Investigating the Potential for Marine Resource Protection through Environmental Service Markets: An exploratory study from La Paz, Mexico.

Abstract

Marine Protected Areas (MPAs) have long been advocated as effective management vehicles for promoting long-term conservation of marine resources and biodiversity. However MPAs are failing in their conservation goals; MPA objectives are impeded by insufficient funds and a heavy reliance by low socio-economic populations on natural resources.

Investigation into a potential Payments for Environmental Services (PES) program for marine protection was conducted in La Paz, Baja California Sur, Mexico. Surveys elicited tourism's willingness to pay (WTP) to reduce fishing pressure in Espíritu Santo Marine Park. Interviews with local fishermen investigated necessary levels of compensation in order to cease fishing, by proxy of required salaries in alternative employment outside of the fishing sector.

Results indicated that required compensation values outweighed WTP by the tourist sector. Median WTP per trip amounted to $12.50 and $30, additional to pre-existing price, for day excursions and longer trips respectively. Median WTA of fishermen was Mx$1500 weekly, approximately $135 at time of survey. Aggregated median WTP was able to cover annual compensation costs for less than *one third* of the fishing population. That fish stocks were not in collapse, thereby not creating sufficient scarcity and decreasing opportunity costs, and potential high transaction costs were identified as constraints.

However, PES for marine protection should not be dismissed entirely; sites which are less productive and where fishermen's opportunity costs are low will be more suited to such a compensation scheme. Furthermore PES can work alongside existing markets.

1. Introduction

Reefs systems are among the most productive and biologically diverse of Earth's ecosystems, housing thousands of plant and animal species, less than one tenth of which have been identified (Ahmed et al 2005, Moberg & Folke 1999). In addition, reef ecosystem functions provide crucial goods and services to hundreds of millions of people and significantly contribute to human welfare at the local, national and global levels through the provision of food, coastal protection, recreational possibilities and cultural benefits to name but a few (Cesar & Chong 2005, Arin & Kramer 2002, Moberg & Folke 1999). Over 100 countries have coastlines containing reef

ecosystems, and it is believed at least tens of millions of people depend directly upon coral reefs for their livelihoods or for part of their protein intake (Moberg & Folke 1999). However, such a high dependence has in turn led to human-associated degradation, particularly from fishing practices.

Individually, small-scale[1] fishing units are less threatening to ecosystems than larger operations. Cumulatively, however, small-scale fisheries (i) contribute more than 25% of world catch, (ii) account for half the fish used in direct consumption and (iii) employ approximately 90% of the world's fishermen (Díaz-Uribe et al 2007, Mathew 2001, Ruttenburg 2001). In as little as two decades, due to the widespread adoption of motorisation, small-scale fisheries have grown significantly, exerting increased pressure on a finite resource base. These technical developments have not led to labour displacement; on the contrary, they appear to have led to increased fishing days and greater employment within the sector (Mathew 2001). Current exploitation levels are excessive and cannot continue to support small-scale fishermen (Ikiara & Odink 2000).

Marine protected areas (MPAs) have long been advocated as effective management vehicles for promoting long-term conservation of marine resources and biodiversity, and have rapidly become mainstream policy tools (Carr 2000). Today, virtually all coastal countries have implemented some form of MPA (Agardy et al 2003), and in 2002 and 2003 respectively the World Summit on Sustainable Development and World Parks Congress called for the establishment of a global system of marine protected areas (Balmford et al 2004, Kelleher 1996). However, worldwide MPAs are failing their conservation objectives due to insufficient funds (Depondt & Green 2006). Their design, development and running costs can be high and their acceptance dependent upon local socio-demographics; MPA implementation can cause economic and social dislocation of marginalised communities, such as small-scale fishing communities triggering conflict and MPA destabilisation (Christie 2004, Sanshirico et al 2002, Brown et al 2001, Oracion et al 2002, Sumaila et al 2000). Local users need to be brought onboard and compensated for loss of access and livelihoods. However, in developing countries, where local resource dependence is highest and conservation needed most, limited government spending will prioritise economic development (Kiss 2004, Balmford & Whitten 2003).

Payments for environmental services (PES) create direct markets and can provide additional

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[1] The vast number of fishing methods worldwide incurs differing definitions of "small-scale" fisheries. Here "small-scale" is used to indicate the smallest viable fishing units within Mexico as defined by Mathew (2001) and Kurien (1998).

revenues for conservation that are outside of government budgets. PES calls on those benefiting from environmental services to bear the cost and channel funds to those who provide them, thus incentivising ecosystem protection (Wunder 2005, Pagiola et al 2005). Although not their primary objective, PES schemes have the potential to address conservation and poverty concurrently. Communities dependent upon scarce resources are paid the value of opportunity costs in order to compensate a required behavioural change; the expected result is an environmental improvement (Landell-Mills & Porras 2002). PES are therefore considered well suited to addressing these dual issues in developing countries where national resources are limited.

Indeed the implementation of tourist fees has been suggested as a solution to the financial unsustainability of MPAs (Depondt & Green 2006). More specifically, fees can provide alternative revenues for local small-scale fishermen and hence reduce pressure upon marine resources. This appears to be a 'silver bullet' for MPAs and marine conservation; however, to date, successful applications of visitor fees are uncommon and reef systems remain undervalued in the market place (Depondt & Green 2006). Furthermore, the willingness of fishermen to exit the local fishing sector is crucial. Provision of alternative livelihoods has long been a policy tool attempting to uplift small-scale fishers' socio-economic status (Crawford 2002, Ikiara & Odink 2000). A move away from fishing and into alternative employment can shield low-income households from environmental and economic shocks, trends and seasonality that define the fishing industry. At the same time it also has potential to reduce dependence on natural resources (Ellis & Allison 2004). That small-scale fishermen will readily shift into alternative employment rests on several untested assumptions. These include fishing as a last resort, fishers as the "poorest of poor", fishing as a hard, undesirable occupation and finally that poor fishermen care little about their work type as long as it provides enough to subsist (Pollnac et al 2001).

