



The recreational value of coral reefs in the Mexican Pacific

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A B S T R A C T

The aim of this study was to determine the recreational value of the three major coral reefs in the Mexican Pacific: Cabo Pulmo, Islas Marietas and Huatulco. 488 and 455 domestic and international tourists respectively were interviewed, and their socioeconomic profile and perception of the coral reef they visited were determined. Using the dichotomous choice contingent valuation method, a willingness to pay of US\$ 5.79 for conservation activities was determined, as well as a net annual benefit from the reef of US\$1.4 million. The results of the study show that the tourists are willing to pay a higher entrance fee than that established by the federal government. Therefore, if a new entrance fee policy is implemented for entering to marine national parks, the federal government could increase its limited budget for monitoring and research activities in these ecosystems.

1. Introduction

Coral reefs are some of the most productive and diverse ecosystems in the world, covering just 0.1% of the ocean's surface and giving home to almost one third of the marine species in the world (Côté and Reynolds, 2006). The ecological goods and services of coral reefs are diverse and encompass food provision, shoreline protection, erosion regulation, biogeochemical cycling, and tourism and recreational opportunities (Barbier, 2011; Barbier et al., 2011; Elliff and Kikuchi, 2017). However, despite their global importance, coral reefs are highly vulnerable and their deterioration is occurring at an alarming rate (Hoegh-Guldberg et al., 2007; Carpenter et al., 2008; Rinkevich, 2008; Burke et al., 2011). The last report of the World Resource Institute stated that approximately 75 percent of the world's coral reefs are currently threatened by a combination of local and global pressures. The most immediate and direct threats arise from local sources, which currently threaten more than 60 percent of reefs (Reyter et al., 2011).

In Mexico, the major coral reef areas are located next to the most important touristic hotspots such as Puerto Vallarta, Ixtapa, Huatulco and the Riviera Maya. Coastal development in these regions has increased rapidly during the last 20 years (Datatur, 2017), with adverse impacts on coral reefs. These impacts include overexploitation of fishing resources, degradation of vegetation and ecosystems for the construction of urban and touristic infrastructure, pollution of water, air and soil due to solid, liquid, and gaseous residues, increase of sediment run-off, untreated sewage, damage from anchoring, physical damage from boats in shallower areas, contamination by sun-block-coated tourists (Murray, 2007; Tortolero-Langarica et al., 2014; Gil

et al., 2015). Global climate change is also threatening reefs through coral bleaching, disease, and ocean acidification (Kramer et al., 2000; Barbier et al., 2011; Calderon-Aguilera et al., 2012).

Paradoxically, all these coral reefs are located in protected areas established by the federal government, with the aim to preserve these important ecosystems. Why then does this situation persist? There are two major reasons: the lack of regulation enforcement, and inadequate funding. Enforcement and surveillance should guarantee that only accredited fishers can fish in the area as well as avoid coastal pollution due to the tourist centers. Unfortunately, in the long run, there is not optimistic scenario unless the necessary management measures are taken. In the present administration of President Peña Nieto (2012–2018), the Mexican government has faced several threats to macroeconomic stability, and in order to reduce the public deficit, some governmental offices have suffered budget reductions. Unfortunately, the environmental protection has been one of the most affected areas. The annual budget of the governmental agency in charge of environmental protection (Secretary of the Environment and Natural Resources), SEMARNAT, was reduced by 22% in 2016, and for 2017 it got an additional reduction of 35% (SHCP, 2017). The National Commission of Natural Protected Areas, which is under the jurisdiction of the SEMARNAT, has reduced its budget by approximately 30% in 2017. This involves a shortage of staff and financial resources for each activity assigned for the operation of protected areas: monitoring, research, enforcement, evaluation.

One way to finance marine reserves is to charge an entrance fee. This is a way for local communities to capture the scarcity rent of their resource. Revenues thus collected would help cover maintenance and

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Table 1
Examples of recreational valuation studies.

Author	Site	Value in US\$ annually
Fernandes (1995)	Saba Marine Park, Caribbean	2 million
Cesar (1996)	West Lombok, Indonesia	23.5 million
Driml (1994)	Great Barrier Reef of Australia	62 million
Mattson and DeFoor (1985)	John Pennekamp Coral Reef State Park, Florida	47.6 million
Pendleton (1995)	Bonaire Marine Park, Netherlands Antilles	19.2 million
Nam and Son (2001)	Hon Mun Islands, Vietnam	8.7 to 17.9 million
Arin and Kramer (2002)	Anilao, Mactan Island and Alona beach, Philippines	1.3 million
Carr and Mendelsohn (2003)	Great Barrier Reef of Australia	700 million to 1.6 billion
Mathieu et al. (2003)	Seychelles Islands	88,000
Yeo (2003)	Pulau Payares Marine Park, Malaysia	390,000
Cesar (2003)	Red Sea	112 million
Cesar and Van Beukering (2004)	Hawaiian Islands	360 million
Ahmed et al., 2007	Gulf of Lingaye, Bolinao, Philippines	4.7 million
Asafu-Adjaye and Tapsuwan (2008)	Muko Similian Marine National Park, Thailand	31 to 71 million
Casey et al., 2010	Mesoamerican Barrier Reef System	100–400 million
Ransom and Mangi (2010)	Mombasa Marine National Park and Reserve, Kenya	346,733
Cruz-Trinidad et al., 2011	Bolinao-Anda, Philippines	38 million

