

Financial sustainability of the Hon Mun Marine Protected Area

Lessons for other marine parks in Vietnam

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Abstract

This study explores the relationship between economic values of coral reefs, coastal poverty, and policy interventions in Vietnam, using the Hon Mun Marine Protected Area (MPA) as a case study. Hon Mun was set up in 2001, and is currently funded by a 4-year US\$ 2 million programme (principally supported by international donors). This financial support has ensured sound management of its natural resources: it is recognized as a well-run MPA. In the long term, continued management would provide greater net benefits (particularly in terms of fisheries and tourism) than a 'no management' scenario. Yet to ensure future management, Hon Mun needs to develop its own sustainable and autonomous financing regime.

PREM Working Paper: 05/14

Keywords: Coastal poverty, marine parks, ecosystem management

Date: 5 December, 2005

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Acknowledgements

This research was funded by the Poverty Reduction and Environment Management (PREM) Programme. We would like to express our sincere appreciation to Truong Kinh, manager of the Hon Mun Marine Protected Areas and Mr. Ho Van Trung Thu, the IUCN representative at the Hon Mun Marine Protected Areas.

Poverty Reduction and Environmental Management (PREM)

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1. Introduction

Marine and coastal resources in Vietnam are under increasing threat from human activities (Burke, Selig and Spalding, 2002). One way to manage these threats is through Marine Protected Areas (MPAs), which safeguard valuable ecosystems within their confines. Despite the ecological and socio-economic benefits they provide, the management of MPAs is often severely constrained by both a lack of funding and a poor relationship with communities living around (or within) them.

Recently, the marine biological, ecological and management dimensions of coral reefs have received increasing attention from policy-makers; however, the inter-relationships between the economic values of coral reefs, coastal poverty and local livelihoods seem not to play a significant role in the policy-making process.

Many of the efforts aimed at coral reef management and conservation within MPAs in Vietnam have been initiated and implemented with insufficient consideration of the monetized value of coral reefs or the livelihood contexts of the local communities. Yet, these issues are crucially important for rational resource use and sustainable management in MPAs. Policy-makers repeatedly face the following questions: what are the main economic activities associated with the Hon Mun MPA? Which stakeholders depend on these activities, and are they sustainable? How do local residents feel they have been affected by the establishment of the MPA? Will active management of Hon Mun provide greater net economic benefits in the long term (compared to a 'no management' scenario)? How can these benefits be 'captured', both to fund MPA management and provide socio-economic stability for local communities?

Using the Hon Mun MPA as a case study, this study explores the relationships between i) the economic value of coral reefs, ii) coastal livelihoods, iii) coral reef degradation and iv) policy interventions in Vietnam. We estimated the economic value of coral reefs in the Hon Mun MPA through an analysis of reef fisheries and reef-related tourism, as well as other services provided by reef ecosystems. We also looked at the behavioural aspects of reef use by engaging with different reef stakeholders. We found out how villagers perceived changes in both quality of life and resources, and uncovered their views on resource impacts on human activities. To derive a decision-making framework for the MPA management options, we analyzed the costs and benefits of a 'with management' scenario and a 'no management' scenario. We established linkages between economic values of coral reefs, financial sustainability and local socio-economic issues. An approach that takes these linkages into account will be required for the sustainable management of the Hon Mun MPA.

Our results show that tourism benefits of coral reefs are the key source of revenue for park management and local livelihood improvements. We prove that, in the long term, continued management would provide greater net benefits (particularly in terms of fisheries and tourism) than a 'no management' scenario. Yet to ensure future management, Hon Mun needs to develop its own sustainable and autonomous financing regime. One way to 'appropriate' the park's potential economic benefits is through a user-fee for eco-tourists. Subsequent

revenues could be ploughed back into management of the park and its buffer zone, and could also support much-needed alternative livelihood schemes in the region. If implemented successfully, a ‘win-win-win’ scenario can be realized, where ecological, economic and social needs are fulfilled.

2. Background

The Hon Mun MPA comprises a group of eight islands: one large island (Hon Tre) and several small islands located in the south of Nha Trang Bay. The distance between the islands and the mainland ranges from several kilometers to about 15 kilometers (in the case of the furthest islands). The Hon Mun MPA can be seen as representative of Vietnam’s south central bio-geographic zone. Its biodiversity levels are comparable to those of the global centre of coral diversity, within Eastern Indonesia, the Philippines and the Spratly Islands (Vo Si Tuan, 1998). The site supports a variety of habitats and ecosystems, including fringing coral reefs, mangrove forests and seagrass beds, as well as an adjacent deep-water upwelling. Recent surveys have counted around 350 species of reef-building corals, 220 species of demersal fish, 106 species of molluscs, 18 species of echinoderms, and 62 species of algae and seagrass (Vo Si Tuan *et al.* 2002).

Hon Mun almost entirely supports the tourism industry in the city of Nha Trang. There are 5 diving schools based in Nha Trang, which use the area around Hon Mun Island as a dive site. Fishing is a major activity in the area, with about 79% of household heads being fishers. The fisheries are still small in scale and use a variety of fishing gears. Most of the fishing boats have limited power (15 – 45 CV) and trawl in offshore waters for squid by night. In-shore bottom trawling is also common.

The 5,300 inhabitants of the Hon Mun MPA greatly depend upon coral reef-based resources for their livelihoods. The three most significant productive activities for these inhabitants are, in order of importance: small-scale fisheries, lobster cage culture and fishing crew labor. All are considered to be dependent on coral reefs. The overall poverty level of villagers in the MPA is lower than that of communities in other coastal areas in Vietnam. Recent analysis also shows that the standard of living within the MPA is not as low as in other areas. Access to electricity, roads, and health care has been improved. However, the livelihoods of the poorest people have still not been guaranteed in terms of food security, vulnerability and unsustainable use of reef resources. As with MPAs everywhere, Hon Mun faces high human pressure and demands on its valuable coral reef resources. The biggest threats to the biodiversity of Hon Mun MPA include destructive fishing methods and over-fishing.

The establishment of the Hon Mun MPA was approved on 10 January 2001. Its four-year management project is principally funded by international donors, who have contributed over US\$2 million to date. This financial support has ensured sound management of its natural resources: it is recognized as a well-run MPA (ICEM, 2003). In the long term, its managers face two central questions: i) whether continued management would provide greater net benefits (particularly in terms of fisheries and tourism) than a ‘no management’ scenario and ii) how to develop its own sustainable and autonomous financing regime.