Successful PES implementation requires investigation into a number of separate components. Firstly, an optimal fee is required: one which reflects true visitor willingness to pay (WTP). Secondly, assessment of fishermen's opportunity costs and willingness to accept (WTA) compensation is needed. Finally, presence of a suitable collection and dispersal mechanism is necessary. A number of studies have focused on evaluating PES potential, but often only by looking at one side of the market. Most often studies focus upon visitor WTP for environmental improvements. Rarely, however, are WTA studies reported. As such most investigations ignore compensation requirements and thus overestimate project and economic benefits (MacMillian et al 2001).

This paper is organised into ten sections. In Section 2 the study area is described. Section 3 contains a review of the relevant literature on coral reef valuation. The methodological approach adopted is described in Section 4 and 5. Survey results are shown in Section 6; visitor and fishermen results are separated into section 6a and 6b respectively. Economic analyses are contained in Section 7. Section 8 displays the aggregates of WTP and WTA. Policy implications of the study's findings are discussed in Section 9. Section 10 contains conclusions.

2. Study site

In May 2007, a MPA was established around the island of Espíritu Santo. Espíritu Santo Marine Park is situated in the bay of La Paz and Gulf of California, Baja California Sur, Mexico (BCS), as illustrated in figure 1.

Figure 1. Location of Espíritu Santo Island within Bay of La Paz and Gulf of California (Golfo de California).

Tourism is among one of the Mexico's three leading sources of foreign exchange and a powerful economic driver (López-Espinsa de los Monteros 2002, UNWTO 2006). This is particularly true in the state of BCS, where tourism has been growing at an annual rate of 20% since 1988 (López-Sagástegui & Sala 2006).

The state capital of La Paz is among one of BCS's three main tourist centres and possesses a large ecotourism market (Herrera-Ulloa et al 2003, López-Espinsa de los Monteros 2002). Most of the current ecotourism activities occur around the island of Espíritu Santo. This island and the surrounding waters are recognised worldwide for their natural beauty and productivity; these sites are important breeding grounds for a number of species, many of which are endemic (Brusca et al 2004, López-Espinsa de los Monteros 2002).

In Mexico 82% of fisheries are fully- or over-exploited (Hernandez & Kempton 2003). BCS is no exception. Although few published studies are available, Sala et al (2004) documented "fishing

down[2]" within BCS during the last 30 years. Sala goes on to claim maximum fish length in catch decreased 45 cm in individual length over a mere 30 year period.

Small-scale fisheries in Mexico account for approximately 40% of national catch and recent estimates from the National Institute of Fisheries (NIF) place approximately 130,000 boats working within this sector (Arreguín-Sánchez et al 2004). Approximately 300 fishermen are known to operate around the Island of Espíritu Santo (Hudson Weaver pers comm.). Many of which derive household income solely from fishing (Hudson Weaver et al 2006). Fishing around the island is most commonly carried out from 7m vessels with engines of 40-60hp. A vast array of fishing practices occur, ranging from hand-held hooks, hook and lines to gillnets, fixed nets and diving (Arreguíz-Sánchez et al 2004). Most fishers operate without individual licences under what is essentially an open access scheme. Limitations on fishing are carried out via minimum legal net and catch size, however monitoring and regulation are poorly enforced (Hudson Weaver pers comm., Arreguíz-Sánchez et al 2004).

This study adds to emerging PES literature by investigating the potential for establishing a marine-based PES scheme in La Paz, Mexico, looking at both demand and supply sides of the market. More specifically, it assesses the potential of marine tourism to provide alternative revenue for local small-scale fishermen and in doing so reduce over fishing in the region. The study identifies tourism's WTP for a reduced commercial fishing pressure around the island of Espíritu Santo, La Paz. At the same time, it looks at the other, often neglected, side of the market, asking if compensation for loss of fishing sites would be accepted. Furthermore, it identifies factors affecting the levels of WTP or WTA and discusses the feasibility of a PES scheme for marine conservation in the area given the potential revenues and costs.

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3. Previous literature on coral reef valuation

[2] "Fishing down" describes the process when fisheries shift from targeting larger, long-lived species to smaller, shorter-lived, lower trophic levels (Salas et al 2004).

Marine-based tourism generates billions of tourist dollars and claims the ability to address conservation and development concurrently (Spergel & Moye 2004, Ross & Wall 1999). However relatively few studies have attempted to identify tourism's value of coral reef conservation (Arin & Kramer 2002). And even fewer still have addressed the social cost of proposed marine conservation schemes.

Assessment of reef value to stakeholders, whether this be tourists or local resource users, can be conducted through market or non-market approaches. Market-based methods use observed prices and quantities to estimate costs and benefits of the good in question. White et al (2000) indicated that total tourism revenues accruing directly due to the presence of the coral reef at Apo Island, Negro Oriental, Philippines, could be as high as US$20,000 annually.

