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A Business Case for Marine Protected Areas: Economic Valuation of the Reef Attributes of Cozumel Island

José Alberto Lara-Pulido [1,*], Ángela Mojica [2], Aaron Bruner [2], Alejandro Guevara-Sanginés [1], Cecilia Simon [2], Felipe Vásquez-Lavin [3,4,5], Cristopher González-Baca [6] and María José Infanzón [7]

1 CENTRUS—Centro Transdisciplinar Universitario para la Sustentabilidad, Universidad Iberoamericana, Mexico City 01219, Mexico; alejandro.guevara@ibero.mx
2 Conservarion Strategy Fund (CSF), Washington, DC 20011, USA; mojica.angelam@gmail.com (Á.M.); aaronbruner@gmail.com (A.B.); cecisimon@gmail.com (C.S.)
3 Facultad de Economía y Negocios, Universidad del Desarrollo, Concepción 4030000, Chile; fvlavin@gmail.com
4 Center of Applied Ecology and Sustainability (CAPES), Pontificia Universidad Catolica de Chile, Santiago 8320000, Chile
5 Instituto Milenio en Socio-ecología Costera (SECOS), Santiago 8320000, Chile
6 Director Parque Nacional Arrecifes de Cozumel, Comisión Nacional de Áreas Naturales Protegidas, Quintana Roo 77600, Mexico; cristopher.gonzalezb@conanp.gob.mx
7 Independent Consultant, Mexico City 54769, Mexico; maria.infanzon.valdivieso@gmail.com
* Correspondence: jose.lara@ibero.mx

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Abstract: Tourism to Cozumel Island generates USD 762 million annually in local economic activity, and 111 visitors stay in local hotels for each inhabitant. The island's coast is its principal attraction, yet water quality and reef health are threatened. This paper studies the link between the local economy and management of Arrecifes de Cozumel National Park, using a choice experiment to assess the economic value visitors assign to underwater visibility, biodiversity, and visitor congestion in reef areas. We found that, on average, tourists are willing to pay USD 190 per visit to avoid a projected decrease in biodiversity, USD 120 per visit to prevent a projected decline in visibility, and USD 98 to avoid high congestion during reef visits. We find high heterogeneity in willingness to pay estimates, which may be useful for targeting both conservation and marketing efforts. On the other hand, increasing the reef access fee from USD 2 to USD 6 could fully fund effective protected area management, with no substantial effect on visitors' consumer surplus. Results suggest that a conservation surcharge could be added to all tours, with little impact on visitation, and that significantly increasing private sector collaboration and government spending on conservation would be good economic choices.

Keywords: choice experiment; contingent valuation; ecosystem services; protected areas; coral reefs; tourism; Cozumel; Mexico

1. Introduction

In this paper, we analyze visitors' willingness to pay (WTP) for conservation of the reefs of Cozumel Island in Southeast Mexico. In particular, we applied an in situ discrete choice experiment (DCE), during May and June 2016, to direct users of the reef to estimate their WTP for underwater visibility, biodiversity levels, and crowding from snorkel and scuba diving tours. The intention was to explore the feasibility of mechanisms to fund sustainable development of the area, as there is currently a substantial financial gap that poses an important risk for the reef's ecological integrity. We find a high WTP for underwater visibility and biodiversity that justifies an increase in reef access fee, which could be devoted to financing conservation efforts.

Cozumel Island is located off the eastern coast of Mexico's Yucatan Peninsula. The island is a major tourist attraction, receiving an average of four million visitors annually, the majority on day visits from cruise ships [1]. Snorkeling and scuba diving excursions to the island's reefs and beaches in the almost 12,000 hectares protected by the Arrecifes de Cozumel National Park [2] are one of the main activities for day-visitors, and the principle draw for the smaller number of tourists who visit the island independently on multiday trips (See Figure 1).

Figure 1. Coral Reef in the Arrecifes de Cozumel National Park. Source: International League of Conservation Photographers (ILCP).

Tourism is the foundation of Cozumel's economy, generating USD 762 million annually [1]. Eleven million people visit the island every year (prior to COVID-19), equivalent to 111 visitors annually per resident [3]. Tourism activities are mainly based around the island's well-preserved nature included in five natural protected areas, which have earned international recognition in the World Network of Biosphere Reserves and in the Ramsar Convention (see Figure 2). However, the explosion in visitation, which increased on average 4.5% annually over the last 27 years [3], also threatens the island's coral reefs and other natural resources. It is estimated that tourist load capacity is exceeded [4]. As a result, although the current state of conservation is high, if trends in visitation continue without increased investment in conservation, ecosystem health is expected to decline significantly in the coming years.

In this context, the present study aims to understand the economic implications of improving reef management in Arrecifes de Cozumel National Park (or of failing to do so), and the scope for increasing the park access fee to help fund improvements.

Figure 2. Aerial view of Cozumel port. Source: International League of Conservation Photographers (ILCP).

2. Materials and Methods

We used a choice experiment to estimate tourists' willingness to pay for potentially desirable attributes of Cozumel's reefs. This method has been widely used in recent years to analyze preferences for goods and services not transacted in markets, including estimating the economic value of ecosystem goods and services [5–8].

In particular, we considered preferences for four attributes: diversity and abundance of species, underwater visibility, levels of visitor congestion, and use fees. The literature suggests that these are among multiple attributes to which visitors may assign value. For example, Williams & Polunin (2000) [9] identify that both variety and abundance of coral and fish species are important. Polak & Shashar (2013) [10] find that divers prefer fish diversity to abundance. Pabel & Coghlan (2011) [11] find that experienced divers have a greater preference for marine diversity, underwater beauty, and coral formations than for cost, educational facilities, and length of the trip to the dive site. We selected our final set of attributes by drawing on the authors' site-specific knowledge, aiming to capture a broad set of locally important issues. Attributes related to the presence of charismatic species, protected area status, and coral reef coverage were considered but dropped to avoid an overly complicated questionnaire and the need for a larger sample size.

Selected attributes needed to be (1) understandable for interviewees and (2) directly related to their experience in using the reef. Therefore, in addition to providing respondents with nontechnical descriptions of each attribute, we used images on choice cards to represent the levels analyzed (Figure 3). We defined three levels each for biodiversity, visibility, and congestion (high, medium, and low). We specified 10 levels of fee increase (from MXN 0 to MXN 2000, or USD 114). This range was determined from a pilot application of the questionnaire (N = 70) with a maximum fee of MXN 3000 (USD 171), in which we found that visitors were not willing to accept increases of more than MXN 2000.