3. Methodology

3.1 Analytical framework

Figure 3.1 shows the structure of the analytical tools used in this research. The economic valuation component comprises the estimations of i) tourism values, ii) fishery and aquaculture values and iii) conservation values of coral reefs in the Hon Mun MPA. These estimated values are then used in the cost-benefit analysis for two management options: the ‘management scenario’ and the ‘no-management scenario’. The results of this analysis may help policy-makers decide whether to continue with MPA management (which is due to end in 2005). The estimated economic values of coral reefs are also essential to design an autonomous financing regime.

The ‘behavioral aspects of resource use’ component relates to the social dimension of the Hon Mun MPA. Pollnac (1998, p.5) argues that, “Attempts to understand the ecology of coral reefs must account for the behaviour of human beings”. We used indicators suggested by Pollnac (1998) and Pollnac and Crawford (2000), to assess behavioral aspects of coastal resource use. This provided a baseline assessment and a detailed understanding of the socio-economic, political and cultural characteristics of the community. Then we integrated the social results with the estimated economic values of coral reefs, in order to develop a potential approach for sustainable management of the Hon Mun MPA.

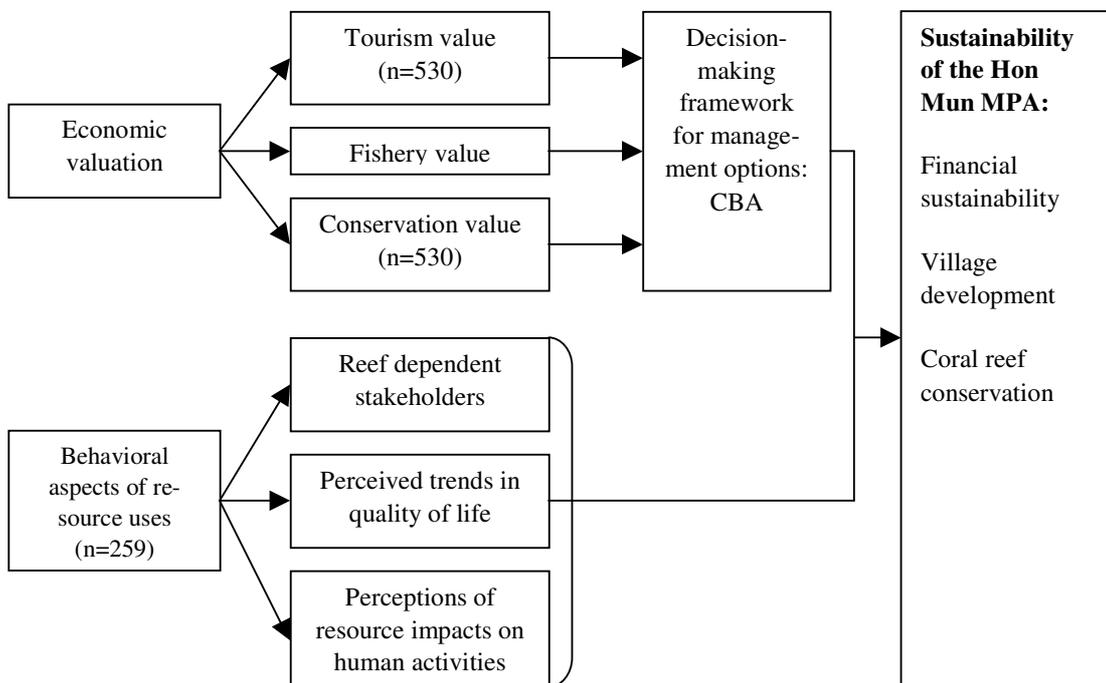


Figure 3.1 Analytical framework.

3.2 Economic valuation of coral reefs

This section builds on an economic valuation of recreational aspects of coral reefs in a small Vietnamese coastal island (Pham & Tran, 2002). This is part of a growing literature on the economics of coral reefs (Hodgson and Dixon, 1988; Spurgeon, 1992; Pendleton, 1995; Driml, 2000; Cesar, 2000, Cesar and van Beukering, 2003).

Total Economic Value is a basic concept for analyzing the economics of coral reefs. The Total Economic Value of a coral reef ecosystem is often used to express the value of all goods and services supported by coral reefs (Pearce and Turner, 1990; Pendleton, 1995). The Total Economic Value of coral reefs is taken as a function of “use” and “non-use” values. Use values comprise i) direct uses such as fisheries, recreation, education and building supplies; ii) indirect uses or functions such as coastal protection or biological support; and iii) option values that preserve options for future use. Non-use values consist of bequest values and existence values. Bequest values are the values associated with passing on natural assets intact for future generations. The existence value is often understood as the value of an ecosystem to humankind irrespective of whether it is used or not (Cesar, 2000).

Direct local use values can be attributed to the benefits that are gained through the use of coral reefs. These were estimated on an annual basis for two broad categories of use: near-shore fisheries and tourism. Indirect use values associated with coastal protection were not incorporated in the estimation, because this function plays a negligible role in this study site. This study focused on the two primary direct use values and avoided detailed examination of other minor local uses (which probably have less policy relevance). The study also estimated the non-use values of coral reefs. This conservation benefit was determined by asking people to express their preferences irrespective of whether they use the reefs or not. The value of the conservation benefit can be seen as a low estimation due to the so-called “nesting and part-whole effects” problem (Hanley, 2000, p. 242). These values combine to give a ‘lower boundary’ estimate of the TEV. (Note: the scope of this study did not allow for a separation of the non-use values into parts such as option, quasi-option, bequest and existence values.)

Tourism benefits

From the various travel cost models (Haab & McConnel, 2002), the zonal travel cost model (ZTCM) was selected to estimate consumer surplus of the recreational activities of coral reef users. The ZTCM divides the entire area from which visitors originate into a set of visitor zones and then defines the dependent variable as the visitation rate. The ZTCM was applied to divers and snorkelers in the Hon Mun MPA.

The production approach used in this research aims to estimate the producer surplus of those producer service providers willing to offer their services to divers/snorkelers (Cesar *et al.*, 2002). The benefits of producers were calculated through the value added of their direct and indirect expenditure related to the reef activities. Direct expenditure related to reef diving and snorkeling experiences includes boat tour tickets to the site, as well as diving/snorkeling equipment hire and services. Indirect expenditure includes transportation costs (both interna-

tional and national), hotel costs and other costs. To estimate the total value added of the reef-related activities, we have to assume a coefficient that reflects the service providers' share of profit. The recreational activities, directly and indirectly, have spill-over effects for the local economy through employment generation, development of secondary industries etc. The multiplier effect of the value added therefore needs to be taken into account. Since there has been no official calculation of the multiplier effect by the government or by other research studies, we assume a multiplier of 1.5 for tourism in general on Vietnam's economy (given the fact that the resources of Vietnam's economy are not fully employed¹).

