Ecotourism: Good for biodiversity conservation and communities’ well-being?

- An analysis of Nha Trang Bay Marine Protected Area in Viet Nam

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**Abstract**

This study examines influence of ecotourism on biodiversity conservation and the economic performance of the local community. The Nha Trang Bay Marine Protected Area, Vietnam, is used as the study case, with data collected from 150 households and 60 tourism providers. The statistical method and the propensity score-matching technique are employed for the analysis. We demonstrate that ecotourism has been both positively and negatively influencing on economic well-being of the community but negatively impacted marine biodiversity conservation over years.

**Key words** Biodiversity, ecotourism, economic well-being, marine protected area, Nha Trang Bay, propensity score matching

**Introduction**

Marine protected areas (MPAs) are of growing interest globally and also in Viet Nam. They are considered as a common tool for the protection of coastal, marine and fishery resources (Dudley, 2009; Gossling, 1999; Pauly et al., 2002; Halpem, 2003, Fernandez and Pham Do, 2010). In many developing countries, the management of MPAs has become an important policy that involves a dynamic and participatory process, where an integrated strategy is applied for the conservation and sustained multiple use of the coastal zone, taking into
account traditional, cultural, and historical perspectives (Webb, Maliao, & Siar, 2004; Hayens and Tu, 2005; Thuy, 2015).

However, the real effectiveness of MPAs is still questionable. MPAs are principally studied from a biological perspective, with some cases documenting improved environmental conditions and increased fish yields. The MPAs that meet narrowly defined biological goals are generally presented as “successes”. These same MPAs may, nevertheless, be social “failures” when social evaluation criteria are applied. This implies that standards for measuring both biological and social success should be applied equally and that MPAs should be designed to meet multiple social and biological goals.

Like many other coastal states, Viet Nam has taken initiative to establish MPAs since the 1980s. However, until 2001, a pilot project on the establishment of MPAs was carried out in Hon Mun. The project was funded by the Global Environmental Facility (GEF) through the World Bank, the Danish International Development Agency (DANIDA). The Ministry of Fisheries, Khanh Hoa People’s Committee and IUCN – The World Conservation Union were responsible for implementing this project. The reason why the Nha Trang Bay MPA was selected for the first comprehensive preservation project was that this area has the highest marine biodiversity in Viet Nam. It comprises a diverse array of tropical habitats including coral reefs, seagrasses, mangroves, sandy beaches and rocky shores. In total, 350 species of reef-building scleractinian corals, 220 species of demersal fishes, 106 species of molluscs, 18 species of echinoderms, and 62 species of algae and seagrass have been recorded (Tuan et al., 2005).

MPAs are considered to be a measure for “Integrated Ocean Management” in Viet Nam (Hoi, 2013). Management has changed rapidly from managing development of activities that traditionally take place within MPAs, such as fisheries and aquaculture, to focusing on new entrants, particularly the tourism industry. Tourism has been identified as an important

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1 The Ministry of Fishery is merged into Ministry of Agriculture and Rural development in 2007
instrument to help the communities within and around MPAs diversify out of the fishing industry. Broadly, tourism is one of the alternative income generating activities that can promote economic growth in coastal areas (Goodwin and Swingland, 1996; Kiss, 2004, Kruger, 2005), particularly in Viet Nam (Hayens and Tu, 2005; Thuy 2015).

The creation of MPAs might bring a paradoxical effect. On the one hand, MPAs is meant to protect species and biotas. On the other hand, MPAs also highlights the qualities of the areas and the abundance and richness of habitats and ecosystem, which makes them more attractive for tourists and thereby lead to higher pressures. The rapid development of ecotourism and the loss of biodiversity in Nha Trang Bay MPA may imply that there is a linkage between ecotourism and biodiversity. Even though some of the tourism activities may help protect biodiversity, it is also obvious that ecotourism can impact biodiversity more negatively. The literature on MPAs shows that tourism development in connection with MPAs in Viet Nam has led to consequences: landscape fragmentation, vegetation degeneration, and coastal erosion, which in turn impedes the goal of economic growth (Garcia-Herrera, 2010; Hayens and Tu, 2005; Thuy, 2015). Conflicts regarding land use between tourism and the fishing industry and local community have increased significantly (Lan, 2009). In these conflicts, there are both winners and losers. Without sustainable strategies, the natural resource rent will be unevenly distributed and growing inequality will represent a big challenge (Tuan et al., 2010; Thuy, 2015). Thus, there is a need of recognition of and research into the impacts of tourism on marine biodiversity and community well-being in MPAs.