However, ecosystem services, such as reef systems, yield a wide range of benefits to society and individuals, which are often not captured within market prices whether this be due to the public nature of such a good or their multiple non-use values. In order to assess the value placed upon non-marketed goods and allow valuation of non-use goods, hypothetical markets are required. The contingent valuation method (CVM) (Bateman et al 2002, Mitchell & Carson 1989) constructs a scenario to which respondents are asked to directly state their *maximum* WTP or *minimum* WTA for a specified change in an environmental amenity. The response elicits a direct expression of the good or service value. Respondents are provided with a realistic and viable scenario in order to extract the amenity's value. The situation described must be clear and the change/environmental improvement specified. Institutional framework and payment vehicle are also provided within the scenario and should be the most probable if the program were to go ahead (Arin & Kramer 2002, Arrow et al 2003).

Arin & Kramer (2002) found average WTP of US$3–6 for entrance to island resorts in the Philippines, and an aggregated potential revenue from entrance fees as high as US$ 954,171, under a conservative estimate. White et al (2000) found similar mean WTP values (US$3–$5.5) for entrance fees for the Philippine reefs located at Mabini, Batagas; Mactan Island, Cebu; and Panglao Island Bohol. Aggregated values yielded potential additional revenues of US$228,000–280,000 and US$18,000–27,000 for Mabini, Batangas and Panlao, Bohol respectively. Dixon et al (1993) estimated diver mean WTP for an entrance fee for Bonaire Marine Park in the Caribbean at $27.40 per person, the much higher value perhaps reflecting its closer locality to the US.

Extremely few articles have focused upon the willingness of fishermen to leave the sector, and, in turn, the requirements to do so. Ikiara & Odink (2000) found WTA exit from Kenyan fishing

industries of Lake Victoria dependent upon a number of factors. These included opportunity cost, ownership of machinery and experience. However, Béné (2003) identified other cultural aspects as important in fishermen's decision making.

4. Survey Design

The CVM was used to elicit both WTP and WTA, which were determined using surveys of tourists and local small-scale fishermen respectively.

Questionnaire design in each case was fairly similar. WTP survey design covered four main areas as suggested by Arrow et al 1993 and Oppenheim 1992, these included visitor profile, attitudes towards marine environment and local commercial fishermen, main WTP elicitation and a final demographics section. Questionnaires targeting fishermen differed in containing only three sections; attitudes towards marine environment and job satisfaction, main WTA elicitation and demographics.

Maximum WTP was modelled for trip expenditure out to the marine park, additional to current price and was defined as the maximum WTP amount that would make the respondent indifferent to taking the trip and therefore not partaking in the marine excursion. An International NGO was chosen as the institutional mechanism for collection and distribution of payments. WTP was elicited via a description of the current situation and the potential improvement in the environmental good: an increase in fish abundance via provision of revenue towards alternative sources of employment for local fishermen. Possible WTP values were chosen using the payment ladder method.

Minimum WTA was modelled as the minimum required salary in employment outside of the fishing sector. Respondents were asked if they would be willing to accept alternative employment; potential responses were 'Yes', 'No' and 'Don't know'. This allowed fishermen to reject the scenario and also express a degree of uncertainty, as suggested by MacMillan et al (2001). Fishermen who stated a willingness to accept alternative employment (those answering 'Yes'/'Don't know') were asked the minimum weekly wage required to maintain their current standard of living. A follow-up question then asked if this was a sufficient salary to accept alternative work, if not how much extra would be required. Minimum salary needed to exit

fishing and enter an alternative job was the sum of these two values. Again WTA values were elicited using a payment ladder. Follow-up questions included reasons for accepting alternative employment and whether they believed they would be as content in this new employment.

5. Data Collection

Pilot surveys were carried out among both of the populations in question and resulting information fed back into survey design. Data collection occurred over a three-month period beginning May 2007.

The tourist sample population was identified as all those tourists visiting Espíritu Santo Marine Park over this period. Due to the off-peak timing of the study and the low tourist population density a non-probabilistic, convenience collection method was adopted, as recommended by Arin & Kramer (2002). Surveys were distributed to tourists in one of two ways: via tour operators onboard when returning from excursions or approached by the author on land (interviewee's suitability was assessed using a number of preliminary questions). Questionnaires were self-, interviewer-administrated or mixed depending upon what the situation required.

The fishermen sample population was identified as all those local, small-scale, commercial fishermen based in La Paz, BCS. All surveys were conducted using the interviewer-administrated method. Again due to a low-population size a non-probabilistic collection method was utilised; approximately 300 fishermen are thought to operate around Espíritu Santo (Hudson Weaver, pers comm.).

6a. Survey findings – Tourism sector

6.1 Tourist sample characteristics

Completed questionnaires were collected from 78 visitors. The socioeconomic characteristics are presented in Table 1. and visitor profile in Table 2. Ninety-one percent of the sample were non-residents, most coming from the US (74.4%). Males comprised the majority of the sample (64.1%) and 76.9% were below 46 years of age. Educational levels were extremely high: 75.6% had obtained a university degree. Monthly household income ranged from as little as $200 to over $30,000. Mean monthly household income for the sample was $6169.67 as shown in table 2.

Table 1. Socioeconomic characteristics of tourist sample

Table 2. Characteristics of visitor profile

Marine excursions were divided between day trips and longer excursions at a ratio of approximately 2:1. Average excursion length was 2.12 days and average price $408.01. Diving and sport's fishing were found to be the more dominant purpose for outings, 36.3% and 33.8% respectively. Furthermore, first time visitors accounted from 65.4% of the sample, this figure was found to be even higher at 72.7% within day-trippers. Average household incomes were found to be significantly different between day and longer excursions, significant at the 1% level (t=1.476, df=31).