Visitors were selected using the systematic sampling procedure. We interviewed 259 domestic visitors, of which 98 were divers and 161 were snorkelers. At the same time, 281 foreign visitors (112 divers and 169 snorkelers) were also interviewed. All the respondents were interviewed in the tour boats, on the way back to or in the port.

Fisheries benefits

The coral reef ecosystem is characterized by high biodiversity and productivity. These ecosystems support a great diversity of species of demersal fish, octopus, lobsters, mollusks etc. In the study area, coral reef ecosystems even support lobster and grouper cage culture, which are highly lucrative activities in the coral reef areas of Vietnam (IUCN Vietnam, 2003; Le Anh Tuan, 2002). Reef fisheries not only provide income, employment and foreign exchange, but also are a major source of animal protein for local people.

The production valuation method has been widely used to estimate the economic value of reef-associated fisheries. De Groot (1992) and Driml (1999) value the benefits of fisheries in the Galapagos National Park and Great Barrier Reef, respectively, using gross financial value of harvested products and ignoring the ecological economic linkages. Hodgson and Dixon (1988), Cesar (1996) and McAllister (1988) try to link reef quality and fishery productivity using a production function. Cesar (1996) discusses factors that determine the estimated fishery value of coral reefs. Cartier and Ruitenbeek (2000) discuss three types of weakness of this production valuation method for reef fisheries. Firstly, gross revenue of fisheries is usually taken at face value, ignoring opportunity costs of capital and labor in fishing effort. Secondly, the dynamics of coral reef habitats are often simplified and even ignored. Lastly, if the approach bases harvest rates on some level of extraction effort, it may overestimate value. Equally, if its harvest rates stem from maximum sustainable yield, it will likely underestimate the economic value.

In this study, we estimated the value added of reef-associated fisheries and aquaculture through calculations of the total gross value as well as costs and labor inputs. The commercial fishery data we collected covers both offshore and near shore fisheries. Therefore, when estimating reef fisheries' (near shore fisheries) value, we need to determine the reef-dependence of these fisheries. Our estimate of the total gross value of reef fisheries is based

¹ The multiplier of a full employed economy is 1 – a perfect competitive economy that reaches the efficient equilibrium.

on reef dependence, fish catch and fish price (Cesar *et al.* 2002). Another approach is to directly estimate the fisheries' value per km² of reef by multiplying annual potential reef fisheries yield per km² and average market price of reef fish (Cesar 1996).

Face-to-face survey interviews for households as well as focus group interviews were conducted to collect primary data (which included information on fishing, and ornamentals and pharmaceuticals from reefs). Secondary information was collected from the province's Department of Fisheries and reports of other related research. The secondary data was also collected from daily records of buyers and sellers.

Conservation benefits

We asked visitors to state their willingness to pay to ensure the reefs are maintained in their current state in Hon Mun Marine Protected Area. We also asked visitors about their willingness to pay for an improvement in coral quality. The method we used was Contingent Valuation with a payment card elicitation procedure. We estimated the reefs' value to the population of visitors, both international and domestic, to Hon Mun. However, our sample was confined to visitors who actually experienced the coral reefs during day visits.

A pre-test survey was performed on 30 people to identify questions which produced unexpected results and to define the bids in the payment card through open-ended questioning. Individual visitors were chosen as respondents for the interviews. A 'visitor' was defined as someone who used Hon Mun for diving/snorkeling. Villagers who lived within range of the islands were not included in the survey. Samples were taken using two approaches. The first approach was to directly interview divers/snorkelers. The second approach involved handing the questionnaire to visitors on boat trips and asking them to complete the forms. The research sample mainly covered the urban population of Vietnam because most Vietnamese tourists are from urban areas. Vietnamese in rural areas are too poor to afford the luxury of traveling.

3.3 Behavioral aspects of coral reefs uses

We employed Pollnac & Crawford (2000)'s approach that develops a set of indicators covering a range of human factors that potentially impact coral reefs. These indicators are categorised according to a set of baseline components: (1) identification of reef dependents; (2) perceived trends in quality of life and resources; and (3) perceptions of resource impacts on human activities.

Analysis of the reef stakeholders allows a better understanding of the interaction between reefs and people. To further understand reef stakeholders, we qualitatively analyzed this groups' occupation structure. Analysis of occupation structures helps to understand the relative importance of different components of coastal resources (Pollnac and Crawford, 2000). It shows the role of coral reefs in creating jobs and livelihoods for the coastal communities. Village statistics often provide occupational categories by grouping primary occupations such as fishing, aquaculture, agriculture and services. Yet, these kind of categories do not help to understand the role of coral reefs in sustaining livelihoods.

Perceived trends in quality of life is an important indicator for deriving behavioral aspects of resource use (Pollnac and Crawford, 2000). A survey was used to determine how respondents compare their well-being today with that of five years ago and five years in the future (better off, worse off or the same). They were also asked to provide reasons for the changes.

Information on how people perceive the impacts of their own resource use may help when setting up community-based management programmes. It would also help in the monitoring of changing perceptions over time (Pollnac and Crawford, 2000).

Information concerning community members' perceptions of coastal resources and potential human impacts on these resources was gathered from a sample of 259 respondents. These respondents were requested to indicate the degree of their agreement or disagreement with 10 statements. Each of the 10 statements involved some aspect of the relationship between coastal resources and human activities.

The data were collected using relatively rapid appraisal techniques, which include mapping, observation, key informant interviews and sample surveys. Socioeconomic data were collected over a period of four weeks using a household survey, key informants and direct observation. The sample size for the household survey was 259 (of the 991 households in the Hon Mun MPA). Households were selected using a random sampling procedure. We interviewed every 3rd or 4th household in each village road, depending on the number of households along each road. The questionnaire consisted of five sections: (1) Introduction, (2) Fishery activities, (3) Resource dependence, (4) Household's perception of resource uses, and (5) Socioeconomic profile.