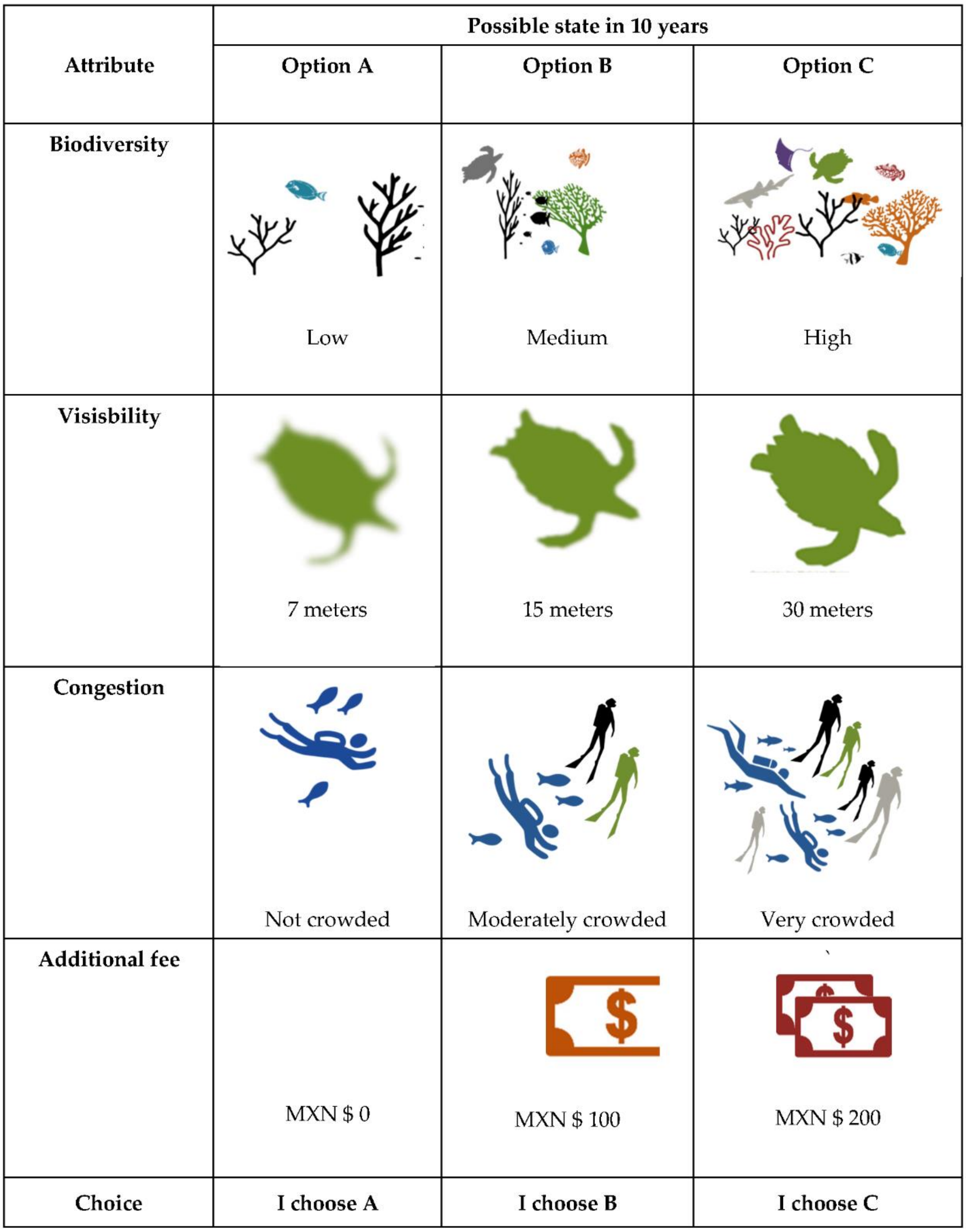

Figure 3. Example of a choice card, showing graphics used to illustrate the levels for each attribute. Source: Own elaboration.

In addition to establishing the number of attributes and levels for each attribute, the application of a choice experiment required selecting the number of choice sets (i.e., choice cards from which respondents indicated their preferred alternative), and the number of alternatives in each choice set. We defined 16 choice sets of 3 alternatives. We chose three alternatives because we wanted respondents to compare different scenarios to a possible degraded situation in the future. Following recommendations by Johnson et al. (2013) [12], we divided the choice sets into two blocks, such that each respondent faced only eight choice sets and to avoid a decrease in response efficiency.

We used DCREATE in Stata to design alternatives for each of the choice sets. DCREATE can yield dominant combinations, which will always be preferred. We eliminated these combinations manually over 50 iterations of the command. In each iteration, we evaluated the D-efficiency of the design (D-efficiency is a relative measure to assess statistical efficiency of a design and relates to the information matrix $(X'X)^{-1}$ for a given design matrix (X). As long as $(X'X)^{-1}$ is similar (without the intercept) to a diagonal matrix, D-efficiency is higher [13]). Kuhfeld (2005) [14] indicates that the D-efficiency is a relative measure that must be compared between different designs in the same situation, with the same attributes and levels. The final design has a D-efficiency of 89% out of a maximum value of 100%, which is a high level of efficiency taking as reference the simulation study of different design features of Vanniyasingam et al. (2016) [15]. The final design is presented in Appendix A.

The intended sample size was determined following De Bekker-Grob et al. (2015) [16], in particular:

$$N > \left(\frac{q}{rpa_1^2}\right) \cdot \left(\Phi^{-1}\left(1 - \frac{a_2}{2}\right)\right)^2$$

where N is the size of the sample; p the probability of the population choosing an alternative, $q = 1 - p$; r is the number of choice sets; α_1 is the allowed deviation from the true proportion of the population; and is α_2 the level of significance. Since we did not have a previous estimation of the proportion of the population, we assumed maximum variance (i.e., $p = 0.5$). In addition, the following values were considered for the required parameters: r = 16; α_1 = 0.03; α_2 = 0.03, obtaining $N > 327$.