6.2 WTP for reduction in fishing pressure

Table 3. indicates the WTP summary statistics and responsiveness of sample to increasing bids. Mean WTP was US$36.84. However, it can also be seen from Table 3. that less than 35% of the sample would be WTP the mean bid of $36.84. A one-tailed t-test reported mean WTP as significantly larger in those on longer excursions ($t=-1.931,\ df=27,\ p<0.05$). These results recommend price differentiation between day trips and those longer excursions. Furthermore, even using price differentiation mean WTP for subgroups excludes over 50% of these samples. This suggests the use of median WTP in pricing decisions.

Table 3. Tourism's WTP for reduced fishing pressure in Espíritu Santo Marine Park, (per trip, additional to existing cost).

6b. Survey findings – fishing sector

6.3 Fishermen sample characteristics

Interviews were completed with 49 fishermen. Table 4. summarises the demographics of the sample group. Table 4. also reports demographics split into those WTA alternative employment and those not. All interviewees were male. The majority of whom were born in La Paz (80.4%) and all others were originally from surrounding regions. Just over 50% of the sample had not continued into secondary education, 14.2% of which had no schooling at all. Over 80% of the

fishermen sampled were over the age of 35, perhaps indicating an aging workforce with little recruitment: 8.2% of the sample had less than 10 years experience in the fishing industry. Monthly household earnings ranged from Mx$800 up to Mx$7500.

Table 4. Summary of fishermen demographics

Eight fishermen sampled refused alternative employment. Respondents indicated a love of fishing and the freedom it provided as the predominant reasons for rejection. Three respondents stated that they already had alternative employment and could take on no further work.

6.4 WTA alternative employment

Table 5. Fishermen's WTA alternative employment, (weekly salary, Mx$).

Mean WTA was Mx$ 1693.90. No great difference in mean WTA was seen between those unsure about accepting alternative employment and those responding "Yes". Over half of the sample, 63.4%, were willing to work for the median value of Mx$1500, approximately US$135 at time of survey.

7. Econometric analysis

Both WTP and WTA estimates were analysed using the statistical software package STATA 8.0.

WTP and WTA were recorded using the payment ladder format. Under such scenarios it is assumed that values on the ladder contain the true WTP_i or WTA_i, where WTP_i is specified in model (1):

$$WTP_i = x_i'\beta + \varepsilon_i \qquad (1)$$

Where x_i represents a vector of explanatory variables, β represents a vector of parameters and ε is an error term distributed normally, with mean 0 and standard deviation σ (Maddison & Mourato 1999).

In order to determine the factors that were important in determining the WTP_i for reduction in fishing pressure an Interval Data Model (Cameron and Huppert 1989) with robust standard errors were used.

However, utilising proxy point WTP values from payment card responses neglects the fact that these data are essentially interval data. When a respondent i chooses payment t_{1i} from the payment card this means that he is willing to pay as much as t_{1i} but not as much as the next number up in the card, t_{ui}. Hence, the probability that a respondent picks t_{1i} is the probability that WTP lies between t_{1i} and t_{ui}:

$$P(t_{1i}) = P(t_{1i} \leq WTP < t_{ui}) \qquad (2)$$

Ignoring this, and using uncensored models, can result in biased average valuations or biased regression coefficients, particularly in cases where intervals are large (O'Garra & Mourato 2007, Cameron & Huppert 1989). As noted by Cameron and Huppert (1989), payment card data can be analysed parametrically with interval data maximum likelihood models.

In the context of a payment card, WTP_i will lie between t_{1i} and t_{ui}, with WTP_i generally specified as in (1) above. The probability of choosing t_{1i} can be written as (Cameron and Huppert, 1989):

$$P(t_{1i}) = \Phi((t_{ui} - x_i'\beta)/\sigma) - \Phi((t_{1i} - x_i'\beta)/\sigma) \qquad (3)$$

where Φ is the standard normal cumulative density function. The corresponding log likelihood function can be written as:

$$log\ L = \sum_{i=1}^{T} log\ [\Phi((t_{ui} - x_i'\beta)/\sigma) - \Phi((t_{1i} - x_i'\beta)/\sigma)] \qquad (4)$$

The model runs for WTA data also.

7.1 Determinants of WTP

Table 6. List of explanatory variables for WTP

Explanatory variables of the WTP amounts are displayed in Table 6. Several model specifications were tested using visitor profile, attitudinal and demographic data. Table 7. provides variables of the preferred model, which is also displayed below, alongside corresponding co-efficient values and significance levels.

$$WTP = \beta_1 + \beta_2(PRICE) + \beta_2(PURP) + \beta_3(ACCESS) + \beta_4(GENDER) + \beta_5(OVER45) + \beta_6(NATIONAL) + \beta_7(MEMBER) + \beta_8(No.DEP) + \beta_9(HHINCOME) + \varepsilon$$

Table 7. Coefficient estimates for significant variables

Price was found to be a positive determinate of WTP. A higher trip price coincided with a greater WTP. This retained significance when household income was added to the model and is most likely explained by the longer length of these trip; visitors may place a higher value on conservation as they have longer to appreciate it. However WTP for longer excursions was found to be a proportionally smaller degree of price paid than for day trips. Day-trippers, on average, were willing to pay an additional 14.5% on top of their current trip price; this was seen to be much lower in respondents on longer trips (0.2%). A one-way t-test found this difference to be significant *($t=4.569$, $df=57$, $p<0.0001$)*. This indicates that the marginal increase in WTP is not proportional to increase in trip price.

Household income was also a predictor of WTP, however, significance was not as strong as seen for price; this may be due the allocation of proxy average salaries for respondents not providing household income. Non-response to questions regarding income has often been found to be non-random (Alvarez-Farizo 1999). Household income and WTP were not found to be strongly correlated *($r=0.208$)*.

