Are tourists willing to pay additional fees to protect corals in Mexico?

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and

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1.0 Introduction

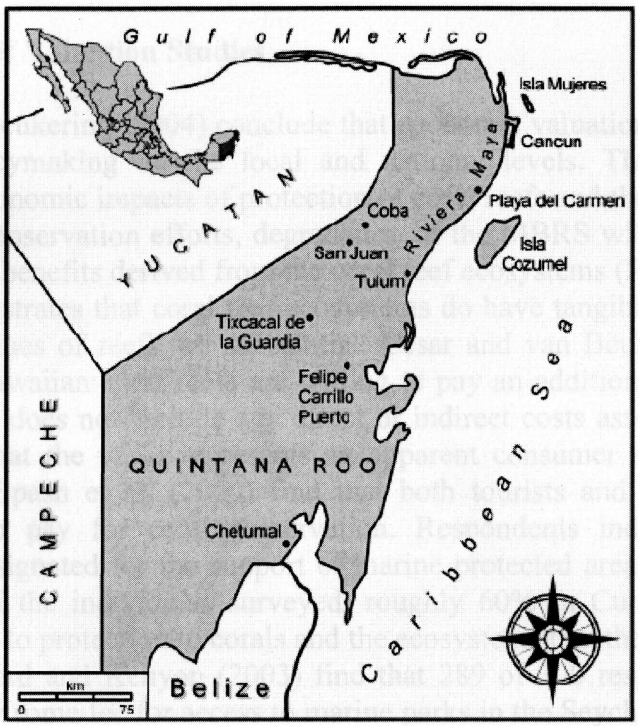
Coral reefs have been referred to as the rainforests of the sea, maintaining the most diverse forms of life on earth. The framework built by corals and algae provides the foundation for ecosystems that support an unsurpassed variety of flora and fauna (Moberg & Folke, 1999). Invertebrates, such as hard and soft corals, mollusks, sponges, anemones, sea whips, tube worms, shrimps, crabs, lobsters, clams, starfish, sea urchins and tunicates represent a mere sampling of the diversity of life found in these ecosystems (Cesar & van Beukering, 2004). Unfortunately, fifty-eight percent of the world's reefs are potentially threatened by human activity – from coastal development and destructive fishing practices to overexploitation of resources, marine pollution, and runoff from inland deforestation and farming (Burke and Maidens, 2004).

The primary objective of this paper is to determine if tourists, visiting the Riviera Maya, are willing to pay an entrance fee to enhance coral reef protection. We use a discrete choice contingent valuation (CV) experiment with almost 400 visitors to determine a measure of compensating variation for contributing to a public trust to protect corals. Results suggest there are significant possibilities for implementing a "coral fund" to raise revenues for coral protection programs in the Riviera Maya region of Mexico's Yucatan Peninsula. A secondary objective is to learn more about these tourists: asking the following types of questions - where are they from, what are they doing, why are they here, how long do they stay, perceptions of environmental issues.

1.1 Background

The Mesoamerican Barrier Reef System (MBRS) is the largest such system in the Western Hemisphere and includes the second longest barrier reef in the world. The reef system stretches from the northern tip of the Yucatan Peninsula to the Bay Islands and Cochinos Cays, spreading through Mexico, Belize, Guatemala and Honduras (Arrivillaga & Garcia, 2004). The reef system supports sixty-six species of corals and over four-hundred types of fish. The MBRS is a vital contributor to economies at the local and national levels. Reef-based tourism is a very important and rapidly growing industry in the Mexican state of Quintana Roo. Tourism in the area includes SCUBA and snorkeling as well as resort-based activities. The reef system also supports commercial and subsistence fishing (Burke & Maidens, 2004).

Since the establishment of Cancun in 1970, the Riviera Maya has become a major international tourist destination. Torres and Momsen (2005) report that Cancun alone received close to two million visitors in 2002, with a total of nearly 4 million tourists arriving by plane and two million cruise ship passengers visiting the Riviera Maya. This tremendous level of visitation to the region increases the level of stress placed on the MBRS and the environment in general, but may also represent an opportunity to collect significant funds through a mechanism like our "coral fund". The state of Quintana Roo has become increasingly dependent on tourism for its economic wellbeing, the industry accounts for roughly eighty percent of gross state product (Torres and Momsen, 2005).



(Torres and Momsen, 2005)

Functioning coral reef ecosystems provide a number of goods and services (Moberg & Folke, 1999). Goods produced include renewable resources as well as substances and materials mined from reefs. Reefs provide a wide variety of services, including: physical structure services, biotic services within ecosystems and between ecosystems, biogeochemical services, information services, and social and cultural services (Moberg & Folke, 1999). Renewable resources from coral reef ecosystems include sea food products, raw materials for medicines, curio and jewelry, and live fish and coral collected for the aquarium industry. Non-renewable goods mined from the reef are materials for building and the production of lime and cement. Some of the most important services provided by coral reef ecosystems are shoreline protection, maintenance of habitats, promotion of biodiversity, regulation of ecosystems, climate recording, aesthetic values, community livelihood, and the support of recreation (Moberg & Folke, 1999).