We surveyed during May and June of 2016, with the help of the local office of the National Commission of Protected Areas (CONANP by its acronym in Spanish). A project field coordinator trained a team of 7 people to carry out surveys. He explained the essential elements of the DCE methodology and the questionnaire. The team conducted a pretest, obtaining 70 responses. Afterward, we reduced the maximum fee increase, as noted above, as well as making minor changes to the explanatory texts used in the survey. With help of the local CONANP office, we selected strategic points on the island to conduct the survey. These included the airport, ferry dock, cruise pier, central plaza, and dive shops. Government and private permissions were sought and obtained as necessary.

Participation by respondents was voluntary and was initiated by the field team approaching visitors with a prewritten greeting and an invitation to participate. Field team members were clearly identifiable by a dress code and identification badge with CONANP's logo. We developed versions of the questionnaire in Spanish and English. The survey had four parts. It began with a brief introduction that explained the context, confirmed anonymity of responses, and presented the institutions involved. The second part of the survey asked about respondents' activities in Cozumel, and personal opinions and attitudes towards environmental issues. In the third part, we described the reef's current ecological status, which is currently in relatively good shape but facing strong environmental pressures. We also explained how the choice experiment would work, described the attributes, and showed an example of the choice cards. We then presented the choice cards and collected responses. The survey ended with questions regarding sociodemographic data (see supplementary information for the full questionnaire).

It should be noted that Cozumel receives two distinct types of visitors: (i) day visitors and (ii) overnight tourists. Day visitors include cruise passengers and people staying at Playa del Carmen and Cancún (two beach destinations very close to Cozumel). Overnight tourists, on the other hand, stay more than one night in Cozumel. Our a priori expectation was that each visitor type would value the selected attributes differently. Therefore, we aimed to collect data from a full sample of each visitor type.

We collected 740 complete surveys during May and June 2016. Surveys were carried out at selected locations to obtain a good mix of national and foreign visitors with diverse sociodemographic characteristics, and the desired stratification between visitor types.

Willingness to pay is modeled after estimating the probability of a person choosing an alternative in a given situation. It is based on the Random Utility Model, which assumes that a person will choose a certain alternative if they obtain a level of satisfaction (utility) greater than the rest of the eligible alternatives. Formally this is stated in Equation (1).

$$V_{ik} > V_{jk};\ \forall j \in C, \quad (1)$$

where V represents the (indirect) utility associated with alternative, i, obtained by individual, k, and compared with the rest of the alternatives, j, that belong to the set of possible alternatives, C [6]. Generally, it is assumed that indirect utility is a function of a vector of characteristics associated with alternative i and an independent error term. This is shown in Equation (2).

$$V_{ik} = v_{ik}(Z_i) + \epsilon_{ik} \quad (2)$$

This approach estimates the probability that the utility of alternative i is greater than the probability of the other alternatives j, as shown in Equation (3).

$$P_{ik} = P\left[\epsilon_{ik} - \epsilon_{jk} > v_{jk}(Z_j) - v_{ik}(Z_i);\ \forall j \in C\right] \quad (3)$$

This probability is generally estimated assuming that the errors have an extreme value distribution of Type I [6] If this is the case, then it is possible to specify a logistic model. Broadly, there are 3 types of logistic model: (i) conditional logit, (ii) mixed logit, and (iii) latent class model [17,18]. The fundamental difference between these models is the type of variables that are included in their estimation. The conditional logit includes those that vary by alternative j, the multinomial includes those that vary by individual, and the mixed includes both. The conditional logit model yields a unique coefficient per alternative (for example, the price of the alternative); the multinomial logit yields a different coefficient for each characteristic of the respondents (for example, years of schooling). In the mixed logit, both types of coefficient are obtained according to the variables included in the model.

The latent class conditional logit model permits the identification of different types of preferences, given a number of classes. Classes in this model are groups of respondents that show similar preferences. These classes are unknown to the analyst and are determined by the model itself by looking for the best fit to the data, given a number of classes (For a formal explanation of the latent class model see Greene (2003) [17]). The classes group people by their non-observable characteristics; for example, those who are more willing to contribute to environmental causes. The main advantage of the latent class model is identifying the underlying factors that indicate preferences for the attributes in the choice experiment. The number of classes are specified ex-ante, and are usually chosen using the Akaike Information Criterion (AIK) or the Bayesian Akaike Criterion (BIC), choosing the number of classes that results in the minimum value for the chosen criterion (AIK or BIC) [19] (If the number of classes differ with the AIC and the BIC, it is preferrable to use the minimum number of classes). We found that the minimum value of both criteria is reached at six latent classes. However, with this number of classes, there is not enough variation in values within some classes, such that the standard errors around some of the coefficients cannot be estimated. Thus, for the latent class model, we chose to fix the number of classes at four, which is the number at which all coefficients and standard errors can be identified. We discuss these results later.

A fourth model is a hybrid of the mixed logit and the latent class conditional logit (see [20]). As in the latent class model, this model estimates parameters for each attribute and class, and permits heterogeneity of parameters for each individual. In this case, the model permits some attributes to be fixed and estimates individual coefficients for the rest (as in the case of the mixed logit). We chose to fix the bid variable and specified random parameters for the rest of the attributes. As in the case of the latent class conditional logit, we fixed the number of classes at four.

The conditional and multinomial models rest on the assumption of Independence of Irrelevant Alternatives, which assumes that the probability of preference between alternatives A and B remains unchanged, regardless of whether a third alternative C exists.

Empirically, it has been found that this assumption does not hold, suggesting that there are important limitations on models that depend on conditional and multinomial models [17]. In the case of mixed logit and latent class conditional models, this assumption is not necessary. To support interpretation, we ran all five models and compared the results for each.

Regarding the specification of the independent variables, we generated dummies for each level of the biodiversity, underwater visibility and congestion attributes, because we wanted to identify possible nonlinear preferences and because of the noncardinal nature of their levels (e.g., low, medium and high biodiversity). We took the worst level of each attribute as the base outcome (low biodiversity, low underwater visibility, and very crowded). Thus, each level has its own coefficient, which is compared to the base outcome. The price attribute is specified as a continuous variable, which implies that it has only one coefficient associated for all of the samples, or for each class in the case of the latent class model.

3. Results

Among the relevant characteristics of the sample (Table 1), 41% of the respondents spend the night in Cozumel, suggesting that our stratification was effective. A total of 68% either dived or snorkeled, including day visitors and overnight visitors. The average age in the sample is 36 years. The average monthly income is MXN 13,092 (~USD 650) for Mexican visitors and MXN 143,076 (~USD 7100) for visitors from other countries.

Table 1. Descriptive Statistics.

