

ECONOMIC EVALUATION OF FISHERIES AND TOURIST SERVICES OF THE VERACRUZ REEF SYSTEM NATIONAL PARK, MEXICO: A SPATIAL APPROACH

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ABSTRACT

The National Park Veracruz Reef System was declared a marine protected area by the Mexican government in 1992. It contains 23 reefs presenting different degrees of environmental deterioration mainly due to the influence from nearby rivers, its proximity to the port city of Veracruz-Boca del Río and the currents patterns. The degree of deterioration depends also upon the type of use (tourism, fisheries, scuba). A conservation assessment of the system is currently under development. In this paper we incorporate spatial analysis to characterize and map the spatial allocation patterns for different activities taking place in the reef system. Our study includes a preliminary assessment of the economic value of the reef based on the tourism and fishing activities. We use information from SCUBA diving shops; tourists guide groups (boat tours), biomass values, and official information for the value of the captures. The travel cost method for scuba and boat tours and published information is used to assess the benefits from the different zones within the park. The results are discussed and management recommendations for fishing areas are proposed.

Keywords: economic evaluation, fisheries, tourism, marine protected area

Introduction

For more than a decade, the need to estimate the value of ecosystems for management purposes has been recognized by different authors (Costanza *et al*, 1997; Hein, *et al.*, 2009), because knowing the value of ecosystems goods and services can be useful in fine tuning management programs of marine protected areas. Value estimations imply dealing with locations of activities occurring within the protected area. Knowing the types of use of the different reefs in the National Park Veracruz Reef System (PNSAV) may lead to policies for improved tourist and fisheries use and maximize the total value of services provided by the reef.

Study Area

The National Park Veracruz Reef System (Spanish acronym PNSAV), located on the Gulf of Mexico's east coast, in front of the city and port of Veracruz (Figure 1), is a Marine Protected Area (MPA) that contains 23 coral reefs, including six coralline islands, which formed in an area where coral formations are limited by the waters of the Antigua, Jamapa and Papaloapan rivers, and the strong winter winds called “nortes” (Salas-Monreal, *et al.* 2009; Salas-Perez and Granados-Barba, 2008; Salas-Perez *et al.*, 2008). This reef system is the largest in the Gulf of Mexico and probably functions as a bridge for various species dispersed between Caribbean and Florida reefs (Jordan-Dahlgren, 2008).

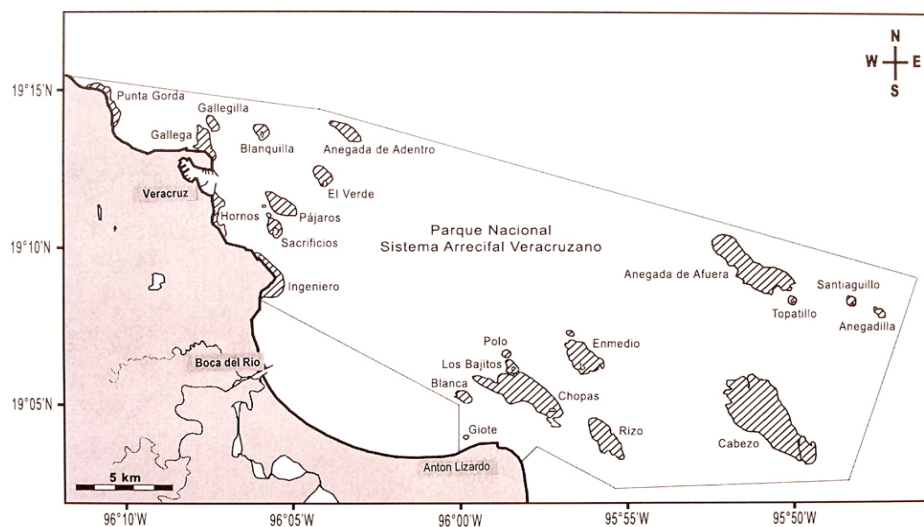


Figure 1. National Park Veracruz Reef System (PNSAV)

In the PNSAV there are several fisheries of commercial importance, extraction of shells for souvenir products; harvesting of ornamental aquarium fish for export; and for-profit recreational activities that include island tourism and SCUBA diving. Due to this importance the PNSAV was in 2004, classified as a RAMSAR site and in 2006 was declared a biosphere reserve by UNESCO. This MPA is one of the most studied areas in the Gulf of Mexico (Granados-Barba, *et al.*, 2007; Jordan-Dahlgren, 2008; Okolodkov *et al.*, 2007; Ortiz-Lozano *et al.*, 2009).