Costs – benefits analysis

It is evident that policy-makers are increasingly interested in using cost – benefit analysis tools to make decisions with regard to environmental issues. They need information on benefits and costs of alternative scenarios. According to Beukering *et al.* (2002, p. 48), the overall approach (which is usually called the 'impact pathway approach') includes 4 main steps: (1) defining the study boundaries; (2) identifying the physical impacts that are economically significant; (3) quantifying the socio-economic effects; and (4) valuing these effects in monetary terms and conducting a sensitivity analysis. In short, this approach is a version of cost – benefit analysis often seen in the literature. The economic challenge is to address both the costs and benefits of reef management, within a context of ecological complexity (Ruitenbeek, 1999).

The scenarios were determined through consultations with local policy-makers, mainly those working in the management of the MPA. Policy-makers have several coral reef management-related questions: what is the total economic value of the coral reef ecosystem, and what are possible management options? In other words, is it worth managing the coral reef? And who is going to gain or lose from different management (or non-management) options? We selected two scenarios for investigation: with and without management.

Figure 3.2 shows the conceptual net benefits of coral reefs over time. The proposed scenarios yield benefits and incur costs over stakeholders' lifetimes. Graphically, we can directly

compare annual net benefits of the scenarios. To ascertain the magnitude of the total net benefits of the scenarios, net present values (NPVs) are usually used. In each scenario, not all benefits and costs can be expressed in monetary units; some benefits or costs can only be assessed qualitatively. In this study, the net benefits of coral reefs are defined as value-added of coral-associated tourism service suppliers, consumer surplus of divers and snorkellers, spill-over effects of reefs on the fishing industry, and the biodiversity values that visitors are willing to pay for in an improved marine park.

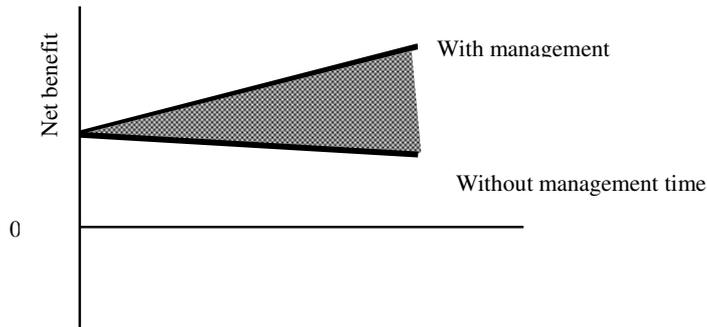


Figure 3.2 Conceptual net benefits of coral reefs overtime.

4. Value of resource uses in and around the Hon Mun MPA

4.1 Tourism benefits

The Hon Mun Marine Protected Area is the most heavily used marine reserve in Vietnam (Senaratna, 1999; Pham Khanh Nam and Tran Vo Hung Son, 2001), currently attracting around 300,000 visitors per year. However, the number of visitors who directly use the coral reefs by diving and snorkeling is much lower. The number of ‘dive days’ is 18,000 per year (4,500 and 13,500 for domestic and foreign visitors, respectively), served by 6 diving clubs, all based in Nha Trang city. The number of ‘snorkel days’ is nearly threefold, approximately 52,000 per year (36,400 and 15,600 for domestic and foreign visitors, respectively).

Consumer surplus

Using the Zonal Travel Cost Models, we separately estimated consumer surpluses for domestic and foreign visitors. For the domestic visitors, we divided the area around Hon Mun into 8 zones, with each zone being increasingly distant from the site. The four different functional forms were built up and tested for the best fit with the data. The log-linear model appears to be the best: with this model all the variables are statistically significant, high adjusted R-squared and the (perfectly) normally distributed disturbance terms. The coral-related tourism demand function in log-linear form is as follows:

$$\ln(zvisitrate) = -4.16 - 0.077zcost + 0.00161zinc \quad (4.1)$$

where $zvisitrate$ is visitation rate of a zone, $zcost$ is travel costs from a zone to the site and $zinc$ represents the average income of a zone. From the demand function, we built up the

demand curve and calculated the consumer surplus; this is the area under the demand curve and above the travel cost. The estimated consumer surplus per diver/snorkeler is VND 138,614.

The consumer surplus for foreign visitors was estimated in a similar way. However, a common problem involved in every zonal TC model for foreign tourists is zoning. The Hon Mun MPA is currently not a typical destination for foreign visitors who want to experience coral reefs. So the individual TCM, which is based on the variant number of trips per individual to the site, cannot be applied to Hon Mun. Besides, most of the foreign visitors who come to Hon Mun MPA are multi-site travelers. We divided the origins of foreign visitors into 10 zones. The travel costs gradually increase from zone 1 to zone 10. The categorisation of the zones here does not totally depend on distance from original country to Hon Mun, but on the travel costs (which include transportation costs and time costs). The linear log coral-related tourism demand function is:

$$VR = 1.102 - 0.208 \ln(tc) \quad (4.2)$$

where VR is visitation rate from a zone and tc is travel costs of tourists from that zone.

The consumer surplus of foreign diver/snorkeler at Hon Mun MPA is VND 1,076,460 per dive/snorkeler.

Producer surplus

The direct expenditure for diving and snorkeling experiences includes package tour tickets to the Hon Mun MPA. We assume only 25% of this expenditure can be considered as value added. The indirect expenditure for diving and snorkeling experiences includes lodging costs and travel costs. For the international air fare, we assume the value added is 3%. We also assume that the local travel and hotels yield the value added of 25%. The multiplier of these marine-related expenditures was assumed to be 1.5. Producer surplus or total value added is the sum of: value added of direct expenditure, value added of indirect expenditure and the multiplier effect of these expenditures. The estimated producer surplus is VND 11,381 million for the diving industry and VND 17,056 million for the snorkeling industry.

Total tourism values

The welfare gain of the visitors and value added for the economy from the reef-related recreation industry constitute the recreational benefits of coral reefs in Hon Mun for society. Table 4.1 summarizes the recreational benefits of coral reefs in Hon Mun, derived from applied valuation techniques.

4.2 Fisheries and aquaculture benefits

The net fisheries value per km² of reef was estimated based on i) the annual potential fisheries yield per km², ii) the average market price of reef fish per kilogram and iii) data on effort and cost to capture fish. The annual potential fisheries yield can be estimated as half the average reef fish standing stock (calculated from reef fish visual censuses when detailed

stock data is not available) (Uychiaoco *et al.*, 2004 quoted from Schaefer, 1954). The gross fisheries value of the reef is estimated at US\$15,538 per km² (by multiplying the annual potential fisheries yield per km² and the average price of fish). Consultations with experts in the Hon Mun MPA indicated that the spill-over effect of the MPA is negligible. The possible reason is that the MPA was established in 2001, so there has been little time for the spill-over effect to materialize. Therefore in this study, we gave the spill-over effect a value of zero.