The MBRS faces numerous threats from natural and anthropogenic factors. Natural risks include tropical storms and hurricanes as well as coral bleaching, and algal overgrowth. Pressures from humans result primarily from overfishing and increased coastal development. Tourism results in various destructive activities, including direct contact, loss of mangroves, and changes to the coastline (Arrivillaga & Garcia, 2004). These factors inhibit the ability of coral reef ecosystems to function properly, limiting their output of goods and services.

2.0 Valuing Coral Reef Ecosystems

The primary question of this paper is whether or not tourists are willing to pay for increased protection of the ecological health of the MBRS. In order to answer the question, a contingent valuation experiment is used to determine willingness to pay (WTP) for a program (based on scientific and politically feasible opportunities) that will protect the coral reef ecosystem and its associated ecological services from further degradation.

2.1 Previous Coral Reef Valuation Studies

Cesar and van Beukering (2004) conclude that economic valuations of coral reef systems are important for policymaking on the local and national levels. These values provide an understanding of the economic impacts of protection of coral reefs and the losses associated with degradation. Without conservation efforts, degradation of the MBRS will continue. Destruction will result in the loss of benefits derived from the coral reef ecosystems (Szmant 2002).

Research demonstrates that coral reef ecosystems do have tangible economic values and that the non-market values of reefs are substantial. Cesar and van Beukering (2004) find that recreational users of Hawaiian coral reefs are willing to pay an additional $133 million in fees each year. This amount does not include any direct or indirect costs associated with reef-based recreation, indicating that the value represents an apparent consumer surplus associated with Hawaiian coral reefs. Spash et al. (2000) find that both tourists and locals in Curacao and Jamaica are willing to pay for coral preservation. Respondents indicate that they would contribute to a fund designated for the support of marine protected areas. Spash et al.'s results also show that most of the individuals surveyed, roughly 60% in Curacao and over 80% in Jamaica, attribute rights to protection to corals and the ecosystems that they support[3].

Mathieu, Langford and Kenyon (2003) find that 289 of 300 respondents indicated that they were willing to pay some fee for access to marine parks in the Seychelles Islands. The study yields an average consumer surplus per park visit of $2.20, or an annual amount of $88,000 based on 40,000 tourists per year. Yeo (2002) finds that 91% of respondents indicated that they would visit a marine park in Malaysia if an entry fee were charged, demonstrating a significant and positive WTP.

Research also demonstrates that the costs associated with the destruction of Caribbean coral reef ecosystems are substantial. For example, Burke and Maidens at the World Resources Institute (2004) estimate that coral degradation in the region will reduce net revenues from commercial fishing by $95 to $140 million per year by 2015. They also estimate that annual net revenues from reef-related tourism will fall by $100 to $300 million.

Some of these conclusions must be considered carefully, however. Researchers continue to question particular techniques of CV and stated preference elicitation methods. Caution must be taken when developing and implementing surveys based on the CV approach as well as when analyzing the data such field work yields (Bailey and Lusk 2006).

2.2 Continuing Problems With Stated Preference Elicitation and "Cheap Talk"

Despite concerted effort to validate the CV method over the past 15 years, skepticism still exists regarding whether the stated willingness to pay values truly estimate actual willingness to pay. One such issue is hypothetical bias. Diamond and Hausman (1994) argue that responses in real life do not correspond with the stated preferences in surveys. They believe that willingness to pay would be much less if one was made to pay at the time of the survey. Also, willingness to pay gets distorted when responses are based on the 'warm glow' where the respondent has a good feeling about the issue without truly caring for it (Diamond and Hausman 1994). Kahneman and Knetsch (1992) concluded that people derived greater benefit from saying that they would

[3] Although some individuals were not willing to pay, it was not because they did not think corals were important. Rather, they believe corals have an intrinsic right to life.

contribute to a good cause than through greater consumption. Therefore, they labeled CV to be more a reflection of willingness to pay for moral satisfaction than a valid tool in assigning monetary value to a natural resource

As the difference between willingness to pay and actual behavior, or hypothetical bias, has come under scrutiny, the idea of cheap talk was introduced. The cheap talk design includes an actual discussion of hypothetical bias in the survey in an attempt to make it "an integral part of the CV questionnaire" (Cummings and Taylor 1999). The cheap talk script makes three general points: it describes the hypothetical bias phenomena; it discusses possible explanations for this phenomena – why subjects might vote differently in real and hypothetical referenda; and it requests that subjects vote in the upcoming hypothetical referendum as if it were a real referendum (Cummings and Taylor 1999). Results from experiments found that the introduction of the cheap talk removes the hypothetical bias and makes the results more realistic where hypothetical willingness to pay will more closely approximate actual willingness to pay (Cummings and Taylor 1999). List (2001) concludes that "cheap talk does mitigate hypothetical bias for certain consumer types," but the strategy is less effective when bidders are experienced in the market.