Sports fishermen were found to be WTP less than divers, significant at the 5% level. No obvious attitudinal differences were observed between trip purpose sample groups (distribution of responses were very similar to whole sample overall).

Attitude towards the rights of the local communities to access the local marine resources was a positive determinant of WTP, significant at the 5% level.

With the exception of household income, no demographic data was found to be significant determinants of WTP. It was expected, due to the Mexico's lower economic status that nationals would have more limited WTP and so provide lower bids. This was found to be the case in a number of regressions run; this significance was lost when household income was included providing further support to this theory.

7.2 Determinants of WTA

Table 8. List of explanatory variables for WTA

Again a number of model specifications were tested; the preferred model is shown below:

$$WTA = \beta_1 + \beta_2(INCOME) + \beta_2(WKprev) + \beta_3(COOP) + \beta_4(OwnEQ) + \beta_5(OppWK) + \beta_6(Content) + \beta_7(AGE) + \beta_8(YRSfish) + \beta_9(EDU) + \beta_8(No.HHWK) + \beta_9(No.DEP) + \varepsilon$$

Explanatory variables are described in Table 8. Table 9. displays all those variables specified within the preferred model and corresponding co-efficients and significance levels.

Table 9. Coefficient estimates for significant variables

Income from fishing and if respondents had alternative employment previously were found to be significant positive determinants of WTA throughout all models. Owning of own fishing equipment was also found to be a significant positive determinant. That owning own equipment is a significant positive determinant of WTA is perhaps due to increased security from asset wealth, or perhaps due to an unwillingness to exit the industry, given this previous investment.

Of the demographic information, only age and number of people working in household were shown to be determinants of WTA. However these were both negative; older fishermen and those with a greater number of alternative household incomes were willing to accept lower salaries. That age is negatively associated with WTA is perhaps due to a belief that age can reduce employment options, as indicated in follow-up responses to attitudinal questions.

Education did not appear to be a determinant of WTA. This is perhaps due to insufficient variation in the data to allow sufficient explanatory power; 85.7% of the fishermen sampled had not progressed past secondary education. Also education may not have been associated with

employment opportunities as complementary employment options are often in manual labour or sea-related.

Number of dependents did not seem to determine WTA values. This could be due to a number of factors not considered within these models. Furthermore, in assessing WTA, fishermen may be attempting to maintain an approximate current standard of living as apposed to increasing household income for dependents; hence WTA will be determined by present income and not family size. Correlation between number working in household and number of dependents was not found to be particularly strong *(r=0.429)*.

8. Aggregation of results

For aggregation purposes, median WTP figures will be used, as the most conservative estimates of tourist benefits. Given the small sample size and the potential for overstatement arising from the hypothetical nature of the payments in the WTP scenario (Bateman et al, 2002), it was felt that the most conservative estimate of the benefits would be more appropriate to inform policy in this case.

The Nature Conservancy (2006) predicts visitor numbers to Espíritu Santo Marine Park at approximately 25,000/yr. Aggregation of median WTP provides annual revenue of $500,000. However, 50% of day visitors would be unwilling to pay this increase. Ideally, differential pricing for day trips and longer excursions should be considered. Unfortunately, no information of number of each trip type is available. Assuming the survey sample to be representative, approximately 30% of trips were longer than one day. Furthermore, the Nature Conversancy (2006) states mean average stay as 2.5 days, implying a spike in day visitors as 'length of trip' ranged from one to six days. Using this data, this price increase would result in a 35% of loss of tourism capital; annual revenue would equal only $325,000. Price differentiation is therefore advisable. Using price differentiation would result in those on longer excursions (30% of the population) paying the larger $30 median value of WTP and the remaining day-trippers paying only a $12.5 increase to trip price. Under such a scheme aggregated median values totals $443,750. Assuming a 6.2% increase in tourism, as predicted for the Americas by the World Tourism Organisation, UNWTO (2006) provides a less conservative value. Potential revenue is estimated at $471,262.50 for 2007.

Approximately 300 fishermen are thought to fish around Espíritu Santo (Hudson Weaver pers comm.). Two scenarios were calculated: utilising a normal working year model of 42 weeks, and

possibly a more realistic 50-week scenario. This second model was calculated due to fishermen's socio-economic situation perhaps not allowing such leisure time and Mexico's legal requirement of a minimum seven-day vacation period (Aguilera pers comm.).

Table 10. Estimated potential benefits and costs of proposed PES scheme

In contrast if mean figures were used, revenue from visitors would be over double that raised using the median WTP price increase. However, as discussed earlier, over 50% of the sample would be indifferent to the excursion.

9. Policy Implications

This study shows that the finances required to compensate local small-scale fishermen are greater than tourism's WTP. This is perhaps due to the very different nature of each side of the market. Visitors are paying for a holiday: a relatively unimportant decision in the wider context. The fishermen, however, are being asked to make a lifestyle change. At present, using the UNWTO projected median aggregation and a 51-week year; tourism revenues can fund alternative revenues for 69 fishermen annually. This number increases to 82 using the 42-week year. That neither of these schemes can, at present, reduce fishing pressure by a less than a third is not a positive sign. Utilising the less conservative mean figures for WTP would also not allow full compensation of the fishing population, and would only cover approximately half of the required cost.

This finding has a number of implications for the scheme. Given the disparity between WTP and WTA, monies from PES could function as transitory programs working alongside pre-existing markets. Tourism brings direct economic and more indirect benefits, such as increased employment opportunities. PES schemes can provide mechanisms to enable movement out of the fishing sector into these alternative employments, such as training schemes. However, after a specified period, fishing areas could be closed and PES funds used for enforcement of no-fish zones. Also it may not be necessary to cease all fishing activities; PES schemes could be used in order to allow seasonal closures which allow replenishment of stocks.