The objective of this study is to determine the monetary value of PNSAV taking into consideration three predominant commercial activities: island and reef tours, SCUBA diving, and fishing (food production).

This is a preliminary work to reveal: a) the spatial arrangement of activities taken place in PNSAV, identifying preference sites for SCUBA diving and recreational tourism; b) the travel costs for both SCUBA divers and surface tourists, c) the value of the reefs according to the activities taking place on them, d) calculate the value of the fisheries within the PNSAV with official information of catches and prices of species.

Methods

Following Hein *et al.* (2009), three ecosystem services were included in this study: SCUBA diving, surface tourism, and fishing. SCUBA divers and other tourists visiting the reefs and islands were interviewed during the summer of 2008. The interviews, which were conducted by park rangers, included each tourist's place of residence and reefs visited within the park. This information was used to calculate a preliminary estimate of the total value of the park. Dive shop owners were interviewed to determine the number of divers taken to the reefs per year, as well as an estimate of their client's total expenditures including hotel accommodations and restaurants during each visit. This information is presented on an accompanying map.

Information related to the value of catches was obtained from the National Commission for Fisheries (CONAPESCA) for the period 1998 to 2006. Although the data includes more than 80 species, we selected the most valuable (those above 3% of the total value of catches), and then eliminated all but reef and reef-related species. The reef species were those identified in an on-going reef census conducted by Institute of Marine Science and Fisheries (ICIMAP) researchers. The reef-related species are those found near reefs and/or feed predominantly on reef species (Pérez-España, pers. com.). The total area of the reef is 52,000 ha.

Results

SCUBA diving

The interviews totaled 115 for SCUBA divers and 689 for tourists. Table 1 shows the divers place of origin and the reefs they visited. Shop owners estimated a total of 15,000 diving trips in 2008, indicating only 0.95% of visitors were interviewed. They also provided estimates of average trip costs. All monetary figures are expressed in US Dollars.

Table 1. Estimates of total cost for SCUBA divers visiting PNSAV during 2008

Origin zone*	Visitors (%)	Total trip cost** (\$)	Total trips*** (#)	Total cost (\$) all visitors
1	36.5	279	5,484	1,531,097
2	19.4	303	2,903	880,258
3	30.0	335	4,516	1,513,806
4	6.5	423	968	409,548
5	6.5	903	968	874,065
6	1.1	1,463	161	236,000
			Total Cost	5,444,774

*1=Veracruz; 2=Neighboring states; 3=Central México; 4=Distant states; 5=USA; 6=Europe

** Includes transportation to Veracruz, hotel, food and diving costs

*** Total number of SCUBA trips per year (data from SCUBA diving shop owners) = 15,000

More than 90% of the divers are domestic, with about a third from Veracruz (or come from nearby communities), and a slightly lesser number from the urban Mexico City area. Foreign divers represent only 7.6% of the total.

The frequency of reefs visited is depicted in figure 2. The most visited reefs are those with 1) easy access (nearest Veracruz at the northern part of the PNSAV); 2) high degree of reef conservation; and 3) attractions such as the sunken ship. Figure 2 also shows the estimated value of the different reefs.