Variable	Unit	Obs.	Mean	Std. Dev.	Min	Max
Day visitor	Percentage	740	0.59	0.49	0	1
Lifetime visits to Cozumel	Number	740	2.49	4.29	1	50
Stay in Cozumel	Days	740	5.79	21.06	1	360
Trip duration	Days	740	10.97	41.51	1	730
Includes diving or snorkeling	Percentage	740	0.68	0.47	0	1
Diver	Percentage	740	0.33	0.47	0	1
Dive site crowding is …	Negative = −1, Irrelevant = 0, Positive = 1	740	−0.65	0.63	−1	1
Contributes to an environmental organization	Percentage	740	0.13	0.33	0	1
Dependents	Number	738	2.14	1.53	0	21
Age	Years	739	36.23	13.63	13	74
Women	Percentage	740	0.46	0.50	0	1
Schooling	Years	740	14.71	2.45	0	18
Income (Mexicans)	Pesos/month	206	13,092.72	12,820.4	2000	48,000
Income (foreigners)	Pesos/month	294	143,076.00	92,592.47	15,416.67	308,333.3
Married	Percentage	723	0.49	0.50	0	1
Working	Percentage	740	0.70	0.46	0	1

Source: Author's own elaboration.

There is a significant difference between the average level of education among the Mexicans in the sample (14.7 years) and the national average of 9.2, according to INEGI (2015) [21]. This difference is expected, and is in line with the socioeconomic characteristics of beach tourists in the State of Quintana Roo, as reported by Torruco & González-Solis (2015) [22]. Other descriptive statistics are given in Table 1.

In Table 2 we present the results from the four models described in the previous section (except multinomial logit, which is not suitable for our kind of data). Coefficients are interpreted as the relative weight that a given attribute has on respondents' decisions, as an indicator of their preferences. A negative sign implies a decrease in satisfaction when that attribute increases. We expected a negative sign on the "fee" attribute, indicating that people are less willing to choose more expensive alternatives. Regarding the other attributes, we expected a positive sign and a higher value for better levels. For example, we expected a positive and higher value for high levels of biodiversity than for medium levels. In the case of crowding, we expected a positive and higher value for less crowded settings. Moreover, an individual coefficient can be interpreted by comparing it to the omitted reference level. For example, for high levels of biodiversity, we obtained a coefficient in the conditional logit model of 1.3988, which means that this level is preferred to a medium level (1.0725), and also preferred to the reference level (low biodiversity, the reference scenario).

Table 2. Econometric results.

Variable	Model									
	Conditional logit	Mixed logit	Latent Class Conditional Logit				Latent Class Conditional Logit (Random Parameters)			
			Class 1	Class 2	Class 3	Class 4	Class 1	Class 2	Class 3	Class 4
	Coefficient (z Statistic in Parentheses)									
Fee	**−0.0066**	**−0.0087**	**−0.0178**	0.0025	**−0.0204**	**−0.0090**		**−0.0102**		
	(−8.07)	(−9.09)	(−4.92)	(0.93)	(−6.07)	(−3.12)		(−9.94)		
Biodiversity (medium)	**1.0725**	**1.1684**	−0.3984	**0.4838**	**0.8944**	**2.7714**	−0.2858	**1.9606**	**0.7289**	**2.8363**
	(27.37)	(22.01)	(−1.98)	(2.97)	(7.95)	(13.79)	(−1.37)	(2.86)	(8.55)	(13.82)
Biodiversity (high)	**1.3988**	**1.6410**	**1.1697**	0.3491	**0.7445**	**3.8135**	**0.9926**	2.9813	**0.5588**	**3.9861**
	(31.86)	(22.8)	(6.3)	(1.66)	(5.18)	(13.89)	(5.68)	(1.98)	(5.28)	(15.04)
Visibility (medium)	**0.7447**	**0.8829**	**0.9308**	**1.2151**	**0.8205**	**1.1891**	**0.9006**	**3.1800**	**0.9400**	**1.2019**
	(18.26)	(17.69)	(6.16)	(10.55)	(7.6)	(7.6)	(6.14)	(3.36)	(12.39)	(7.72)
Visibility (high)	**0.8697**	**1.1278**	**1.7080**	**1.5014**	0.2586	**1.6440**	**1.4175**	**6.4864**	**0.5472**	**1.7045**
	(15.77)	(14.95)	(7.09)	(7.99)	(1.4)	(7.95)	(9.16)	(2.84)	(4.36)	(8.41)
Crowding (medium)	**0.7755**	**0.9082**	**2.1571**	**0.4973**	**0.7087**	**0.9037**	**1.7510**	1.1728	**0.6006**	**0.9300**
	(16.7)	(16.23)	(8.42)	(3.26)	(5.22)	(4.78)	(9.51)	(1.74)	(7.11)	(6.78)
Crowding (low)	**0.7989**	**1.0013**	**3.1279**	0.1719	**0.7531**	**0.7833**	**2.6259**	0.8343	**0.4397**	**0.8466**
	(16.43)	(15.47)	(10.2)	(0.91)	(5.26)	(3.33)	(9.49)	(1.68)	(4.54)	(3.9)
Married	.	.	0.4556	**0.9297**	**0.7483**		0.4958	**0.9577**	**0.7337**	
	.	.	(1.5)	(3.36)	(2.99)		(1.73)	(2.46)	(3.21)	
ln(income)	.	.	0.1009	**−0.3274**	−0.0580	(base class)	0.0386	**−0.4348**	−0.1003	(base class)
	.	.	(0.44)	(−3.44)	(−0.64)		(0.3)	(−2.91)	(−1.06)	
Constant	.	.	−2.0548	**2.3645**	−0.3826		−1.2480	2.3497	0.6540	
	.	.	(−0.86)	(2.48)	(−0.41)		(−0.93)	(1.54)	(0.67)	
Class share	100%	100%	18%	22%	21%	39%	20%	7%	35%	38%

Source: Own elaboration. Coefficients in bold are significant at a 99.9% level; nonsignificant coefficients are in grey.

Results were in accordance with the expected values and signs for all coefficients. Visitors prefer more biodiversity, greater underwater visibility, less crowding, and lower fees. The signs are consistent across models, yet there are some differences in their magnitude. We also included two personal characteristics (if the respondent was married and the natural logarithm of income) in the latent class conditional logit. The selection of these variables was based on an exploratory analysis of the sociodemographic characteristics that were significant in several specifications of the latent class conditional logit model; these two were the only variables that were significant in most specifications.