The main objective of this paper is to analyze the effects of tourism on biodiversity conservation and well-being of the local communities in and around the Nha Trang Bay MPA. More specifically, the paper investigates: (1) How has tourism affected the biodiversity health of the Nha Trang Bay MPA?, and (2) How has tourism affected the well-being of the local communities? This can actually happen in two ways – through the linkages to the
tourism industry and through the ecosystem effects. In addition, other pressures that may affect the biodiversity of the Nha Trang Bay MPA are discussed.

The remainder of the paper is structured as follows. First, I provide the study site of Nha Trang Bay MPA, in which an overview of the tourism industry and the population development in this area is presented. Next, I discuss challenges in measuring the effects of tourism on biodiversity conservation and communities’ well-being and present the methodology including the conceptual framework and data. Key findings are then given in the results section, in which the effects of tourism on biodiversity conservation and communities’ well-being are highlighted. Finally, I discuss and summarize the main findings.

**Nha Trang Bay Marine Protected Area, Viet Nam**

Nha Trang Bay MPA is a group of 9 islands (Hon Tre, Hon Mieu, Hon Tam, Hon Mot, Hon Mun, Hon Cau, Hon Vung, Hon Rom, Hon Noc) and surrounding waters. It is located south of Nha Trang city. Its total area is approximately 1600 km², of which 380 km² are land and 1220 km² are waters surrounding those islands (Nam et al., 2001).

In 2002, the People’s Committee of Khanh Hoa Province issued a temporary regulation and zoning scheme for the Nha Trang Bay MPA. The scheme set out a series of management zones to regulate extraction of resources within the MPA and balance marine biodiversity conservation and resource use. Three zones are applied, with different levels of use and protection: core zone, buffer zone and transition zone.
Figure 1: The zoning scheme and tourism sites in Nha Trang Bay MPA in 2002

(★: site locations for coral data)

(Source: Hon Mun MPA Authority, 2002)

Figure 2: The rezoning scheme in Nha Trang Bay MPA in 2005

(Source: Hon Mun MPA Authority, 2005)

Figure 1 shows zones of the Nha Trang Bay MPA established in 2002. After some adjustments in 2005, the island of Hon Noc, to the East of Hon Tre, was removed from the core zone. The north eastern Hon Tre and the southern corner of this island, known for high coverage of seagrass, was added to the core zone sanctuary (see Figure 2). The core zones including Hon Mun, Hon Rom, Hon Vung and Hon Cau islands become perfect areas for marine organisms to exist in and to restock themselves. Within core zones, aquaculture and fishing activities, except traditional dam dang fixed net, are strictly forbidden. A limited number of tourists are allowed, and they can only swim, dive or go snorkeling. However, buffer zones are open entirely for tourism activities and traditional fishing gears. Management activities are focused on the “no anchoring” zone as well as planned aquaculture. Spearfishing and dive fishery are also open but limited for buffer and transition zones (ICUN,

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2 This rezoning scheme has not approved yet by the government
It should be noted that trawling and destructive fishing as well as polluting activities are forbidden in all three zones.

The establishment of the zoning scheme for the MPA had consequences for the development of tourism and existing livelihoods of the local people. Some areas are highly developed and extensively modified through provision of infrastructure, such as Hon Mun and Hon Tam. These areas are normally constructed with sealed roads, car parks, toilets, visitor centers, picnic areas, camping areas and accommodation, thus often attract large numbers of people. In contrast, other zones within the same protected areas may be classified as remote, where there is limited access, no or few facilities, and only small numbers of visitors, and there are restrictions on the types of activities permitted. In the latter category, Hon Mieu and Hon Tre are the most notable areas. In Hon Mieu island, Tri Nguyen aquarium and Bai Soi swimming beach are popular but the other parts of the island are still unaffected by tourism. Dam Bay and Vung Ngan in Hon Tre have not been affected by tourism until now, but they will soon be involved because several tourism projects are about to be implemented.