Suggestions of hypothetical bias were considered as we developed the survey. As discussed below, survey design focused on creating the most efficient questionnaire possible based on existing literature. As a result, we utilize "cheap talk" through a direct explanation of hypothetical bias. This element of survey design and implementation is discussed more thoroughly in the next section.

3.0 Survey Design and Implementation

The data for this study were collected through in-person surveys administered primarily in village of Akumal on the Riviera Maya. The study targeted English-speaking tourists through convenience intercept sampling. While we recognize the limitations associated with this sampling technique, we made every effort to concentrate interviewers in direct proportion to the concentration of tourists at several locations throughout the area.

Development of the survey began with a review of literature covering coral reef ecology and the economic valuation of coral reefs. Spash et al. (2000), Spash (2002) and Hanley (2000) provided particularly useful information specific to the CV of coral reefs. Based on the information provided by these studies and a contingent valuation survey implemented in Hawaii by Cesar et al. (2002), a draft of the survey was developed. An initial pretest was conducted in order to identify any apparent and systematic problems. The researchers also received feedback on the survey from numerous environmental economists via the internet.[4] Another round of pre-testing occurred once the team was on site in Akumal and 2 staff members from the Centro Ecologico Akumal (CEA) suggested minor revisions to the survey instrument.

As the research team developed the survey, some general guidelines were followed in order to maintain simplicity and clarity. The survey employed closed-ended questions whenever feasible in an effort to minimize pressure on the respondents as well as simplify data entry. We designed questions that sought to elicit responses revealing respondents' general environmental

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preferences, preexisting knowledge, and personal characteristics in order to control for those factors.

The survey consists of four sections. An initial "warm-up" section asked for very basic information. The second section began with questions on SCUBA and snorkeling. Respondents were asked if they had ever been scuba diving, then they were asked if they had been diving in Mexico or anywhere else in the world in the past twelve months. The questions on snorkeling followed the same pattern. Section three turned its attention to the valuation experiment.

The valuation section of the survey followed the guidelines for CV set forth by the National Oceanic and Atmospheric Administration's (NOAA) January 1993 report. In accordance with these standards, the survey was administered through personal interviews and attempted to determine WTP for future protection rather than willingness to accept compensation (WTA) compensation for damage already done. The section provided a brief description of benefits derived from coral reef ecosystems, the state of corals on the MBRS, and current conservation efforts. Half of the surveys also included an extra information point describing potential cancer treatments found among coral reefs.[5] The exact wording of this section follows.

Information provision

I would like to read you 3 short statements concerning the current state of the Mesoamerican Barrier Reef system, the stressors on reef health and some ideas on how to improve coral preservation.

- *The Mesoamerican Barrier Reef System is the second longest barrier reef system in the world. Barrier reefs are rich in diversity, and are important to the fishery and tourism industries.*
- *Natural disasters and human activities like over-fishing, pollution, global climate change and direct contact threaten the health of the Mesoamerican Barrier Reef system.*
- *Monitoring, research and protection programs have been established on the Mesoamerican Barrier Reef system, but many of these programs are largely under-funded and under-staffed.*

In the valuation scenario respondents were first asked if they would pay an additional fee to protect the MBRS, then they were questioned about their WTP through a dichotomous choice approach. A particular program for conservation was not specified in order to eliminate potential biases against certain agencies such as the Mexican government or non-governmental organizations (NGOs). The survey simply stated that funds generated through the fee system would be placed directly into a trust for coral protection. Though unspecific and idealistic, the research team felt that the need to control for those potential biases outweighed the importance of identifying a particular agency. We also explained hypothetical bias and reminded interviewees that they have a limited budget and that substitutes for the MBRS exist. Finally, respondents were asked a follow-up question to determine the reasons for their answers. The wording of the section is as follows:

Valuation scenario

Recognizing that conservation programs cost money and need agencies to implement and manage them– would you be willing to pay more (i.e. a an entrance fee) for your visit to the Yucatan to help implement a coral protection program?

Now I am going to ask you a question about how much you would pay. Because you are not actually going to pay right now, the fee is hypothetical. Some researchers are concerned that when a payment is hypothetical, people will overstate the amount they are willing to pay. This is called hypothetical bias.

[5] By providing this additional point, we intended to test the impact on respondent's WTP when they are told corals may have medicinal uses.

We want to get people to think about their willingness to pay as if they were in a real situation, where if they agree to pay, they will have to actually pay money.