Table 4.1 Annual recreational benefits of coral reefs in Hon Mun.

Consumer surplus in million VND (US\$)		Producer surplus in million VND (US\$)			Total recreational benefits in million VND (US\$)
Domestic visitors	Foreign visitors	Value added of direct expenditure	Value added of indirect expenditure	Multiplier effect	
5,669 (368,136)	31,323 (2,033,969)	9,071 (589,011)	9,888 (642,046)	9,479 (615,528)	65,430 (4,248,690)

After investigating various types of fishing gear (such as push net, purse seine, lift net, lobster seedling and diving) the recent survey by the Hon Mun MPA concluded that 70% of the gross fishing value is based on gains during the main fishing season (Hon Mun MPA 2002). We take this ratio to calculate fishing costs, valued at US\$4,661 per km² of reef. The estimated value-added fishery value is US\$ 1,740,256 per year, calculated from the gross fishery values, fishing costs and the total area of the MPA.

Lobster cage culture in Hon Mun MPA is now becoming a thriving industry. There were a total of 2,000 lobster cages with a total production of about 128 tons² in the MPA in 2003. Financial costs and benefits of lobster and grouper cage culture were estimated from 7 key informant interviews in the Hon Mun MPA.

We estimated the total value added from coral reef's support function for fisheries and aquaculture. This was based on the value added of each activity and its reef dependencies. Table 4.2 gives total values of reef-based fisheries and aquaculture in the Hon Mun MPA.

4.3 Conservation benefits

WTP of visitors to conserve biodiversity through a trust fund was assessed. Bid amounts ranged from VND 5,000 to more than VND 150,000 per dive/snorkel and from US\$1 to more than US\$10 per dive/snorkel for domestic and foreign respondents, respectively. 'Rejecters' represented 29.7% and 24.2% for domestic and foreign respondents, respectively.

² 1 cage produces 64 kg of lobster on average.

Table 4.2 Total values of reef-based fisheries and aquaculture in Hon Mun MPA.

	Quantity (tons)	Value added – million VND (thousands US\$)	Reef dependence (%)	Value added (US\$)
In-shore fisheries	13,000-70,000 kg/ 1.26-2.50 km ² *	1,740,256	100	1,740,256
Lobster	156	19,313 (1,254)	100	1,254,078
Grouper	Negligible ³	0	-	0
Total	-			1,994,334

* Uychiaoco *et al.* 2004.

Using the linear utility model, the mean WTP per visit was estimated at VND 48,288 (US\$ 3.1) for domestic visitors and VND 60,830 (US\$ 3.9) for foreign visitors. The total conservation value of Hon Mun's coral reefs was estimated to be approximately VND 1,975 million (US\$ 128,245) for domestic visitors and VND 1,770 million (US\$ 114,945) for foreign visitors.

5. Behavioral aspects of coral reefs uses

5.1 Reef dependent stakeholders

Generally, coral reef stakeholders are considered to be not only those living adjacent to the reefs and harvesting reef resources directly, but all those who consume various kinds of reef products and services (Whittingham *et al.*, 2003). In this study, we only considered direct users of reef resources in the MPA (i.e. villagers whose livelihoods are mainly based on harvesting, processing and selling reef resources).

Table 5.1 shows a ranking of productive activities undertaken by the MPA villagers. This distribution illustrates the role of coral reefs in creating jobs and sustaining livelihoods in coastal communities. It also helps to illustrate how local people depend on the reefs. Reef-related aquaculture was ranked second in importance by 24 percent of respondents, while near-shore fishing was ranked first by 47 percent. The diverse productive activities in the table are dominated by a narrow range of occupations, mainly fishing, aquaculture and crewing. These results imply that the local community's livelihoods depend heavily on coral reefs, which support their productive activities 100%. This undiversified occupational structure highlights the obstacles that the Hon Mun managers face in their conservation tasks.

³ Key informant interviews showed that the Hon Mun's water quality is not suitable for grouper cage culture because groupers are prone to disease.

5.2 Perceived trends in Quality of Life and Resources

The interviewees were asked to state their household well-being presently compared to 5 years ago. Around 30% of heads of each of the 259 respondent households indicated a better-off situation. There are two main reasons for this: lobster cage culture (31%) and more productive fisheries (21%). A good conservation program may create a beneficial source of hatchery and feed for lobster culture. More productive fisheries may be explained by greater investments in modern fishing gear and/or spill-over effects of the MPA.

Table 5.2 provides a breakdown of respondents' perceived quality of life in the Hon Mun MPA. In the order of 36% of respondents thought that they were presently worse-off due to less productive fishing (61%) and restricted access to fishing areas (11%). The reef conservation activities of the MPA have improved its ecological condition, attracting more tourists to the site (i.e. creating more economic benefits to society). Nevertheless, some local people have become worse-off, which may lead to increasing threats to coral reefs and management efforts. Less productive fisheries should not entirely be blamed on conservation activities of the MPA. The daily catch has decreased in part due to small scale fishing boats increasingly having to compete with more modern, well-equipped vessels. However, restricted access to traditional fishing areas and other conservation activities has undeniably contributed somewhat to the deteriorating situation of local fishermen. As a result, destructive fishing activities still take place within the MPA. This may be compounded by inadequate efforts to provide alternative income generation programs/ livelihood improvement strategies. This is usually blamed on inappropriate policies and insufficient resources for such efforts.

Table 5.1 Percent distribution of ranking of productive activities in Hon Mun.

Activity	1 st	2 nd	3 rd	4 th	Total
Fishing	47	10	-	-	57
Aquaculture	24	22	1	-	47
Crew member	20	10	1	-	31
Teacher	1	-	-	-	1
Fish trading	5	11	8	-	24
Mechanic	1	4	3	1	9
Husbandry	-	-	1	-	1
Tailor	-	2	1	-	3
Official	-	-	1	-	1
Processing/Handicraft	-	5	5	-	10
Total	98	64	21	1	

Table 5.2 *Percent distribution of perceived quality of life.*

Well-being	Compared to 5 years ago	Compared to 5 years in the future
Worse off	36.7	4.6
Same	32.8	68.3
Better off	30.1	26.6
Don't know	0.0	0.4

5.3 Perceptions of resource impacts on human activities

When analyzing behavioral aspects of reef uses, it is essential to understand individual perceptions of resource impacts on human activities. This may help when setting up community-based management programmes, and/or when attempting to monitor changes in these perceptions (Pollnac and Crawford, 2000).