The Nha Trang Bay MPA has a resident population of 4,709 people, with an almost equal distribution of males and females. The population is housed in five communities, which are located in three of the nine islands of the MPA: Hon Tre (Bich Dam, Dam Bay, Vung Ngan), Hon Mot, Hon Mieu, and they make up 1,045 households (Nha Trang Bay Border Defense, 2015). The people are relatively young, with 36% being under the age of 15. The education level is low. Of the household heads, 64% have the equivalent of a Grade I education (basic literacy skills 7-11 years old), 22% Grade II (12-15 years old) and only 5% Grade III (16-18 years old). For partners, usually women, the level of literacy is lower, with only 7% having a Grade II and 5% a Grade III (MPA authority, 2014). The vast majority of the population relies on fishing as the primary bases of their livelihoods, 30% of the households are involved in aquaculture. Both fishing vessels and aquaculture farming are
small scale and mostly practising within the MPA. Yield is for both their own food consumption and the local markets. Almost all households have no other sources of income (Khanh Hoa Department of Agriculture and Rural Development, 2009).

Table 1: Population at Nha Trang Bay MPA in 2014

<table>
<thead>
<tr>
<th>Island</th>
<th>Household (family)</th>
<th>Population (people)</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hon Mieu</td>
<td>657</td>
<td>3,040</td>
<td>38.1</td>
</tr>
<tr>
<td>Hon Mot</td>
<td>26</td>
<td>96</td>
<td>8</td>
</tr>
<tr>
<td>Hon Tre</td>
<td>362</td>
<td>1,473</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>- Bich Dam</td>
<td>192</td>
<td>865</td>
</tr>
<tr>
<td></td>
<td>- Dam Bay</td>
<td>60</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>- Vung Ngan</td>
<td>110</td>
<td>550</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,045</strong></td>
<td><strong>4,709</strong></td>
<td><strong>73.1</strong></td>
</tr>
</tbody>
</table>

(Source: Nha Trang Bay Border Defense, 2015)

Tourism has played a central role in the economic development of Khanh Hoa province. It is reported that there were about 3.6 million visits to Nha Trang in 2014, most of which are domestic tourists. The figures were much smaller in the previous years, about 334,000 in 1998 and 500,000 in 2001 (see Figure 3). The annual growth rate of tourist arrivals was 16% during the period 1998-2014. The average length of stay for international tourists has seen a decline from 3.2 days in 1998 to 2.3 in 2008, but a rise afterwards to 2.9 in 2014. Meanwhile, the length of stay for domestic visitors has increased from 1.8 in 1998 to 3.1 in 2004, and then likely down to 2.4 in 2014 (see Figure 4). Turn-over in the tourism sector has increased tremendously from 883 to 3,950 billion USD. During the period 2005-
2013, the annual growth rate has been 5.5% (GSO Khanh Hoa, 2014). This contributed to 5.6% of the GDP of the province in 2010. The number of people working in tourism has increased over the years. The figure was only 2,332 in 2000 and doubled after 5 years. In 2010, there were 10,348 people employed, which is about 6% of the employees in the tourism industry of the whole country (Thuy, 2013).

**Figure 3: Tourist arrivals to Nha Trang during the period 1998-2014**

(Source: Khanh Hoa Culture, Sport and Tourism Department, 2015)

**Figure 4: Average length of stays of tourists to Nha Trang**

(Source: Khanh Hoa Culture, Sport and Tourism Department, 2011)
Nha Trang Bay MPA is the mainstream for ecotourism in Khanh Hoa province. The definition of ecotourism is a continued lack of understanding. The result is that what is advertised as ecotourism often represents a trip into nature with little or no consideration given to the consequences. In Nha Trang Bay, the two prevalent nature tourism models are island tours and sea tours. Thus, it is reasonable to assume that ecotourism is dominated in this area.