Furthermore, funds may be insufficient as, in La Paz, fishermen are not the *"poorest of the poor"*. Only four respondents were found to earn less than the Mexican minimum wage. These higher

earnings are likely due to the high productivity of the Sea of Cortez which means, although decreasing fish stocks have been reported, this area has not suffered a total collapse (Salas et al 2004, Carvajal et al 2004). Therefore higher salaries, than were perhaps expected, are required to exit the fishing industry. WTA also relies upon believed income, that fishermen still have good months where earnings can be very high further complicates this issue. Given the limited funds, it could be suggested that targeting a larger number of lower income fishermen would be the most effective management strategy. From a poverty-alleviating viewpoint this would certainly be the better option, however higher income fishermen will of course extract more and further scientific analysis would be required to assess impacts of each wealth group.

Built upon best judgement of the site and local situation, ensuring feasibility of this PES scheme relies on coordination and participation by at least three sectors. Firstly, the market requires a WTP for an improvement in the marine environment by the tourist sector and, secondly, an acceptance of compensation by fishermen, as discussed above. Thirdly a government role is expected to be required. Although PES schemes can, and are, advocated for their ability to reduce government participation and cost, often they actually require greater government involvement (Corbera et al in press). Under a resource-rights scheme government regulation is anticipated due to the virtual open access nature of the resource base. For benefits to be transferred to tourism, greater fish populations are required. Vigilance and quota systems would be required to ensure environmental gains are not reversed through increased catches by others, or positive leakage into the sector resulting from increased resource rents. Further government involvement is expected due to the dynamic nature of fishery economics and hence WTA; opportunity costs within such a scheme will be dynamic, as stocks decrease it is expected that WTA will also decrease (due to income as a positive determinant). However opportunity costs of not fishing will increase as stocks replenish. Such a scheme therefore requires prevention of re-entry or dynamic compensation contracts. This is a complex scenario, which will require scientific monitoring and government administration and enforcement. So far within this report transaction costs have been assumed as zero; this is clearly not the case, and under such requirements transaction costs may be extremely high.

PES schemes are in their infancy, moreover PES for marine protection has received even less attention from the market. In order to establish the true long-term feasibility of PES schemes for biodiversity conservation, poverty alleviation and marine protection on-going examination of PES programs is required. Furthermore, studies should aim to address both sides of the market in order to avoid overestimation of a scheme's benefits, particularly if environmental improvements

are required to justify/continue investment. All things considered PES schemes may not always the best-suited instruments for conservation and, as such, should always be contrasted with alternative potential projects for both economical efficiency and environmental improvement before implementation.

10. Conclusion

This study investigated the potential of a currently hypothetical PES scheme for marine resource conservation, in the Sea of Cortez, Mexico. Tourists visiting Espíritu Santo Marine Park located within the Bay of La Paz, BCS, Mexico were asked their WTP for a reduction of fishing pressure within this area. Local commercial fishermen were also surveyed to identify their WTA alternative employment. Estimated potential revenues per annum from tourism ranged from US$443,750 – 471,263. However compensation values were over three time higher at US$1,711,336 – 2,070,051. Under this current environmental climate and present political dynamic the PES proposed is not well suited to Espíritu Santo and its surrounding waters. High compensation and transaction costs would far outweigh tourism's willingness to pay for a marginal environmental improvement. Furthermore, the ease with which new fishermen could enter the sector made the proposed scheme a complex one.

Despite the indication of this exploratory study, it is not entirely negative with respect to PES schemes. Benefits from this proposed PES scheme were calculated using a conservative approach. In addition, alternative sources of revenue, which could be incorporated into financing such a PES, were not examined. Furthermore, a WTP for non-consumptive marine resources exists and hence PES programs have the potential to aid in their conservation. Such compensations schemes should not be dismissed for areas in which the situation is far graver. Under a climate of greater degradation, lower incomes and fewer available alternative employments such schemes have the potential to contribute to biodiversity conservation and poverty alleviation. Furthermore PES can work alongside existing markets.

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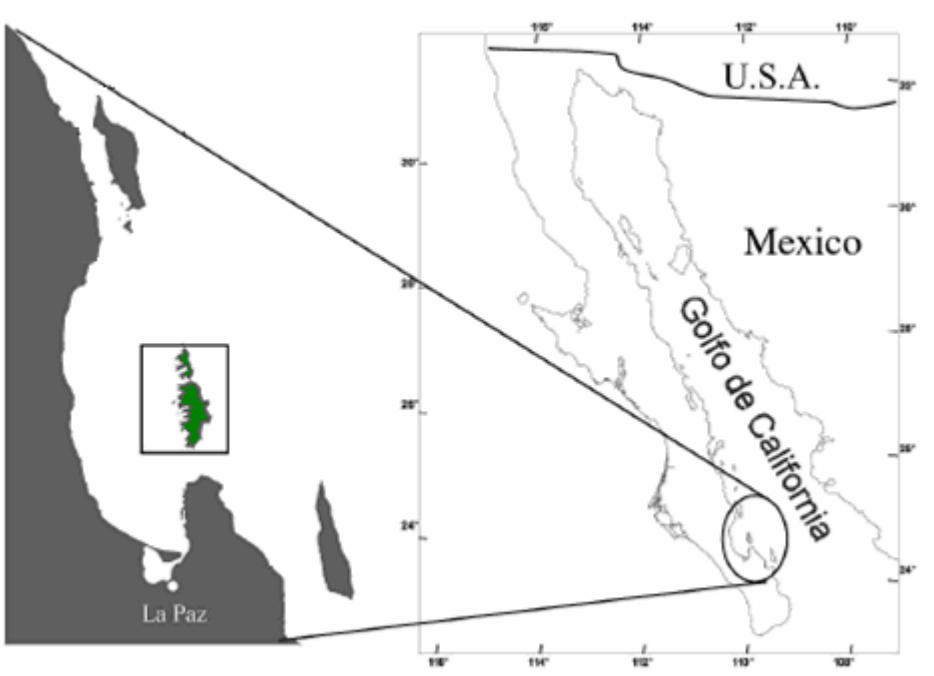
Tables & Figures

Figure 1. Location of Espíritu Santo Island within Bay of La Paz and Gulf of California (Golfo de California).