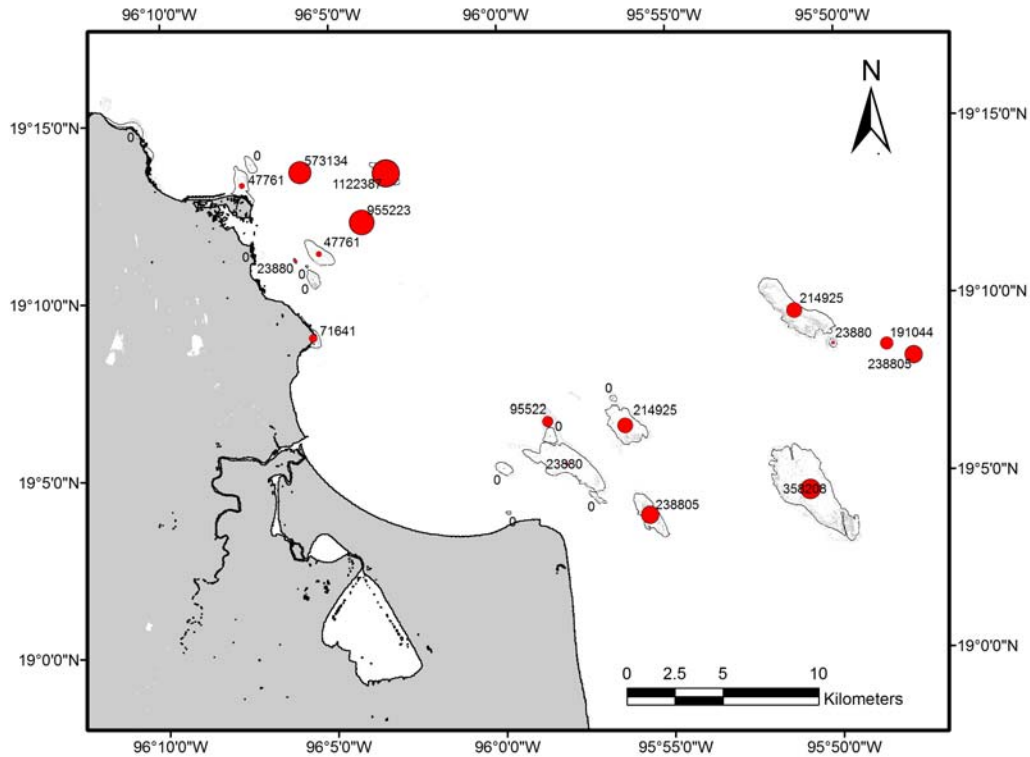


Figure 2. Map of the Veracruz national park reef system (PNSAV) showing the values of reefs for SCUBA divers

The surface tourists (non-divers) activities include much more than boat trips to the park's islands and reefs. Those activities include visits to the Veracruz aquarium, the floating warship museum, and numerous other local sites of interest. Consequently, it was estimated that only a third part of their vacation (an average of three days) was dedicated to the boat trip. Interviews also revealed that visitors are from the same areas than divers (Table 2). Unlike other coastal tourist areas in Mexico, Veracruz relies heavily upon national visitors.

Table 2. Estimates of total cost for surface tourists visiting PNSAV reefs and islands during 2008

Origin zone*	Visitors (%)	Total trip cost (\$)**	Total trips (#) ***	Total cost (\$) all visitors
1	13.5	75	13,498	1,013,125
2	18.6	80	18,578	1,486,212
3	59.2	91	59,216	5,388,679
4	5.5	116	5,806	673,440

5	1.5	251	1,451	364,296
6	1.4	409	1,451	593,614
Total Cost				9,519,365

*1=Veracruz; 2=Neighboring states; 3=Central México; 4=Distant states; 5=USA; 6=Europe

** Includes transportation to Veracruz, hotel, food and diving cost; the boat trip represents one third of the total cost because of other activities made

*** Total number of boat trips*year⁻¹ (data from tourist boat guides) = 100,000

The value per reef is shown in the map (figure 3).