So, keeping in mind that there are other coral reefs and other ecosystems in the world and that you have a limited income to spend, would you be willing to pay a $_____.00 fee that goes directly into a trust for coral protection?

Could you tell me why you answered the way you did?

The final section of the survey asked respondents to provide demographic information. Age, gender, highest level of education completed, and annual household income were chosen as the most important background statistics. In retrospect, questions regarding marital status and number of children may have been appropriate and might have proved useful in the data analysis. Surveyors were instructed to ask respondents to fill this section out in order to improve confidentiality.

4.0 Model Specification

4.1 Theoretical Model

Following Haab and McConnell (2002) and Bell et. al. (2003) we use a random utility modeling framework to review the responses to the proposed fee for the establishment of a trust dedicated to improvement of the Mesoamerican Barrier Reef System (MBRS). The framework represents the survey respondent's decision as a comparison of personal utility in two separate states: current conditions, the status quo, represented as u_0, and with the establishment of the coral protection fund at cost c_1, represented as u_1. We assume that utility is a function of income (y), demographic characteristic of the respondent (z), decision characteristics of the respondent (h), establishment of the trust fund for coral protection(T), and elements of the respondents decision that are unobservable to researchers (ε). Formally, we assume that respondent j will choose to pay the entrance fee if:

$$u_{1j}(y_j - c_{1j}, z_j, h_j, T_1, \varepsilon_{1j}) > u_{0j}(y_j, z_j, h_j, T_0, \varepsilon_{0j}). \quad (1)$$

We can rewrite the expression in terms of a probabilistic statement of whether a respondent will respond YES or NO, given the data that we have. The probability that respondent j will vote yes, then, can be shown as follows:

$$\Pr_j(\text{YES}) = \Pr[u_{1j}(y_j - c_{1j}, z_j, h_j, T_1, \varepsilon_{1j}) > u_{0j}(y_j, z_j, h_j, T_0, \varepsilon_{0j})]. \quad (2)$$

We can also rewrite the equation in a linear form which is used as the theoretical basis for the parametric model. Microeconomic theory suggests that the probability of individual j positively responding to the willingness to pay question is a function of his or her demographic characteristics (D), survey conditions (S), environmental preferences (P) and the fee level (F). D, S and P are vectors that contain multiple variables and F is a single continuous variable which includes the fee values of $5, $10, $25, $50 and $100. This linear model is specified below.

$$\Pr_j(\text{YES}) = \alpha_0 + \beta(D_j) + \delta(S_j) + \lambda(P_j) + \sigma(F_j) + \varepsilon. \quad (3)$$

4.2 Empirical Approach

The model described in equation (3) is estimated using the probit approach and assumes normally distributed error terms (Whitehead, Clifford and Hoban 2002). In order to estimate the parametric model, we substitute the probabilistic statement, Pr_j(YES), with the dependent variable Y where a yes response is equal to 1 and a no response is equal to 0.

$$Y_{1,0} = \alpha_0 + \beta(D_j) + \delta(S_j) + \lambda(P_j) + \sigma(F_j) + \varepsilon. \quad (4)$$

The vector D_j contains a variable measuring annual household income, *INCOME*; age in years, *AGE*; and the length of the respondent's stay in the area, *LENGTHOFSTAY*. The vector also contains dummy variables indicating if the respondent is a Mexican national, *MEXICO*; if the trip is his or her first to the region, *FIRSTVISIT*; if he or she has experience with scuba, *SCUBA*, or snorkeling, *SNORKEL*; and if he or she completed a bachelor's degree, *BACHELORS*. D_j also includes *GENDER* to control for any potential gender differences.

S_j is a vector containing the dummy variable *SURVEY*, which measures the impact of additional information provision concerning potential medicinal benefits derived from corals.[6] The vector also includes the dummy variables *YALKU, TULUM,* and *PLAYA*, which all define specific interview locations. *YALKU* is included in order to gauge the effect of initiating an interview when a respondent comes directly out of the water. The other two location controls are included to test for any difference in responses collected outside of Akumal. *TIME* is a continuous variable that controls for the length of the interview.

Variables defining respondents environmental preferences are included in the vector P_j. The variables *ENVQUALITY* and *ENVEDUCATION* are dummies indicating if the respondent stated that environmental quality was factor in planning his or her trip and if he or she participated in any environmental education programs while in the area, respectively. *NOKNOW* and *VERYKNOW* are dummy variables that measure the impact of a respondents stated knowledge of the MBRS, where *NOKNOW* corresponds to a visitor claiming no knowledge of the reef and *VERYKNOW* indicates an individual who declared that he or she was very knowledgeable. *DIRECTUSE* is a dummy variable indicating if the respondent supported direct use fees for the reef system.

A summary of all variables included in the model is shown in Table 1.

[6] This variable measures the impact on WTP of the additional information provision discussed above in section 3.0.