At the early stage, Nha Trang Bay MPA received annual visitation from 30,000 people in 1995 to more than 400,000 people in 2003. About 10% of them joined diving and snorkeling in Hon Mun MPA (Tuan et al., 2004). However, in the subsequent years there was a dramatic increase and diversification of operations. In 2013, 720,480 tourists, which is 24% of the tourist arrivals, made a visit to the MPA (NTB MPA Authority, 2014) (see Figure 5). There are currently 124 tourist boats run by 19 companies, being a mix of slow wooden boats with a capacity of around 50 horse power (HP) and small speed boats. Among these, 53 boats are registered with capacity of 20 to 40 people, and 71 boats with capacity of 41 to 100 people (Nam, 2014 and Khanh Hoa Culture, Sport and Tourism Department, 2014). Boats can be hired privately or tourists may join daily excursion boats. Hon Mun, Hon Mieu, Hon Tam islands take important roles in attracting eco-tourists. Main ecotourism activities are diving, snorkeling and swimming. There are 6 registered main dive sites served by about 20 diving centres around these islands with approximately 5,000 “dive times” and 7,000 “snorkel times” per year. Northeast of Hon Tam island is the most popular destination for both motorized water sports (including jet-skiing, parasailing ...) and non-motorized water sports (including windsurfing, kite surfing, kayaking).
Figure 5: Tourist arrivals to Nha Trang Bay MPA during the period 1995-2014

(Source: Nha Trang Bay Border Defense, 2015 and Tuan et al., 2004)

Measuring the effects of ecotourism on biodiversity and the health of communities

The difficulty of working out the notion of biodiversity is related to the fact that it is a compound concept, including ecosystems, species and genes. And even if this is clarified, there are no good time series of data on all relevant aspects.

An alternative approach to overcome drawbacks of discussion of impacts of ecotourism on biodiversity is to assess which ecotourism activities might cause loss of biodiversity. The typical approach would be “dose-effect relationship research”. In dose-effect relationship studies, the aim is to demonstrate the relationship between the ‘doses of recreation and tourism’ and biological effect variables (Philipsen 1998). Such studies are enormously complex, as tourism has a variety of different types of impacts on biodiversity.

The composition of the ecotourism industry complicates measuring impacts (Dietvorst and Ashworth 1995; Lash and Urry 1994; Tremblay 1998). In its most simple form, tourism consists of transport, accommodation and recreational activities. When trying to measure the relationships between ecotourism and biodiversity, one should take into account the impacts of both construction and maintenance of tourism infrastructure as well as use of these
facilities by tourists. Typically, for many of these elements of the tourism chain, the impact will vary from one tourist to another (and from one producer to another) depending on activity patterns and general behavior. Impacts on biodiversity can be positive or negative, direct or indirect, temporary or lasting, and can vary in scale from global to local.

Furthermore, it is hard to distinguish the effects of ecotourism from other pressures such as fishing, aquaculture, invading species, long range pollution, climate change, acidification, etc. Tourism can affect the local economy and increase or reduce the pressure from other industrial activities,…In addition, there are also natural variations that has little to do with human interference.

In summary, it is argued that measuring impacts of ecotourism on biodiversity is highly complex and costly, and balancing between biodiversity conservation and economic well-being is a great concern. Therefore, setting priorities for interventions is not only a matter of knowledge on impacts. Interventions in the relation between ecotourism and biodiversity should also be based on considerations of legitimacy, feasibility and effectiveness.

This paper aims to analyze ecotourism in relation to biodiversity conservation and healthy communities by searching for statistical evidences on these historical linkages, as well as examine empirically community’s well-being when ecotourism was introduced to this area. It also discusses different types of interventions currently undertaken and proposes some leads for future interventions.

Methodology

Theoretical framework
Figure 6 illustrates linkages between ecotourism and biodiversity and community’s well-being. The conceptual framework identifies consequences that ecotourism might generate for biodiversity and communities’ well-being.

Biodiversity consequences due to ecotourism development can be measured by: (1) historical changes of species that tourists are interested in. Coral reef and reef fish are considered for evaluation in this study; (2) wildlife area lost by tourism infrastructures; and (3) ecotourism’s threats (direct and indirect) that affect biodiversity. Direct threats are factors which directly affect biodiversity (see Table 2). For instance, snorkeling, diving and boating can cause direct physical damage to reefs. Fishing and collecting can contribute to over-exploitation of reef species and threaten local survival of endangered species. Indirect threats are the drivers that lead to the direct threats. These relate to the seafood consumption, development, construction
and operation of tourism infrastructure as a whole (resorts, marinas, ports, airports, etc.) (see Table 3).