Comparing across models, we find that a high level of biodiversity generates the largest increase in wellbeing as compared to underwater visibility and low congestion. In the case of the latent class conditional model, we observe the highest relative value of all coefficients and classes for this attribute.

We also find that the mixed logit model is preferred to the conditional logit because the standard deviations of the individual random parameters (not reported here) are statistically different from zero (with the exception of the medium level of congestion attribute), which means that there are significant differences in respondents' preferences for these attributes. These are only captured by the mixed logit specification.

Regarding the two variations of the latent class conditional logit model, we find similar results. In particular, the first latent class shows a preference for low congestion to other attributes; the second class does not reveal significant coefficients for almost any attribute, possibly due to this class capturing a large portion of respondents for whom the experiment was not clear; the third and fourth classes correspond, respectively, to people who have a low and high willingness to pay for all attributes (see Table 3 as described below). Moreover, the fourth class, in particular, shows a high preference for biodiversity.

Table 3. Willingness to pay estimates.

Variable	Willingness to Pay (WTP) (USD Per Visit Per Person, 95% Confidence Interval in Parentheses)									
	Conditional logit	Mixed logit	Latent Class Conditional Logit				Latent Class Conditional Logit (Random Parameters)			
			Class 1	Class 2	Class 3	Class 4	Class 1	Class 2	Class 3	Class 4
Biodiversity (medium)	**162**	**135**	−22	−194	**44**	**308**	−87	20	**67**	**279**
	(122, 201)	(105, 165)	(−44, −1)	(−628, 240)	(28, 60)	(126, 491)	(−130, −45)	(−113, 153)	(46, 88)	(212, 345)
Biodiversity (high)	**211**	**190**	**66**	−140	**36**	**424**	**38**	120	**51**	**392**
	(164, 258)	(151, 228)	(40, 91)	(−523, 242)	(22, 51)	(179, 670)	(5, 72)	(−171, 412)	(29, 72)	(303, 481)
Visibility (medium)	**112**	**102**	**52**	−488	**40**	**132**	**29**	**140**	**88**	**118**
	(84, 141)	(80, 125)	(28, 77)	(−1524, 547)	(24, 57)	(53, 211)	(0, 58)	(−44, 324)	(67, 110)	(83, 154)
Visibility (high)	**131**	**130**	**96**	−603	13	**183**	**80**	**465**	**49**	**168**
	(108, 154)	(109, 152)	(71, 121)	(−1920, 713)	(−4, 30)	(86, 279)	(51, 110)	(17, 913)	(27, 72)	(122, 213)
Crowding (medium)	**117**	**105**	**121**	−200	**35**	**101**	**113**	−57	**55**	**91**
	(94, 140)	(87, 123)	(89, 154)	(−695, 295)	(22, 49)	(59, 142)	(77, 149)	(−189, 74)	(38, 71)	(65, 118)
Crowding (low)	**120**	**116**	**176**	−69	**37**	**87**	**199**	−91	**39**	**83**
	(94, 147)	(93, 139)	(121, 231)	(−324, 185)	(24, 50)	(41, 133)	(138, 260)	(−192, 11)	(20, 58)	(42, 124)
Class share	100%	100%	18%	22%	21%	39%	20%	7%	35%	38%

Source: Own elaboration. Confidence intervals are derived using the delta method [23,24]. WTP estimates shown in bold are associated with coefficients significant at 99.9% level. WTP estimates shown in gray are associated with non-significant coefficients.

We analyzed the sociodemographic data for each latent class, finding no significant differences in any variable across classes. This result indicates that the latent classes identify non-observable differences in respondents' preferences. While not significantly so, income levels are higher for the fourth class, which also stated the highest willingness to pay for biodiversity and underwater visibility attributes. Finally, married people seem to be associated with the third class, which stated low willingness to pay for attributes.

In Table 3 we present WTP estimates for the different models, which are obtained by dividing the coefficient of each attribute by the absolute value of the coefficient on the "fee" attribute. For example, by dividing the high level of biodiversity coefficient (1.3988) by the absolute value of the fee coefficient (0.0066) of the conditional logit model, we obtain USD 211. That is, on average, respondents are willing to pay USD 211 for a setting with this level of biodiversity. Confidence intervals of WTP were calculated following Lopez-Feldman (2012) [24].

Visitors' average willingness to pay to maintain the quality of Cozumel's reefs far exceeds current use fees of ~USD 1.8 per visit per person. For instance, mixed logit model results suggest a mean WTP of USD 130 and USD 135 per visit to avoid loss of underwater visibility and biodiversity, respectively. These values are additional to each other, such that the current use fee represents less than one percent of the combined WTP. Following Train (2015) [25] and Small & Rosen (1981) [26], we estimated visitors' consumer surplus considering current access fees to the protected area, and two higher access fees. These two higher fee levels are: (1) the maximum access fee at which consumer surplus is equal to zero, assuming the attributes were maintained at their best level, and (2) the access fee level that would fully cover the gap in costs for effective management (USD 6), assuming the full amount were transferred to MPA management. We calculated financial needs using the formula derived by Balmford et al. (2004) [27] to estimate the costs of effectively managing marine protected areas. Results are shown in Table 4.

Table 4. Access fees and consumer surplus.

Variable	Conditional Logit	Mixed Logit	Latent Class Conditional Logit	Latent Class Conditional Logit
Consumer Surplus (Fee = USD 2)	391	342	263	305
Consumer Surplus (Fee = USD 6)	387	338	260	302
Access fee at which CS = 0 (USD per visit)	78	100	117	99

Source: Own elaboration.

In the case of the latent class conditional logit, we weighted the consumer surplus by the share of each class (reported in Table 2) and considered that the coefficients of class 2 were equal to zero, as long as no significant effect was found for this class. Considering all models, we found that an access fee of USD 6 leaves a consumer surplus between USD 260 and USD 386 per visit per person, and that the maximum access fee at which CS would go to zero is between USD 78 and USD 117 per visit per person. These findings show that fees could be increased to fully fund effective Marine Protected Area (MPA) management, with a minimal effect on consumer surplus.