Table 1

Demographic Variables (*D*)

Name	Description	Mean	Median	SD	Min	Max
LENGTHOFSTAY	Length of respondents stay in days	11.31	7	17.18	1	180
FIRSTVISIT	= 1 if current visit is first to region, 0 otherwise	0.65	--	--	0	1
SCUBA	=1 if respondent has experince with scuba, 0 otherwise	0.32	--	--	0	1
SNORKEL	= 1 if respondent snorkels, 0 otherwise	0.87	--	--	0	1
AGE	Respondents age in years	40.77	40.00	12.17	17	82
GENDER	= 1 if gender is male, 0 if female	0.52	--	--	0	1
BACHELORS	= 1 if completed a bachelor's degree, 0 otherwise	0.37	--	--	0	1
MEXICO	= 1 if Mexican national, 0 otherwise	0.02	--	--	0	1

Survey Condition Variables (*S*)

Name	Description	Mean	Median	SD	Min	Max
SURVEY	= 1 if survey A, 0 if survey M	0.50	--	--	0	1
TIME	Length of survey in minutes	8.48	8	3.378	3	32
YALKU	= 1 if conducted at Yal Ku Lagoon, 0 otherwise	0.20	--	--	0	1
TULUM	= 1 if conducted on beach in Tulum, 0 otherwise	0.15	--	--	0	1
PLAYA	= 1 if conducted in Playa del Carmen, 0 otherwise	0.08	--	--	0	1

Environmental Preference Variables (*P*)

Name	Description	Mean	Median	SD	Min	Max
ENVQUALITY	= 1 if respondent considered environmental quality of area, 0 otherwise	0.82	--	--	0	1
ENVEDUCATION	= 1 if respondent participated in environmental education during visit, 0 otherwise	0.21	--	--	0	1
CD	= 1 if listed coral degradation as most pressing environmental problem, 0 otherwise	0.01	--	--	0	1
NOKNOW	= 1 if respondent claimed no knowledge of MBRS, 0 otherwise	0.39	--	--	0	1
VERYKNOW	= 1 if respondent claimed high knowledge of MBRS, 0 otherwise	0.02	--	--	0	1
DIRECTUSE	= 1 if respondent supported direct use fees for the MBRS, 0 otherwise	0.80	--	--	0	1

4.3 Willingness to pay

We interpret the willingness to pay (WTP) an entrance fee as the amount at which respondents are indifferent between the two states described above, the status quo and one with the installment of a trust for MBRS protection.

5.0 Results

5.1 Descriptive Statistics

Of the 398 respondents, 84.7% said that they would be willing to pay an entrance fee into Mexico if they could be guaranteed it would go toward coral protection and 80.4% believed it was reasonable to charge additional direct-use fees. Almost all respondents, 99.2%, stated that the Mesoamerican Barrier Reef System (MBRS) should be protected.

Table 2

Descriptive Statistics - Protection and Fees		
Protect MBRS		
MBRS Should Be Protected	393	99.2%
Should Not	3	0.8%
Total	396	100.0%
Direct-Use Fees		
Users Should Pay	320	80.4%
No Pay	78	19.6%
Total	398	100.0%
Entrance Fee		
Would Pay	337	84.7%
Would Not	61	15.3%
Total	398	100.0%

The majority of respondents reside in North America, 68.1% from the USA and 10.6% from Canada. Most other interviewees were from Continental Europe or the United Kingdom at 11.3% and 6%, respectively. A small percentage of respondents resided in Latin America or Mexico. Gender dispersion was nearly equal and the mean and median ages were 40 years. Nearly 25% of interviews were conducted with couples. The largest percentage of respondents, 37.3%, listed a Bachelor's Degree as their highest level of education obtained. Roughly 20% of respondents held a Graduate Degree or completed some college. Ph.D.s (4.8%), Associate Degrees (8.6%) and High School (9.6%) accounted for the remainder of interviewees.

Table 3

Descriptive Statistics - Country, Gender and Couples

Country of Residence			Gender		
USA	271	68.1%	Male	206	51.8%
Canada	42	10.6%	Female	192	48.2%
UK	24	6.0%	**Total**	398	100.0%
Europe	45	11.3%			
Latin America	4	1.0%			
Mexico	7	1.8%	**Respondents Interviewed as Couples**		
Other	5	1.3%	Couple	99	24.9%
Total	398	100.0%	Single	299	75.1%

Table 4

Descriptive Statistics - Education and Age

Highest Education Level of Respondents			Age	
High School	38	9.6%	Mean	40.77078086
Some College	82	20.7%	Median	40
Associate's Degree	34	8.6%	Mode	30
Bachelor's Degree	148	37.3%	Range	65
Graduate Degree	76	19.1%	Minimum	17
Ph.D.	19	4.8%	Maximum	82
Total	397	100.0%		

Average length of stay was 11.31 days, but the median and mode were both 7 days. The majority of the tourists interviewed, 65.3%, stated that they were visiting the area where the survey was conducted for the first time; however, 70.1% had visited somewhere else along the MBRS. The majority of respondents, 73.8%, stated that vacation was the primary reason for their visit. Others included snorkel (12.8%) and SCUBA (5.5%) as primary reasons for travel. Most interviewees, 87.4%, had snorkeled and 32.4% had been scuba diving. While 82.2% of respondents said that the environmental quality of the area played a role in the planning of their trip, less than 21% participated in environmental education activities during their stay.

