging task. Indeed, this study provides insight into one dimension in terms of recreational diving, but there are other sets of possible users in MPAs. Nevertheless, the WTP estimates in this study affirm that divers' profiles and related SED factors associated with recreational diving play a significant role in influencing the benefit of MPAs.

Future studies should therefore consolidate global data related to MPAs, such as all types of users, total costs and benefits of all services, and management details, to offer comprehensive MPA analyses. As pointed out by Ban et al. (2009), such a global assessment of MPA costs falls short of the estimation of other costs. Moreover, the funding of MPAs from other sources, such as government funds and/or donations, should complement the entrance fee, thereby avoiding the trade-offs of one for another. Peters and Hawkins (2009) stated that entrance fees should not replace government funding, especially in areas that are prone to political unrest and/or natural calamities and are highly dependent on tourism.

Svensson et al. (2008) asserts that MPAs can successfully be managed when they become self-financed and that user fees are one way of securing a constant flow of funds in managing protected sites. Significantly, financial pathways are not guaranteed without accountability and transparency in relation to MPAs. In other words, MPAs should publish and report their direct and indirect costs, as well as the benefits of protected areas to the public. For instance, these reported figures are essential in exploring other financial avenues to meet all costs and permit sources of revenues other than entrance or access fees. In this vein, fee payers should be allowed to rate MPAs, thereby providing a feedback loop to the managers of these sites. In sum, a recognized global rating system in line with international quality standards would provide a yardstick to increase competition in MPAs in terms of quality, in turn increasing efficiency and the effectiveness of protected sites.

In addition, the engagement of all stakeholders and regulators cannot be ignored in facilitating global standards for MPAs. Specifically, regulatory bodies need to communicate

effectively with local stakeholders in managing ecosystems and allowing them to participate in the local planning of the costs and benefits of protected sites. This is particularly relevant for low income countries that are limited in funds and have less rigid regulations in terms of managing conservation efforts. Indeed, engaging local communities can by-pass such governance and/or institutional barriers (such as corruption) by allowing strong local participation in managing the natural resources.

Other future considerations in managing popular MPA sites related to recreational diving should consider the over-crowding effects of divers (Davis & Tisdell, 2008), as well as related pricing schemes. The latter might include: peak load pricing, comparable pricing, marginal cost pricing, and multi-tiered and differential pricing (Walsh, 1986). Last but not least, the estimated benefits found in this work may provide insights to justify the charging of fees for the proper management and operation of some MPAs providing recreational services that are underway; however, some are newer and their enforcement and pricing strategies are still in their infancy, especially in developing countries.

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