Our results suggest significant heterogeneity, evidenced by the large number of classes arising from statistical criteria and the large differences in WTP estimates between models. We analyzed the sources of this heterogeneity in several ways. In Table 5, we present WTP estimates from the conditional logit model (which assumes respondents share the same preferences) for different groups. By doing this, we are able to compare sources of heterogeneity that are related to sociodemographic characteristics and gain insight into the different classes of preferences that are in our sample. This approach is different from the latent class model, in which classes are unobservable and are determined by the data themselves. We find significant differences between sociodemographic groups, with certain types of tourists willing to pay more or less. For example, we find that people with prior experience scuba diving or snorkeling have a lower WTP, as do one day visitors, people with more schooling than average, non-Mexican tourists, less frequent visitors, people who do not contribute to environmental organizations, older people, and non-Mexican people with higher levels of income.

Table 5. WTP for different sociodemographic profiles (USD per visitor) (95% confidence interval).

Group	N	Biodiv. Medium	Biodiv. High	Visibility Medium	Visibility High	Crowding Medium	Crowding Low
Whole sample	740	162 (+ −40)	211 (+ −47)	112 (+ −28)	131 (+ −23)	117 (+ −23)	120 (+ −27)
Scuba diving or snorkel tour included	505	157 (+ −43)	200 (+ −50)	106 (+ −30)	117 (+ −22)	112 (+ −25)	118 (+ −29)
Scuba diving or snorkel tour not included	235	173 (+ −92)	240 (+ −117)	129 (+ −69)	170 (+ −68)	131 (+ −57)	126 (+ −60)
One day visitors	439	151 (+ −43)	199 (+ −51)	92 (+ −28)	121 (+ −24)	107 (+ −24)	111 (+ −28)
Stay in Cozumel	301	178 (+ −82)	230 (+ −97)	149 (+ −69)	148 (+ −51)	134 (+ −51)	137 (+ −57)
Advanced diver	61	139 (+ −101)	148 (+ −97)	67 (+ −56)	80 (+ −40)	102 (+ −60)	116 (+ −77)
Advanced snorkeler	179	166 (+ −83)	213 (+ −97)	128 (+ −65)	121 (+ −43)	105 (+ −43)	110 (+ −50)
Without experience in diving/snorkel	233	178 (+ −96)	246 (+ −123)	132 (+ −72)	170 (+ −70)	134 (+ −60)	131 (+ −64)
Schooling above mean	411	155 (+ −52)	217 (+ −66)	120 (+ −41)	137 (+ −33)	118 (+ −31)	130 (+ −38)
Schooling below mean	329	168 (+ −61)	203 (+ −67)	104 (+ −39)	124 (+ −32)	116 (+ −35)	110 (+ −37)
Mexicans	331	210 (+ −100)	280 (+ −124)	154 (+ −74)	191 (+ −72)	135 (+ −53)	126 (+ −54)
Foreigners	409	139 (+ −39)	177 (+ −45)	92 (+ −27)	101 (+ −19)	108 (+ −25)	118 (+ −30)
Visits to Cozumel > 2.5 times	156	224 (+ −161)	275 (+ −184)	131 (+ −96)	179 (+ −99)	141 (+ −83)	163 (+ −105)
Visits to Cozumel <= 2.5 times	584	150 (+ −39)	200 (+ −47)	109 (+ −29)	122 (+ −22)	113 (+ −24)	113 (+ −26)
Contributes to environmental org.	94	171 (+ −111)	231 (+ −139)	86 (+ −60)	104 (+ −46)	129 (+ −71)	139 (+ −83)
Does not contribute to env. org.	646	161 (+ −43)	209 (+ −51)	117 (+ −32)	136 (+ −26)	115 (+ −25)	118 (+ −28)
Age > 36	319	158 (+ −61)	207 (+ −73)	102 (+ −41)	127 (+ −35)	109 (+ −34)	113 (+ −40)
Age <= 26	421	164 (+ −52)	213 (+ −61)	119 (+ −39)	133 (+ −30)	123 (+ −31)	127 (+ −36)

Source: Own elaboration.

To further understand the effect of income levels, we estimated the conditional logit model for different levels of income, for Mexicans and non-Mexicans separately. In Figure 4, we present WTP for these groups and their 95% confidence intervals (labelled as low and high in the figure). First, we observe a high WTP at the lowest levels of income, yet with low statistical confidence. Second, in general, there is not much variation in WTP as income increases. For Mexicans, we observe only a slight increase in WTP as income increases. For non-Mexicans, we do not observe the same pattern; however, the low level of statistical confidence may hide actual preferences. In the next section we discuss the implications of these findings.