Table 5

Descriptive Statistics - Visits and Length of Stay

First or Repeat Visit			Length of Stay	
First Visit	260	65.3%	Mean	11.31060606
Repeat	138	34.7%	Median	7
Total	398	100.0%	Mode	7
Visited MBRS			Range	179
Visited Other Places on MBRS	279	70.1%	Minimum	1
Have Not	119	29.9%	Maximum	180
Total	398	100.0%		

Table 6

SCUBA and Snorkel

SCUBA		
SCUBA	129	32.4%
Do Not SCUBA	269	67.6%
Total	398	100.0%
Snorkel		
Snorkel	348	87.4%
Do Not Snorkel	50	12.6%
Total	398	100.0%

Table 7

Descriptive Statistics - Reason for Visit, Env. Quality and Env. Education

Primary Reason for Visit		
Vacation	293	73.8%
Snorkel	51	12.8%
SCUBA	22	5.5%
Wedding	18	4.5%
Other	13	3.3%
Total	397	100.0%

Environmental Quality in Trip Planning		
Environment Important	323	82.2%
Not a Factor	70	17.8%
Total	393	100.0%

Participation in Environmental Education During Stay		
Participate in Environmental Ed	83	20.9%
Do Not Participate	314	79.1%
Total	397	100.0%

Respondent's perceptions and knowledge of tourist activities in the area and the MBRS varied. Half of the interviewees considered tourist activities in the survey area to be environmentally friendly, 36.7% said neutral, and 13.3% said unfriendly. Most interviewees, 46.2%, indicated that they were somewhat knowledgeable of corals in Mesoamerica, 38.9% said they had no knowledge, 12.8% claimed to be knowledgeable, and a minority 2% classified themselves as very knowledgeable. The majority of respondents selected air pollution (42.7%) and water pollution (41.2%) as the most pressing environmental issues facing the world. Global climate change (38.7%), rainforest destruction (35.2%) and hazardous waste (19.8%) were also popular answers.[7]

Table 8

Descriptive Statistics - Env. Issues, Tourist Activities and Knowledge

Pressing Global Environmental Issues		
Air Pollution	170	42.7%
Global Climate Change	154	38.7%
Hazardous Waste	79	19.8%
Water Pollution	164	41.2%
Rainforest Degradation	140	35.2%
Coral Degradation	27	6.8%
Overpopulation	15	3.8%
Trash	14	3.5%
Other	28	7.0%

Friendliness of Tourist Activities		
Friendly	199	50.0%
Neutral	146	36.7%
Unfriendly	53	13.3%
Total	398	100.0%

Knowledge of MBRS		
Not at all	155	38.9%
Somewhat Knowledgable	184	46.2%
Knowledgable	51	12.8%
Very Knowledgable	8	2.0%
Total	398	100.0%

Survey conditions were fairly consistent in terms of weather and time. Most surveys, 92.7%, were conducted when it was sunny and the mean duration was 8.48 minutes with a median of 8 minutes and a mode of 7 minutes. The shortest survey lasted 3 minutes and the longest took 29 minutes. In total, 75.6% of surveys were conducted in the Akumal area: 44.7% at various beach locations, and 20.1% at Yal-Ku lagoon. Surveyors completed 24.4% of surveys outside of the Akumal area: 14.8% on the beach in Tulum, 7.8% in Playa del Carmen, and 1.8% in other locations.

[7] Respondent's were asked to give their two most pressing concerns – in order.

Table 9

Descriptive Statistics - Location, Weather and Time

Location			Weather		
Akumal	30	7.5%	Sunny	369	92.7%
Akumal Bay - Beach	99	24.9%	Cloudy/Hazy	29	7.3%
Half-Moon Bay	79	19.8%	**Time**		
Yal-Ku	80	20.1%	Mean		8.48241206
CEA	13	3.3%	Median		8
Tulum	59	14.8%	Mode		7
Playa del Carmen	31	7.8%	Range		29
Other (Bahia, etc.)	7	1.8%	Minimum		3
Total	398	100.0%	Maximum		32

5.2 Protest Bids

Where interviewees said they would not be willing to pay an entrance fee they were usually giving one of a few common protest bids. Because, as previously mentioned, almost all respondents stated that the MBRS should be protected, we find it useful to discuss some of the reasons for the no responses to the WTP question. Many respondents gave protest bids because they believed that businesses in the area should bear the costs of preservation if they derive at least part of their revenues from the coral's existence and likely caused degradation. Another protest bid came from those individuals who were not direct users of the reef. We found that they refused to pay not because they did not value the reefs existence but because they did not believe that they caused any degradation.