Adapted from López-Espinsa de los Monteros (2002)

Table 1. Socioeconomic characteristics of tourist sample

	No. Respondents	% of Respondents
Male	50	64.1%
Country of residence		
US	58	74.4%
Mexico	9	11.5%
Other	11	14.2%
Age		
18-25	16	20.5%
26-35	29	37.2%
36-45	15	19.2%
46-55	12	15.4%
56-65	6	7.7%
Over 65	0	0.0%
College educated	59	75.6%
Monthly household income (after tax)		
0-$500	1	1.3%
$501-$1000	5	6.4%
$1001-$2000	10	12.8%

$2001-$3000	7	9.0%
$3001-$4000	17	21.8%
$4001-$5000	8	10.3%
$5001-$7500	14	18.0%
$7501-$10000	3	3.9%
$10001-$15000	5	6.4%
$15001-$30000	7	9.0%
> $30000	1	1.3%

Table 2. Characteristics of visitor profile

	All respondents (n=78)	Day trips	Longer excursions
% Respondents		70.5%	29.5%
Length of excursion (mean average days)	2.12	1	4.64
Family size (mean average)	2.59	2.79	2.13
Monthly household earning (mean average)	$6141.49	$5321.30	$8067.17
Cost of trip (mean average)	$408.01	$121.55	$1093.04
First time visitors to La Paz	65.4%	72.7%	47.8%
Visited La Paz previously	29.5%	21.8%	47.8%
Living in La Paz	5.1%	5.5%	4.3%
% Marine purpose for La Paz visit	79.2%	74.1%	95.7%
% Extractive tourism	33.3%	25.4%	52.2%
Main purpose of marine excursion			
Diving	36.4%	38.2%	31.8%
Sports fishing	33.8%	25.4%	54.5%
Snorkelling	23.4%	32.7%	0%
Kayaking	2.6%	0%	9.1%
Whale watching	1.3%	0%	4.5%
Other	2.6%	3.6%	0%
Member of environmental organisation	14.1%	14.5%	13.0%

Table 3. Tourism's WTP for reduced fishing pressure in Espíritu Santo Marine Park, (per trip, additional to existing cost).

	Total sample	Day trippers	Longer excursions
No in sample	77	54	23
Mean WTP (US$)	36.84	27.54	59.43
Std. deviation (US$)	52.69	36.24	75.48
Median WTP (US$)	20.00	12.50	30.00
WTP ≥ US$0	100.0%	100.0%	100.0%
WTP ≥ US$1	100.0%	100.0%	100.0%
WTP ≥ US$2	97.3%	96.2%	100.0%
WTP ≥ US$5	92.1%	90.6%	95.7%

WTP ≥ US$10	76.3%	71.7%	87.0%
WTP ≥ US$15	56.6%	50.9%	69.6%
WTP ≥ US$20	53.9%	47.2%	69.9%
WTP ≥ US$25	43.4%	37.7%	56.5%
WTP ≥ US$30	34.2%	26.4%	52.2%
WTP ≥ US$50	28.9%	20.8%	47.8%
WTP ≥ US$60	17.1%	11.3%	30.4%
WTP ≥ US$70	15.8%	11.3%	26.1%
WTP ≥ US$90	13.2%	11.3%	17.4%
WTP ≥ US$100	10.5%	7.5%	17.4%
WTP ≥ US$200	5.3%	1.9%	13.0%
WTP ≥ US$300	1.3%	0%	1.9%

Table 4. Summary of fishermen demographics

	All respondents (n=49)	WTA alternatives (n=41)	Un-WTA alternatives (n=8)
% Respondents		83.7%	16.3%
% Male	100		
Family size (mean average)	4.54	4.56	4.43
Monthly HH earning, $ Mx (mean average)	3864.20	3916.03	3457.14
Monthly HH earning in a good month, $ Mx (mean average)	6500.00	6523.00	6371.00
% born in La Paz	80.4%	78.9%	87.5%
Age			
18-45	45.7%	44.7%	50.0%
46-65	45.7%	44.7%	50.0%
Over 65	8.7%	10.5%	0.0%
Education			
No schooling	16.3%	16.2%	16.7%
Primaria (4-11)	46.5%	43.2%	66.7%
Secondaria (12-16)	20.9%	24.3%	0.0%
Prepatoria (16-18)	9.3%	10.8%	0.0%
University	2.3%	0.0%	16.7%
Military School	4.7%	5.4%	0.0%
Years as fisherman			
Less than 5	2.3%	2.8%	0.0%
5-10	7.0%	8.3%	0.0%
11-20	23.3%	25.0%	14.3%
21-30	20.9%	22.2%	14.3%
31-40	18.6%	13.9%	42.9%
41-50	9.3%	5.6%	28.6%
51-60	14.0%	16.7%	0.0%
Over 60	4.7%	5.6%	0.0%
Member of cooperative	51.1%	48.6%	62.5%
Owns own equipment	57.8%	56.8%	62.5%
Monthly Household Income $ Mx			
Under 1000	2.2%	2.6%	0.0%

1000-1999	15.2%	12.8%	28.6%
2000-2999	19.6%	23.1%	0.0%
3000-3999	15.2%	15.4%	14.3%
4000-4999	13.0%	10.3%	28.6%
5000-5999	19.6%	17.9%	28.6%
6000-6999	4.3%	5.1%	0.0%
7000-7999	10.9%	12.8%	0.0%

Table 5. Fishermen's WTA alternative employment, (weekly salary, Mx$).