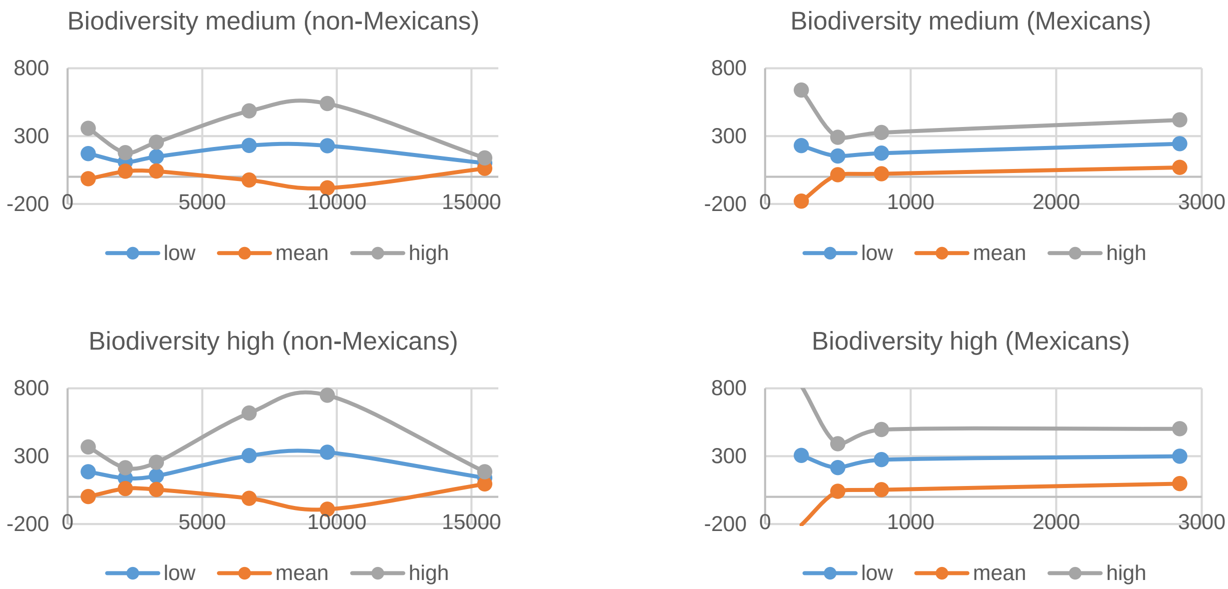

Figure 4. *Cont.*

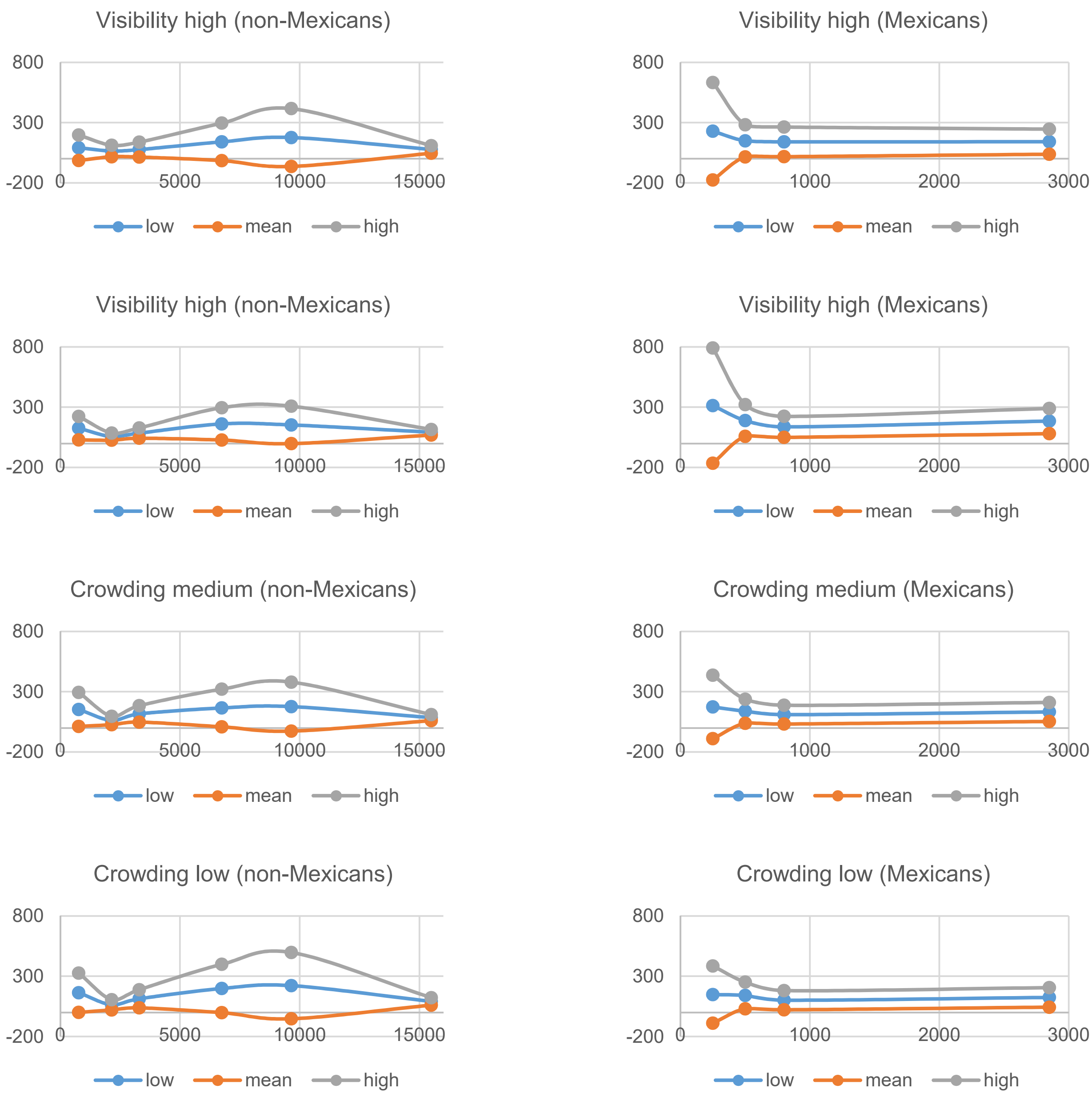

Figure 4. WTP for different levels of income and country of origin. Source: Own elaboration.

4. Discussion

This paper demonstrates that visitor access fees could readily be increased to fund protection of the ecosystem services provided by Cozumel's reefs. In particular, more than tripling the current fee from USD 1.8 to USD 6.5 per visit per person would generate sufficient revenue for the MPA to effectively protect the reef without significantly affecting tourist visitation. This policy change would greatly reduce risk to the foundation of Cozumel's economy. In economic terms, this represents a practical application of a set of instruments to ensure adequate provision of non-market goods. In this case, use fees as a means to ensure beneficiaries share costs

Our estimations are consistent with, although generally higher than, similar studies. The closest study to ours is from Casey, Brown, & Schuhmann (2010) [28], who carried out a discrete choice experiment in the Mexican Riviera Maya to estimate WTP for protection programs. The authors found a mean WTP in the range of USD 42 to USD 58—lower than the values we found. Arceo et al. (2010) [29] approximate the economic value of scuba and boat tours to reefs in Veracruz, Mexico, using the travel cost method. They report recreational value in terms of hectares (~USD 3500/hectare, updated to 2015). Brander et al. (2009) [30] specify a meta-regression of coral reef economic value at a global scale (including Mexico); they report the recreational value in terms of hectare per year (USD 2140/hectare, updated to 2015). Converted to per hectare values, our results are approximately USD 7800/hectare, again higher than the aforementioned studies (this considers approximately 1500 daily tours, 90% of which involve either snorkeling or scuba diving).

Our findings are also at the upper end of the range in values reported in a meta-analyzes by Brander et al. (2007) [31] and Londono-Diaz & Johnston (2010) [32], who derive a meta-regression of WTP specifically for recreational activities in coral reefs.