The most common protest bid occurred when respondents expressed concern regarding the government's role in coral protection and the allocation and use of funds. A major problem was that many tourists do not trust the Mexican government. As a research team, we had considered this problem during the survey design process. We concluded that if the payment vehicle was left unspecified, the respondents could envision whatever method they preferred. Surveyors were also instructed to tell interviewees to assume that revenues would be managed properly. Despite such efforts, respondents continued to express skepticism concerning the handling of the funds.

Some respondents also gave protest bids because they realized that they were already paying the Government in the form of taxes and exit fees. Therefore, they believed that the government should allocate some of those funds to conservation of the MBRS. A related protest bid came from respondents who believed the coral reef is a public good, which allowed everyone free and unrestricted access. These individuals indicated that any preservation efforts would be the Mexican government's responsibility. In contrast to those who cited the government as the problem, these interviewees looked to it as the source of conservation efforts.

5.3 Willingness to pay

First, we look at the responses to the fee amount in simple, non-parametric terms. We find that responses to increasing fee levels conform with basic microeconomic theory. That is, as the fee goes up, fewer people are willing to pay the fee. At $100, only 22.73% of respondents indicated that they would pay the entrance fee. On the other end of the spectrum, 97.30%, stated that they would pay $5. Between the bid levels of $5 and $100 endpoints responses maintain the

negative relationship with the fee level as well: 83.33%, 69.84%, and 45.59% were willing to pay entrance fees of $10, $25 and $50, respectively. Survey responses for the WTP section are summarized in Table 10 below.

Table 10

Willingness to Pay Responses by Fee Amount

	Yes	% Yes	No	% No	Total
WTP_1					
$5.00	72	97.30	2	2.70	74
$10.00	55	83.33	11	16.67	66
$25.00	44	69.84	19	30.16	63
$50.00	31	45.59	37	54.41	68
$100.00	15	22.73	51	77.27	66
Total	217	64.39	120	35.61	337

We also calculate a lower bound estimate of mean willingness to pay using the Turnbull Estimator following Haab and McConnell (2002). Using this approach, we estimate a WTP of roughly $42. The lower bound estimate of WTP with ninety-five percent confidence intervals ranges from roughly $36 to $49. (See Appendix A for a more complete description of our calculations).

5.3.1 Econometric Results

Our initial WTP model assumes complete homogeneity of the population and contains no covariates (Table 11). As expected the sign on the bid price is negative and significant. Using this simple model to determine mean willingness to pay entails simply calculating $-\alpha/\beta$, where α is the constant term and β is the coefficient on the fee variable. This approach yields a mean WTP estimate of $57.03 with a lower bound of $38.28 and an upper bound of $ 85.43 at a 95% confidence interval.

The right side of Table 11 shows the conversion of the probit estimate as the marginal change in the probability of a yes response to a unit change in the bid amount at the mean. For example, the mean bid level given to survey respondents was $37 and at this level, the model predicts 67% of the respondents are willing to pay this amount. If the bid level were increased to $47 then the percentage of respondents saying yes would fall to 59% (.67-.08).

Table 11

Parametric Model without Covariates

Log likelihood:	-167.24326
Pseudo R2:	0.2378
Number of Observations:	337
LR chi2(1):	104.38
Prob > chi2:	0.2378

Variable	Coefficient	dF/dX
wtp1	-0.022 **	-0.0080873

** Indicates significance at the 99% level.

In order to learn more about our sample and to control for any heterogeneity in preferences, we also estimate a model with a full set of covariates. Initially, our model included an income variable. We dropped the income variable in order to gain 50 additional observations. Furthermore, when income was included in the model it was neither statistically or economically significant. The results from the full model are presented below in Table 13.

Using the technique developed by Cameron and James (1987) we estimate WTP using the results from the full parametric model.

$$\mathbf{E\ (WTP) = \sum(XB)}$$

X = vector of the means of all variables

$B = -(\delta/\alpha)$

δ = vector of all estimated coefficients

α = the estimated coefficient of the BID variable

The mean willingness to pay is estimated to be $57.93. All three estimation methods produce relatively similar values for mean WTP; $42 from the Turnbull model, $57 from the parametric model with no covariates, and almost $58 from the parametric model with covariates.