	Total sample	Respondents "Yes"	Respondents "Don't know"
No in sample	41	32	9
Mean WTA (Mx$)	1693.90	1701.56	1666.67
Std. deviation (Mx$)	713.46	695.08	819.68
Median WTA (Mx$)	1500	1500	1500
WTA ≤ Mx$0	0.0%	0.0%	0.0%
WTA ≤ Mx$600	0.0%	0.0%	0.0%
WTA ≤ Mx$800	0.0%	0.0%	0.0%
WTA ≤ Mx$1000	22.0%	15.6%	22.2%
WTA ≤ Mx$1250	39.0%	31.3%	33.3%
WTA ≤ Mx$1500	63.4%	59.4%	44.4%
WTA ≤ Mx$1750	68.3%	65.6%	44.4%
WTA ≤ Mx$2000	82.9%	81.3%	55.6%
WTA ≤ Mx$2500	90.2%	87.5%	88.9%
WTA ≤ Mx$3000	92.7%	93.8%	88.9%
WTA ≤ Mx$3500	100.0%	100.0%	100.0%
WTA ≤ Mx$4000	100.0%	100.0%	100.0%
WTA ≤ Mx$5000	100.0%	100.0%	100.0%

Table 6. List of explanatory variables for WTP

Variable	Description	Code
PRICE	Price paid for marine excursion	Continuous value
PURP(d)	Diving main purpose of marine excursion	Dummy; 1=diving 0=other
PURP(f)	Sport fishing main purpose of marine excursion	Dummy; 1=sport fishing 0=other
PURP(s)	Snorkelling main purpose of marine excursion	Dummy; 1=snorkelling 0=other
PURP(o)	Other main purpose of marine excursion	Dummy; 1=other 0=other
ACCESS	Attitude to statement: It is important that local communities are able to access the marine resources.	Dummy: 1=Strongly Agree 0=Other
GENDER	Respondent's gender	1=Male/0=Female
MEMBER	Respondent Mexican or overseas tourist	1=Mexican/0=Overseas
OVER45	Age category	Dummy: 1=Respondent over 45 0=Respondent under 45
NATIONAL	Respondent Mexican or overseas tourist	1=Mexican /0=Overseas
No.DEP	Number of dependents in respondent's household	Continuous value
HH.INCOME	Respondent's monthly household income	Log, continuous value

Table 7. Coefficient estimates for significant variables

Variable	Coefficient	Std Error
PRICE	0.046***	0.190
PURP(f)	-30.440**	15.400
PURP(s)	3.441	14.150
PURP(o)	-4.861	17.534
ACCESS	24.412**	10.757
GENDER	5.623	12.348
OVER45	-5.262	15.612
NATIONAL	-16.637	13.799
MEMBER	1.884	12.048
No.DEP	1.884	12.048
HHINCOME	14.894**	8.200
CONSTANT	-112.333*	68.977
Obs	77	
LogLikelihood	-250.130	
Waldchi2	33.38	
Prob	0.0008	

Significance at the 10%, 5% and 1% levels *,**,*** respectively

Table 8. List of explanatory variables for WTA

Variable Name	Description	Code
INCOME	Average monthly income from fishing in GOOD month	Continuous value
WKprev	Worked in alternative job prior to becoming fisherman?	1=Yes, had prior job 0=No
COOP	Member of cooperative	1=Yes 0=No
OwnEQ	Owns own fishing equipment	1=Yes 0=No
OppWK	Attitude to statement: There are no other employment opportunities available to us	Dummy: 1=Agree 0=Disagree/No opinion
Content	Belief that will be as content in alternative employment	Dummy: 1=Yes 0=No
AGE	Age of respondent	Continuous value
YRSfish	Years as fisherman	Continuous value
EDU	Level of education	Dummy: 1=completed secondary eduation 0=no secondary education
No.HHWK	Number in household in employment	Continuous value
No.DEP	Number of dependents in household	Continuous value

Table 9. Coefficient estimates for significant variables

Variable	Coefficient	Std Error
INCOME	0.081***	0.033
WKprev	352.655**	176.256

COOP	-156.819	259.752
OwnEQ	440.310*	259.752
OppWK	-257.122	213.089
Content	135.345	234.620
AGE	-18.799**	10.007
YRSfish	5.415	7.630
EDU	-112.912	221.614
No.HHWK	-186.194*	76.533
No.DEP	7.469	49.527
CONSTANT	1906.52***	462.250
Obs	31	
LogLikelihood	-66.94	
Waldchi2	70.30	
Prob	0.0000	

Significance at the 10%, 5% and 1% levels *,**,*** respectively

Table 10. Estimated potential benefits and costs of proposed PES scheme

	Conservative scenario (US$)	Non-conservative scenario(US$)
Potential tourist revenue		
utilising median	443,750	471,263
utilising mean	927,675	983,336
Required compensation		
utilising median	1,711,336	2,078,051
utilising mean	1,932,555	2,346,674