There are at least two plausible explanations for the magnitude of our estimates. First, Cozumel is among the most valuable coral reefs in the world, and our results accurately capture that value. Alternatively, our results might be biased upwards. There is evidence that WTP can be sensitive to price attributes. For example, Glenk et al. (2019) [33] show that WTP increases as the magnitude of vector price increases. However, Svenningsen & Jacobsen (2018) [34] document mixed evidence about this effect, indicating that there is not conclusive evidence that price magnitude biases WTP. In the present study, we redefined the maximum level of the price attribute after the survey pretest, adjusting the maximum from USD 175 to USD 114. This should reduce potential bias related to the maximum price. Unfortunately, we do not have any way to test if this bias exists. However, even if this bias were significant, the difference between current access fees and estimated WTP is very large, such that our main conclusion would be highly unlikely to change.

Furthermore, as in any stated preference approach, our study shares the potential bias that arises when people make decisions under hypothetical situations that do not imply actual transactions or actual trade-offs. List and Gallet (2001) [35] address this issue by carrying out a meta-analysis of 29 experimental studies, and conclude that hypothetical bias exists and should be addressed. Loomis (2011) [36] points out two relevant means to mediate hypothetical bias. First, the author argues for a "cheap talk" script (see [37–39]), which consists of explaining the issue of hypothetical bias to respondents and requesting that they take it into account when choosing their preferred alternatives. Our questionnaire included a brief text to this effect. Second, Loomis suggests dividing WTP estimates by a factor of 3. With this adjustment our estimates of WTP would be in the range of USD 33–63 per attribute—still a likely order of magnitude higher than the fee level necessary to fund effective management of Arrecifes de Cozumel National Park.

Moreover, we find high levels of heterogeneity in our sample, evidenced by the number of latent classes indicated by statistical criteria and by the large variation observed in WTP for different sociodemographic groups. These results imply that our study is not able to fully explain the sources of heterogeneity. However, we are able to provide insight into which specific sociodemographic groups may be more willing to contribute to conservation activities. This study may be a starting point for developing differentiated strategies for both conservation efforts and marketing purposes.

Methodologically, this study contributes a comparison of different estimation techniques, both long-standing and more recent. Additionally, the dataset itself is novel and rarely found in developing countries. This dataset permitted us to test several model specifications, and was shown to be well designed. The data are available as supporting online information. Moreover, Supplementary Materials, including databases and questionnaires, may be the basis for further research in similar sites.

5. Conclusions

Tourists are willing to pay far more than current access fees to enjoy the remarkable recreational experience of the Cozumel reef. This result is consistent with other studies that indicate a high WTP to access protected areas globally (see for example [40–43]). Even within Mexico, Witt (2019) [44] finds that tourists are willing to pay 2.8–9.8 times current access fees to NPAs. This result supports the conclusion that there is significant potential for increasing access fees to fund the Arrecifes de Cozumel National Park. As noted by Banerjee (2018) [45], in the case of Rwanda's protected areas, these funds need to be earmarked for the purpose of protected area management. A growing body of evidence makes clear that adequate funding for protected area management can have a positive impact on reducing degradation of ecosystems and biodiversity loss [46,47].

However, the effectiveness of protected areas is not only a matter of funding. Schleicher, Peres, & Leader-Williams (2019) [48] argue that governance, rule of law, and property rights are also necessary conditions for the effectiveness of protected areas. The same argument is supported by several other authors [43,45,48,49].

Finally, there is evidence of the importance of involvement of local communities, NGOs, regional government and the private sector in decisions related to protected area management [42,43,50–52]. In this sense, this paper justifies just one piece of what is necessary for achieving sustainable management of the Cozumel reef, yet an important one: there is a clear opportunity to raise enough funding to finance conservation activities without negatively affecting the short-term economic benefits of the recreational service that it provides.

This paper provides evidence that protecting Cozumel's reefs, including through raising access fees to fully funding MPA management, is a good choice for nature and for Cozumel's economy. Relevant actions will include coordination between tour companies, the local community, the MPA office and municipal government in order to take advantage of the piece of information we provide.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/su13084307/s1. The Millennium Coral Reef Mapping Project validated maps used for Figure S1 can be found in http://imars.marine.usf.edu/MC/.

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Appendix A

Table A1. Design of Choice Sets.

Biodiversity	Underwater Visibility	Crowding	Fee (MXN Pesos)	Choice Set	Alternative	Block
Low	Low	Moderately	100	1	A	2
High	High	Highly	150	1	B	2
Low	Low	Highly	0	1	Base	2
High	Medium	Highly	100	2	A	2
Medium	High	A little	1700	2	B	2
Low	Low	Highly	0	2	Base	2
Medium	Medium	Moderately	0	3	A	2
Low	High	Highly	200	3	B	2
Low	Low	Highly	0	3	Base	2
High	Medium	A little	200	4	A	1
Low	Low	Highly	110	4	B	1
Low	Low	Highly	0	4	Base	1
Low	Low	A little	800	5	A	2
Medium	High	Moderately	2000	5	B	2
Low	Low	Highly	0	5	Base	2
Low	High	Moderately	2000	6	A	2
High	Low	Highly	500	6	B	2
Low	Low	Highly	0	6	Base	2
Medium	Medium	Highly	800	7	A	1
High	High	A little	1400	7	B	1
Low	Low	Highly	0	7	Base	1
High	Medium	Moderately	100	8	A	2
Medium	High	A little	110	8	B	2
Low	Low	Highly	0	8	Base	2
High	High	Moderately	800	9	A	2
Medium	Medium	A little	150	9	B	2
Low	Low	Highly	0	9	Base	2
Medium	High	A little	500	10	A	1
High	Low	Moderately	110	10	B	1
Low	Low	Highly	0	10	Base	1
Medium	Medium	Highly	500	11	A	1
High	Low	Moderately	1700	11	B	1
Low	Low	Highly	0	11	Base	1
Low	High	Moderately	1400	12	A	1
Medium	Low	Highly	150	12	B	1
Low	Low	Highly	0	12	Base	1
Low	Medium	A little	2000	13	A	1
Medium	Low	Moderately	200	13	B	1
Low	Low	Highly	0	13	Base	1

Table A1. *Cont.*

Biodiversity	Underwater Visibility	Crowding	Fee (MXN Pesos)	Choice Set	Alternative	Block
High	High	Highly	2000	14	A	1
Low	Low	A little	100	14	B	1
Low	Low	Highly	0	14	Base	1
Low	Medium	Highly	150	15	A	1
Medium	Low	Moderately	1700	15	B	1
Low	Low	Highly	0	15	Base	1
Low	Medium	Moderately	500	16	A	2
High	Low	A little	1400	16	B	2
Low	Low	Highly	0	16	Base	2

Source: Own elaboration.

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