Analyzing the parametric model in Table 12, we first notice that the sign on the bid level (WTP1) is negative – conforming to theoretical expectations. In addition to the amount one would have to pay, other indicators of willingness to pay are SURVEY, TIME, DIRECTUSE, and YALKU. The two most significant variables are WTP1 (the bid amount), and TIME, both of which are significant at the .01 level. The length of the survey, TIME, is also statistically significant. The sign of the coefficient indicates that increased duration of the actual survey decreases willingness to pay – perhaps due to some sort of survey fatigue.

SURVEY, DIRECTUSE and YALKU are also influential variables, all of which are significant at the .10 level. The negative coefficient on SURVEY indicates that respondents' WTP increased with the addition of information suggesting potential medicinal benefits of corals (see Section 3.0). This result conforms with our expectations and economic theory, individuals are willing to pay more to protect corals if they think there may be some additional advantage. The coefficient on DIRECTUSE demonstrates that those respondents who support direct use fees are willing to pay a slightly larger amount for coral protection. Analysis of the YALKU variable reveals an interesting and surprising result. The sign suggests that those respondents who were

interviewed at Yal-Ku lagoon were willing to pay less into the coral protection trust. The direction of the coefficient is the opposite of our hypothesis. We expected that those individuals who were interviewed after snorkeling in the lagoon would be willing to pay more. One possible explanation for this finding is that after seeing the reef and surrounding ecosystem in such poor condition, respondents may have believed that money spent on protection would have little or no impact.

Table 12

Parametric Model with Covariates

Log likelihood	-150.3	Number of Observations:	328
Pseudo R2:	0.2987	LR chi2(1):	127.99
		Prob > chi2:	0.000

Variable	Coefficient	Variable	Coefficient
wtp1	-0.024 **	noknow	0.2587
survey	-0.309 *	veryknow	-0.307
time	-0.07 **	directuse	0.4036 *
mexico	0.3746	age	0.0046
lengthofstay	0.0003	gender	-0.025
firstvisit	-0.122	bachelors	0.1677
envquality	0.2433	tulum	0.3233
enveducation	0.2593	playa	-0.182
scuba	-0.052	yalku	-0.414 *
snorkel	0.0671	_cons	1.2862
cd1	-0.885		

** Indicates significance at the 99% level.

* Incidates significance at the 90% level.

6.0 Conclusions

The primary objective of this paper was to estimate willingness to pay for coral protection in Mexico. Using data collected in May 2005 through interviews with English-speaking tourists, we estimate several models, both parametric and non-parametric, and find tourists are willing to pay an additional fee to visit Mexico if they can be guaranteed that the revenue generated will go directly toward protecting coral reefs. The non-parametric results suggest tourists will pay at least $40 and the parametric results suggest they will pay between $20 and $80. With approximately 5 million visitors passing through the Cancun International Airport each year, this suggests that it may be possible to collect between $100 - $400 million annually for coral reef management programs. Thinking conservatively; If we take the $20 fee and assume only 50% of tourists would actually be willing to pay, that is still $50 million left on the table annually.

Despite respondents objections, revealed through protest bids, these results indicate that the Mexican government ought to initiate a fee program designed to enhance coral protection. The most appropriate method of collection is difficult to specify. Anecdotal evidence from the data collection process indicates that tourists, especially Americans, may actually prefer to pay

the fee in the form of an airport tax. The payment mechanism notwithstanding, collection of funds dedicated to coral protection would benefit the environment and provide a continuing base for economic development along the Mexican Caribbean.

7.0 References

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Appendix A

The following equation is used to calculate the Turnbull estimate:

$$E_{LB}(\text{WTP}) = \sum_{j=0}^{M^*} t_j(F^*_{j+1}) \qquad \text{(A.1)}$$

Where E_{LB}(WTP) is the lower bound estimate, t_j is the entrance fee amount, F^*_{j+1} is the percentage of respondents who stated they would not pay the fee at $j+1$, and M^* is the maximum fee amount. We calculate a range of WTP values based on the variance around the Turnbull estimate. This is done using equation A.2.

$$V(\text{E}_{\text{LB}}(\text{WTP})) = \sum_{j=0}^{M^*} \frac{\text{Fj}^*(1-\text{Fj}^*)}{Tj} (t_j - t_{j-1})^2 \qquad \text{(A.2)}$$

Where T_j is the total number of a given bid level offered to respondents See Haab and McConnell (2002) for a complete description of these techniques. Table A.1 contains the values used to calculate the Turnbull lower-bound Estimate.

Table A.1

Turnbull Estimates

			Unrestricted	**Turnbull (*Pooled*)**	
Bid Price (t_j)	**Number of No's (N_j)**	**Number Offered (T_j)**	**F_j (=N_j/T_j)**	**F_j***	**f_j***
5	2	74	0.027	0.027	0.027
10	11	66	0.167	0.167	0.140
25	19	63	0.302	0.302	0.135
50	37	68	0.544	0.544	0.243
100	51	66	0.773	0.773	0.229
100+	-	-	1.000	1.000	0.227