Information concerning community members' perceptions of coastal resources and potential human impacts on these resources was gathered from a sample of 259 respondents. These respondents were requested to indicate the degree of their agreement or disagreement with 10 statements. Each of the 10 statements involved some aspect of the relationship between coastal resources and human activities.

The following statements were used:

1. We have to take care of the land and the sea or it will not provide for us in the future;
2. Fishing would be better if we cleared the coral where the fish hide from us;
3. If our community works together we will be able to protect our resources;
4. Farming in the hills behind the village can have an effect on the fish;
5. If we throw our garbage on the beach, the ocean takes it away and it causes no harm;
6. We do not have to worry about the air and the sea, God will take care of it for us;
7. Unless the coral is protected we will not have any small fish to catch;
8. There are so many fish in the ocean that no matter how many we catch, there will always be enough for our needs;
9. Human activities do not influence the number of fish in the ocean;
10. There is a limit to the area of the sea that can be used by the village.

The statements were arranged in the interviews so as to limit interference between similar statements (e.g., statements number 8 and 9 were separated by 7 other statements). It was also noted that agreement with some would indicate an accurate belief, while agreement with others would indicate the opposite. This was done to control situations where the respondent either agrees or disagrees with everything. Statements were randomly arranged with respect to this type of polarity. Respondents were asked if they agreed, disagreed, or neither (neutral) with respect to each statement. If they indicated either agreement or disagreement, they were asked if they agreed (disagreed) strongly, agreed (disagreed), or just agreed (disagreed) a little with the statement. This resulted in a scale with a range from one to seven. Polarity of the statement is accounted for in the coding process. In other words, as a score value changes from one to seven, this indicates an increasingly strong and accurate belief concerning the content of the statement.

The scale values associated with the nine statements involving beliefs concerning relationships between the coastal resources and human activities were factor analyzed. This was done using the principal component analysis technique and varimax rotation. One of the statements (“Farming in the hills behind the village can have an effect on the fish”) manifested very low loadings on all factors, so it was eliminated from the final analysis. The score test was used to determine the optimum number of factors to be rotated (Cattell 1966). The result of this analysis can be found in Table 5.3.

Statements loading highest on the first component involve the efficacy of human actions (we have to take care, protect, not clear coral, and work together) with respect to the health of the resource. Statements loading high positive on the second component involve perceptions of the lack of human control (God will take care of it), inexhaustibility (endless supplies of fish) and vastness (it can absorb all the rubbish) of the ocean. The items loading highly on component three (limit to area which can be fished and effects of farming on the fish in the water) seem to reflect an understanding of fish in their environment or context. Thus, the first component is labeled ‘*Efficacy*’, the second ‘*Vastness*’ and the third ‘*Context*’.

Component scores representing the position of each individual for each component were calculated. The component scores are the sum of the component coefficients times the sample standardized variables. These coefficients are proportional to the component loadings. Hence, items with high positive loadings contribute more strongly to a positive component score than those with low or negative loadings. Nevertheless, all items contribute (or subtract) from the score; hence, items with moderately high loadings on more than one component (e.g., tin roof and concrete wall in the analysis presented here) will contribute at a moderate level, although differently, to the component scores associated with each of the components. This type of component score provides the best representation of the data. In this report, for this data we will refer to these scores as Environmental Perceptions Component Scores (EPCS). They are standardized scores with a mean of zero and a standard deviation of one.

As a next step in the analysis, we thought it would be interesting to examine the correlations between the perceptions of the environment components and selected independent variables. It is hypothesized that younger individuals and those with more education would be more likely to provide environmentally correct responses to the environmental perception questions. Finally, we wanted to explore the relationship between relative wealth (as measured by electricity consumption and house value) and the responses to these questions. The results of this analysis can be found in Table 5.4.

Table 5.4 indicates that neither age nor house value is significantly related to any of the three environmental perception components. Education, however, is weakly related, but positively correlated (in a statistically significant way) with the efficacy and vastness components. Finally, respondents’ electricity consumption is positively related to the vastness component.

Table 5.3 Principal component analysis of conservation attitudes.

Statement (abbreviated)	Efficacy	Vastness	Context
We have to take care of the land and sea	0.752	-0.025	0.014
We must protect the coral for small fish	0.671	0.027	0.173
Working together can protect our resources	0.657	-0.097	-0.059
Fishing would be better if we clear coral	0.482	0.341	-0.113
God will take care of the sea for humans	0.121	0.709	-0.057
So many fish there will always be enough	0.030	0.663	0.212
Humans do not impact the number of fish	-0.195	0.550	0.091
The ocean can harmlessly absorb beach garbage	0.066	0.529	-0.366
Limit to sea area that village can use	0.079	0.056	0.706
Farms on the hill can effect fish	-0.025	0.017	0.668
Percent of total variance	17.458	16.549	11.820

Table 5.4 Correlations between components and selected independent variables.

	Efficacy	Vastness	Context
Age	0.041	0.079	-0.060
Education	0.090*	0.158**	-0.031
Electric bill	0.038	0.199**	0.003
House value	0.050	0.024	0.050

N varies between 501 and 510 due to missing data.

* = $p < 0.05$.

** = $p < 0.001$.

None of the independent variables are related to the context component score. Since years of formal education and relative wealth (as measured by electricity consumption) are significantly correlated with each other ($r=0.15$, $p < 0.001$), we thought it would be interesting to determine if they independently contribute (in a statistically significant way) to the variance in the vastness component score. A multiple regression analysis of these two independent variables and the vastness component finds that the multiple R is 0.247 ($F=14.785$, $df=2$ 495, $p < 0.001$) and the beta coefficients associated with both education and electricity consumption are statistically significant ($p=0.003$ and $p < 0.001$, respectively) indicating that both contribute in a statistically significant way to the vastness component score.

Research suggests that the role of marine systems in supporting fisheries has been deteriorating due to over-exploitation, degraded coral reefs, and poor management. The use of modernized fishing gear may have improved catches for certain fishermen, yet this is not a sustainable, long-term option. Conservation may provide some 'spill-over effects' in the form of an enhanced source of fry/feed for aquaculture and increased abundance of target fish stocks; yet these 'spill-over effects' are rarely instantaneous, and may take years to fully materialize.