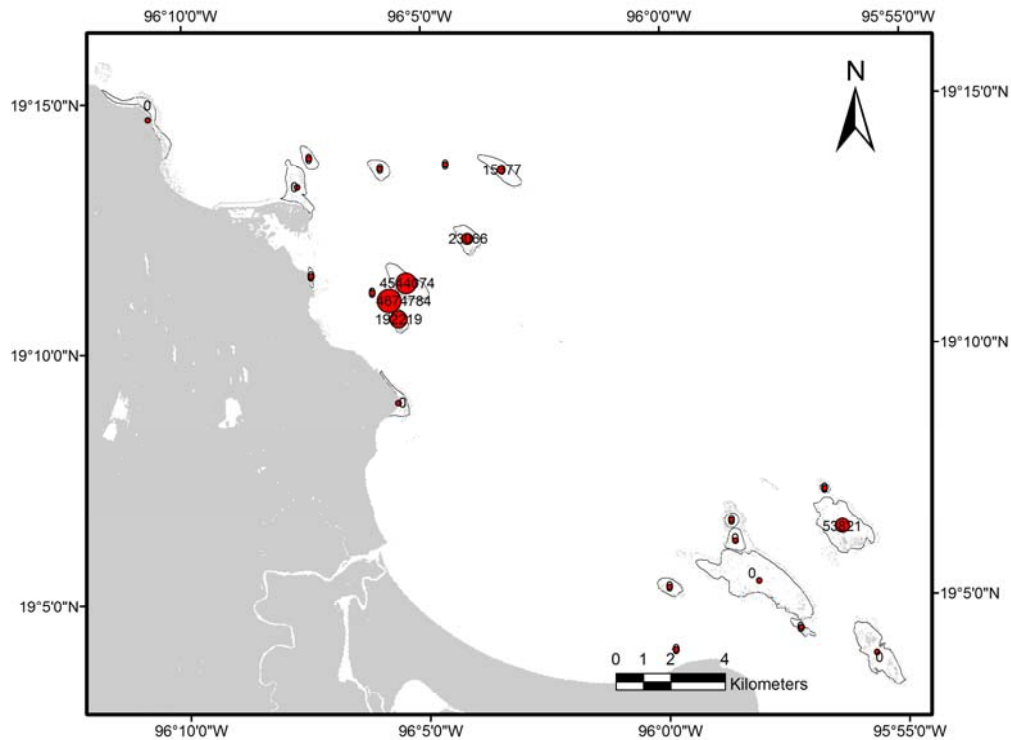


Figure 3. Map of the Veracruz national park reef system (PNSAV) showing the values of reefs for surface tourism.

Fisheries value

The fisheries within the PNSAV being multi-specific, we selected the 36 most valuable species for analysis. Figure 3 shows the annual value of reef and reef-related species captured in the PNSAV area. It was observed that the value of the catches abruptly decreased from 1999 to 2001, and then started to recover after 2002. The value for 2006 was \$1, 915, 047.

The reason for this change is the reduction of catches whereas the prices have increased only marginally.

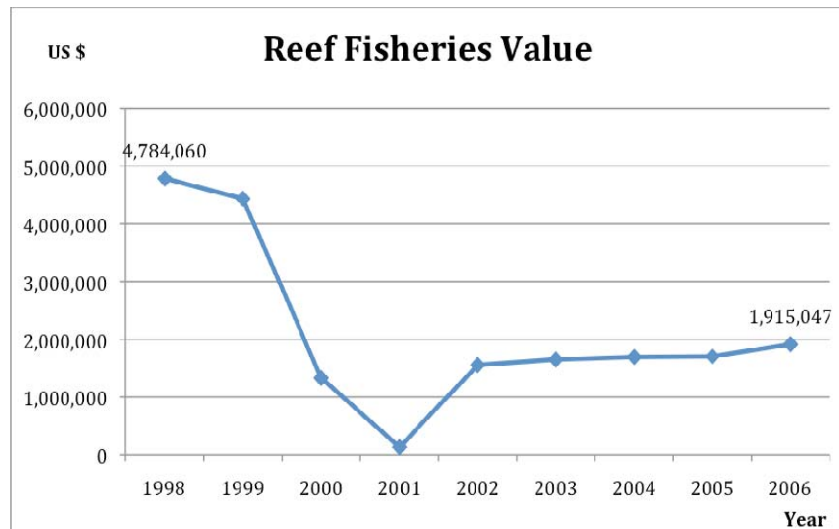


Figure 3. Value of reef fisheries in the PNSAV marine protected area 1998-2006.

While the prices of most species captured have consistently increased, the additional value has been offset by decreased volume. Figure 4 shows price fluctuations for five species.