enforcement costs of a marine reserve. Furthermore, the entrance fee may be used as a tool to regulate the number of visitors to minimize any damage. Since 2002, the Mexican government established a fee of \$25 pesos (approximately US\$ 1.38) per individual per entry to any protected area. This amount is just nominal, and it was the result of a negotiation where service-provider interest groups lobbied for a low, homogenous fee. It was not intended to manage the demand in any way; at this stage the government was more concerned in getting the instrument passed, than setting a useful fee level (Rivera-Planter and Muñoz-Piña, 2005). The entrance fees collected in all natural parks in Mexico go to the Secretary of Finance and Public Credit (SHCP), who is the authority responsible for returning this money to the SEMARNAT. Thus, this ministry uses the money in accordance with its budget needs and conservation priorities. According to various officials in protected areas, from the total annual payment of fees collected in their jurisdictions, SEMARNAT returns only between 8 and 20 percent to them. A practical problem for implementation of any fee for marine parks in Mexico is that the government bodies taking the decisions have little information on the relationship between fee levels and number of visitors that would go at that fee, that is, they do not know the demand functions. The direct way to provide this information is to estimate these demand functions by looking at past visitor numbers and to examine the way in which they have responded to different price levels. However, where historical fee levels show insufficient variation or have been non-existent, such as is the case in Mexico, this approach is impractical (Rivera-Planter and Muñoz-Piña, 2005). Therefore, economic valuation studies should be implemented to generate basic information regarding tourism demand for protected areas.

In the light of these constraints, this paper presents the findings of an exploratory study on snorkelers demand for visiting coral reefs in marine parks at the Mexican Tropical Pacific. We use an environmental economic tool, a dichotomous choice contingent valuation method to determine the willingness of visitors to pay for coral reef conservation. The information resulting from the study will be useful to propose plans and programs with the aim of conserving the ecosystems and consequently, to adequate the price policies to provide additional financial resources for the monitoring, research, enforcement and evaluation of protected areas. In addition to that, the present study constitutes the first empirical approach regarding the economic value of the coral reefs of the Mexican Pacific. Therefore, this study is also a contribution to fill this gap for the academic literature, where several studies regarding economic valuation of the major coral reefs spots worldwide have been done. Thus, in spite of their ecological and touristic importance of these ecosystems in the Mexican Pacific, there are not been research efforts to evaluate the economic benefits associated with recreational services.

2. The importance of valuing the ecosystem services of coral reefs

As with other natural resources like water, forests, and fisheries, the main problem with the deterioration of coral reef ecosystems is the fact that their value is unknown or rarely appreciated by society. To value a natural resource means to have a rough indicator of its importance to the welfare of society. As Cesar has pointed (2002): “we see many coastal populations who are unaware of the goods and services that coral reef ecosystems provide and who are unable to see through the complex linkages of natural world”. We see people using coral reefs unsustainably and even destructively. And we see politicians unwilling to look beyond their short-sighted lenses, and consequently we see a lack of funds for coral reef management, even though the long-term costs of inaction are typically much higher than the funds needed”. (Cesar, 2002: 27). Creation or transformation of markets for environmental goods might help overcome these problems (Hartwick and Olewiler, 1998; Garrod and Willis, 1999). Markets could assist where people use coral reefs unsustainably and even destructively, and where the public policies for conservation and management are limited in terms of budget, human resources, enforcement, monitoring and evaluation (Cesar and Chong, 2003).

Economic valuations of coral reef ecosystem services have been undertaken to address several objectives, such as raising environmental awareness among decision-makers and the public, evaluating the costs and benefits gained from different levels of investment in coastal management, incorporating present and future values of both negative and positive impacts via a common metric and fine tuning economic instruments (Burke et al., 2011; Laurans et al., 2013). At the regional level there have been several estimates of the recreational value of coral reefs around the world. Table 1 shows a summary of some economic valuations. The results of coral reefs environmental services underline that the amounts estimated for both the sum of values and its various components vary widely. However, almost the 80 percent of the total economic value of coral reefs worldwide encompass three ecosystem services (Laurans et al., 2013): 1) tourism and recreational activities, 2) “indirect use values” (based on the positive external effects that ecosystem provide to agents), such as shoreline protection, and 3) extractive activities such as fisheries.

In Mexico, academic literature regarding economic valuation for natural resources has been focused on water resources, recreation, forest management, carbon sequestration, wetlands, fisheries, and decision making (Perez-Verdin et al., 2016). A few studies regarding economic valuation of coral reefs have been conducted. They basically concentrated in the Yucatan peninsula, where the largest reef ecosystem in the western hemisphere is found, and is an important source of tourism-based revenue (Casey et al., 2010). These studies evaluated the economic value of visitors demanding better tourism opportunities

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