Local livelihoods are already in jeopardy due to unsustainable use of reef resources. If income levels and food security further decline, it may become increasingly difficult to protect

reserve areas that have been historically used by fishermen. Already, fishing (including some destructive practices) is occurring illegally within the MPA. Hon Mun must provide greater stability to the local economy if conservation is to succeed.

6. Decision-making framework for management options

'Without management' scenario

Given the fact that the current financial support for Hon Mun MPA will end in 2005, we assume that management efforts at the present level will cease. It's worth noting that before the establishment of Hon Mun MPA, the local government used to invest in the Hon Mun area. The investment amounted to about US\$28,000 per year and funded activities related to fisheries management, including aquaculture development (GEF 1999). Although this addressed immediate national economic and social priorities, it failed to tackle the protection of the important coral reef, mangrove and lagoon ecosystems, or the incremental benefits to global biodiversity. The current enforcement level will be reduced. The natural functions of coral reefs, therefore, will decline, leading to a deterioration of the fishery industry in the long term. Eco-tourism will not be developed either (Ho Van Trung Thu, pers. comm. 13 June, 2004).

'With management' scenario

Under the 'with management' scenario, financial investment is assumed to continue, at least at the current level. Threats to coral reefs, such as destructive fisheries, coral mining, and unsustainable tourism will be eradicated. Eco-tourism will be developed to its maximum potential. Management of Hon Mun could clearly generate significant domestic benefits, especially from tourism. The hypothetical cost of operating Hon Mun as an MPA with the purpose of improving local communities' livelihoods, sustainable tourism development, and conservation of marine biodiversity, is estimated at US\$230,500 start-up costs plus US\$300,000 annual operating costs (GEF 1999; Ho Van Trung Thu, pers. comm. 13 June, 2004). (See Appendix 1 for detailed costs of the Hon Mun MPA). In this research, we considered the period from 2005 onwards, when the MPA's financial support comes to an end. As such, set-up costs were not taken into account. The new management scenario is based on the infrastructure established under the previous management system. We considered a time frame of 25 years, from 2005 to 2030, adapted from Beukering *et al.* (2003, p.6) who argued that "this period leaves enough time for the main environmental impacts to come into effect, while it is sufficiently short to estimate future development".

6.1 Tourism benefits

In the 'without management' scenario, net annual benefits of divers and the related service providers decline after 2010. However, due to the net benefits of snorkeler components outweighing the benefits of the divers, the total annual benefits of the 'without management' scenario still increase slightly over time. This rise in values can be explained by the

continued growth in numbers of tourists visiting the site (as it has not yet reached its maximum capacity). However, the coral reefs are not well conserved in this scenario.

It is clear that the ‘with management’ option causes the total annual benefits from coral-associated tourism to increase quickly right after the introduction of a new financial source in 2005. Since this financial source comes from beneficiaries i.e. divers and snorkellers, it excludes some tourists (i.e. those who protest against user fees). However, these protesters are negligible in number and do not significantly affect the rise of total values, which are mainly due to more beautiful coral reefs and the increasing numbers of tourists.

6.2 Fisheries benefits

The main difference between fisheries benefits associated with the ‘with management’ and ‘without management’ scenarios is the spill-over effects. In the ‘with management’ scenario, fishery values are high and sustained over time because lobster culture is supported (through the provision of feed, seed and water filtering). We assumed the spill-over effect would start working in 2006, after five years of protection. This would involve an increase of 10% per year until the maximum value of US\$3.43 million (100% capacity) was reached in 2015. In the ‘without management’ scenario, the support coral reefs provide to fisheries is assumed to remain constant at the 2004 level. Although, under this scenario, the MPA would not exist from 2005 onwards, the area would still receive government financing for resource protection activities and would still support lobster cage culture. Fishery production levels may not go down, though fisheries would not enjoy the spill-over benefits of protection (Ho Van Trung Thu, Nguyen Viet Vinh, per. comm. 13 June, 2004).

6.3 Biodiversity benefits

As mentioned, the estimation of biodiversity benefits depends on two main variables: average visitor WTP and number of visitors to the site. In the ‘without management’ scenario, annual biodiversity benefits (i.e. conservation values that visitors are willing to pay for an improvement of the marine protected area) are zero because there is no improvement without management. Management will attract more tourists to the resource and thus yield increasing biodiversity benefits over time. These benefits are estimated to reach a maximum level of US\$479,767 in 2015.

6.4 Total economic values of scenarios

We estimated total economic values for individual scenarios by aggregating the net benefits over time. Figure 6.1 shows the annual benefits for both ‘with’ and ‘without management’ scenarios over the period 2005 – 2030.

Net benefits of the ‘without management’ scenario, surprisingly, slightly increase until 2015 and are then sustained. Tourism and fisheries benefits of coral reefs (for one year at the present time) are particularly important, representing 51% and 46% of the total economic value respectively.

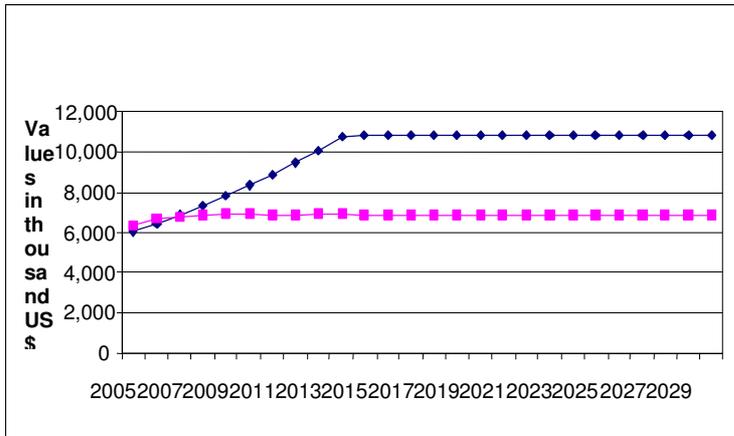


Figure 6.1 Net annual benefits over time of the Hon Mun MPA.

They will therefore determine the trend of the benefit flow over time. While the fisheries benefits remain unchanged over time, the tourism benefits increase due to the overall growth of the coastal tourism market (irrespective of unmanaged coral reefs). As mentioned, this increase mainly relates to snorkelers who enjoy coral reefs but are not sensitive to changes in coral biodiversity. The number of divers decreases over time but this does not significantly affect the total values.