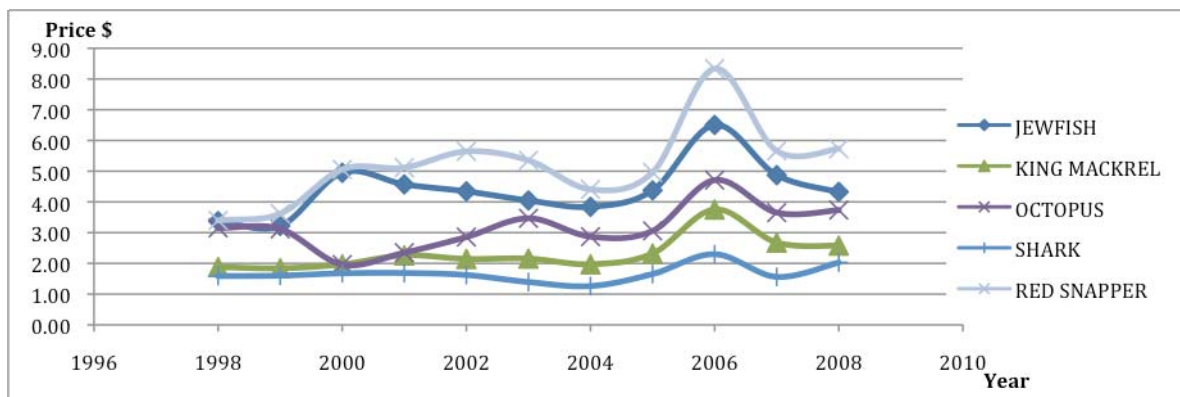


Figure 4. Average prices of some PNSAV marine protected area reef fish 1998-2008.

An analysis of catches and prices show the decrease in value of reef and reef associated fish is mainly related to decreases in catches.

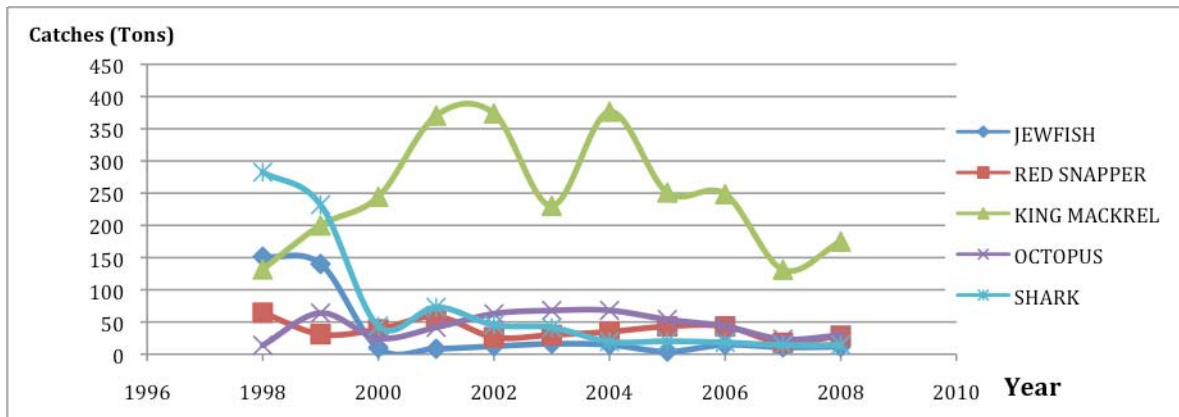


Figure 5. Total annual catches for some of the species within PNSAV 1998-2008 (tons)

Discussion

In reviewing the results of our study the first point of concern was the discrepancy between the reef values we assigned compared with those of previous independent estimates. Costanza *et al.*, (1997) estimated the value of coral reefs as food producers to be \$ 220 per year per hectare, and \$ 3,008 for recreational value (per year per hectare). Our estimates of the reefs as food producers for the year 2006 are approximately 17% of the value estimated by Costanza, and tourist value for 2008 are approximately 10%. Those remarkable differences merit closer scrutiny.

We believe the potential value of the reefs has not been realized, in part, because they are virtually unknown outside of México. Also, tourists are not provided with sufficient information about the marine protected area, and as a result are unaware of the reefs beauty, diversity, and ecological importance.

The accuracy of the estimated value of catches is extremely important to this study. Although most reef species can be easily identified from the catches, there are many other species that may not be included because they are not considered permanent reef residents. Some, however, are dependent upon the reefs because they hunt their prey within the reef and should be considered in total value estimations.

Due to time and monetary constraints, too few interviews with tourists have been conducted. A higher sample is required to achieve adequate reliability.

Because of the decrease of catches volume, more fishermen are requesting permits to transport tourists to the reefs and islands but so far those permits have not been issued. Fishermen currently lack expertise in dealing with tourists needs. But before more permits are issued, it is crucial to estimate the maximum ecologically safe tourist capacity for the reef system before issuing any more permits.

Acknowledgements

We are thankful to Michael J. Snyder for the editing of this document, as well as the park authorities for the information related to interviews performed in 2008 to tourists. We also thank the National Commission for Fisheries (CONAPESCA) who provided the information about the fisheries.

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