In the first two years of the analyzed period, the annual net benefits of the ‘without management’ scenario outweigh the benefits of the ‘with management’ scenario. This is due to the ‘with management’ scenario’s higher costs. Until 2015, the net benefits of the ‘with management’ scenario increase gradually. This is the result of two main effects: i) better functioning coral reefs support tourism and fisheries and ii) the overall growth of the coastal tourism industry of Vietnam and Nha Trang (in particular).

Based on annual benefits of scenarios and the choice of social discount rates, the net present values of management scenarios can be calculated. Dagusta and Heal (1979) argue against a careless choice of social discount rate in a cost – benefit analysis (CBA). Sinden (1993) discusses whether to choose a specific social discount rate for environmental projects or not. Since the choice of discount rate is critical, a sensitivity analysis for discount rates is normally applied in CBA. We take this into account, and in order to have a representative number for the net benefits, we used an average discount rate of 12% over the period 2005 - 2030 to calculate net present values of scenarios. The net present value for the Hon Mun area over the period 2005 – 2015 is US\$70.3 million under the ‘with management’ scenario and US\$53.8 million under the ‘without management’ scenario.

Table 6.1 shows present benefits and costs of with and without management options for the period of 2005 – 2030. As highlighted above, net present values of both options are positive. In this study, we defined the management option as marine protected area management.

Table 6.1 Net present benefits and costs of management options for Hon Mun MPA.

Present Values (in US\$ million)	Tourism benefit	Fishery benefit	Conservation-benefit	Total Benefits	Costs	NPV
With management options	44.30	25.50	2.88	72.68	2.37	70.31
Without management options	30.47	23.64	0.00	54.12	0.22	53.89

Hence, ‘without management’ means the marine protected area will not exist at the site, but the site will still be under management of local government. The main contribution of the MPA management scenario is tourism benefits. One of the biggest challenges that the Hon Mun MPA faces is sustainable financing (Chu Tien Vinh *et al.*, 2003). A possible solution is to apply a so-called “conservation fee” for users of the coral reefs. The large tourism benefit implies adequate justification for this conservation fee. It’s worth repeating that this tourism benefit comprises consumer surplus and producer surplus. Only the “conservation fee” is attributed to (or at least relates to) consumer surplus, while benefits of producers belong to the transportation industry, hotels and restaurants, and diving schools. It implies that the policy-makers who are expected to be users of the cost – benefit analysis must have a broad view of benefits and costs of the MPA. While the costs are easy to see as monetary outflows, the benefits of management are set in a wider context. These include, for example, profits of international travel agents or fisheries spill-over effects, and sometimes intangible benefits such as consumer surplus of divers/snorkelers or use of future generations etc.

7. Conclusions and policy recommendations

Threats to Vietnam’s MPAs are largely a consequence of policy-makers giving inadequate attention to the wider socio-economic context in which parks are set. MPA managers need to shift their focus to the inter-relationships between marine resource dependency, local livelihoods and coastal poverty. Consideration also needs to be given to the economic values of marine resources, and how these can be ‘captured’ for the benefit of parks and their residents. Overall, achieving success is not only about raising park funds but also about spending these funds appropriately, and in line with local circumstances.

Hon Mun currently enjoys a US\$ 2 million (largely international) funding programme, which is quite exceptional for a Vietnamese MPA. This external financing will soon come to an end, and alternative funding must be secured to guarantee the park’s long-term future. In this study, the economic outcomes of two different policy scenarios were computer simulated in order to evaluate the long-term gains of park management. Impacts on tourism, fisheries, and biodiversity were considered individually, and then combined to generate an overall economic value for the scenarios.

The net benefits of the ‘with management’ scenario increase until 2015, after which they remain stable and considerably higher compared to the ‘without management’ scenario. This is a result of three main factors i) healthier marine ecosystems sustain more productive capture fisheries/aquaculture ii) preserved marine life (particularly reefs) attract greater

numbers of tourists and ii) Vietnam's coastal tourism increases regardless of marine conservation initiatives (at least during the period under consideration).

Table 7.1 A proposed user fee scheme for Hon Mun MPA.

Type of tourists	Country of origine	Number of visitors	Service charge	Conservation fee	Combined amount	Total Revenue
Snorkelers	Vietnam	36,400	\$ 0.65	\$ 0.65	\$ 1.30	\$ 47,273
Divers	Vietnam	15,600	\$ 0.65	\$ 1.30	\$ 1.95	\$ 30,390
Other visitors	Vietnam	209,100	\$ 0.00	\$ 0.65	\$ 0.65	\$ 135,779
Snorkelers	Foreigners	4,500	\$ 1.95	\$ 0.65	\$ 2.60	\$ 11,688
Divers	Foreigners	13,500	\$ 1.95	\$ 1.30	\$ 3.25	\$ 43,831
Other visitors	Foreigners	20,900	\$ 0.00	\$ 1.30	\$ 1.30	\$ 27,143
Total		300,000				\$ 296,104

This study indicates that tourism will generate the greatest economic benefits for Hon Mun over the next two decades. Policy-makers need to 'capture' a proportion of these benefits in order to fund operating costs and support communities who, as yet, do not sufficiently gain from marine conservation. One way of doing this is through a 'user-fee' for park visitors. Based on current visitor numbers, a user fee of US\$0.65 for non-divers and US\$1.30 for divers would raise almost US\$300,000: enough to adequately manage the MPA (Table 7.1).

A proportion of these funds could be allocated to improving income generation programmes for affected fishermen. Residents could also be encouraged to become involved in the tourism industry directly, for example if they were given subsidized jobs or appropriate training. Top down management is by no means made redundant by community involvement or by the development of tourism. Uncontrolled tourism development can itself cause ecological degradation. Equally, a community-based management approach will not deter illegal fishing in its entirety. As such, a regulatory approach to marine conservation still has a critical role to play. A user-fee is one prevalent way of appropriating the benefits of MPAs, as visitors are typically willing to contribute to park management. However, alternative revenue generating mechanisms might work more successfully in Vietnam's other MPAs, particularly those that are not popular tourist destinations. Funding opportunities include: government appropriations, levies, surcharges, leases and concessions, bio-prospecting, trust funds, donations, corporate sponsorship, debt-for nature swaps and international donors. All of these options (individually, or preferably in combination) could be explored by MPA management authorities along the coast. Without the socio-economic stability that this funding could provide, the long-term conservation of Vietnam's marine ecosystems is uncertain.

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