**Table 2: Activities with direct impacts**

<table>
<thead>
<tr>
<th>Activities with direct impacts</th>
<th>Actual and/or potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snorkeling</td>
<td>Physical damage (breakage, lesions)</td>
</tr>
<tr>
<td></td>
<td>Kicking up sediment</td>
</tr>
<tr>
<td>SCUBA diving</td>
<td>Physical damage (breakage, lesions)</td>
</tr>
<tr>
<td>Motor boating and yachting</td>
<td>Physical damage from anchoring</td>
</tr>
<tr>
<td></td>
<td>Physical damage from boat groundings</td>
</tr>
<tr>
<td>Fishing</td>
<td>Contribute to over-exploitation of reef fish stocks</td>
</tr>
<tr>
<td></td>
<td>Compete with local fishers</td>
</tr>
<tr>
<td>Collecting (shells, lobsters, conch, coral)</td>
<td>Threatening local survival of rare species</td>
</tr>
<tr>
<td></td>
<td>Contributing to over-exploitation and competing with local fishers</td>
</tr>
</tbody>
</table>

(Source: UNEP, 2015)

**Table 3: Activities with indirect impacts**

<table>
<thead>
<tr>
<th>Activities with indirect impacts</th>
<th>Actual and/or potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resort development and construction</td>
<td>Increased sedimentation</td>
</tr>
<tr>
<td>Resort operation</td>
<td>Sewage disposal</td>
</tr>
<tr>
<td></td>
<td>Fertilizer runoff</td>
</tr>
<tr>
<td></td>
<td>Irrigation</td>
</tr>
<tr>
<td></td>
<td>Nutrient enrichment</td>
</tr>
</tbody>
</table>
Solid waste disposal  Leaching of toxic substances from inappropriate waste disposal  Litter (especially plastics)

Seafood consumption  Over-exploitation of high-priced resource species (snapper, grouper, spiny lobster, conch)

Demand for marine curiosities  Exploitation of rare/ endangered/ vulnerable species such as shells, black coral, turtles

Construction of artificial beaches and beach replenishment  Increased sedimentation (from sand removal or from beach instability)

Airport construction or extension  Increased sedimentation from dredging and infilling

Marina construction  Increased sedimentation from dredging

Marina operation  Pollution from inappropriate disposal of oils and paint residues  Pollution from fueling

Motor boating and yachting  Nutrient enrichment from sewage disposal  Pollution from fueling

Cruise ships  Nutrient enrichment from illegal sewage disposal  Litter from illegal or accidental solid waste disposal

(Source: UNEP, 2015)

Ecotourism is presented as a noble policy strategy towards by creating alternative economic incentives for the local residents. Ecotourism can offer both direct benefits (salary, wages and income from employment opportunities) and indirect benefits (market for local
production and social services such as hospital and schools) which in turn contribute to the improvement of rural livelihood (Lindberg, 1996). At the same time, ecotourism might lead to consequences of restructured land-use pattern dramatically, leading to soil degradation, or environmental effects, migration of the communities or. Inhabited islands were transformed to uninhabited ones for tourism related projects. Local inhabitants, who have been considered as the poorest in their province, were required to moving to mainland, leaving spaces for tourism. This has triggered protests of local residents concerning unsuitable compensation schemes and their alternative livelihoods in future. Thus, awareness on the conservation of biodiversity can only be sustainably obtained if people are really satisfied with the benefits and the rent is shared equally among stakeholders.

Data

The study area consists of sites with differing characteristics, and scales of tourism, inhabitation, fishing and aquaculture activities, migration.

*Table 4: Sites with differing characteristics and scales*

<table>
<thead>
<tr>
<th>Island</th>
<th>Tourism</th>
<th>Inhabitant</th>
<th>Fishing</th>
<th>Aquaculture</th>
<th>Migration due to tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hon Mun</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>Hon Tam</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>Hon Mot</td>
<td>Partly</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>On the way</td>
</tr>
<tr>
<td>Hon Mieu</td>
<td>Partly</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Vung Ngan</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>Vung Me</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(Source: own elaboration)

Field data were collected by using key informant interviews, semi-structured questionnaires and field observations. Field observations were done to identify activities taking place, and to initially evaluate tourism infrastructure in the MPA. Key informant interviews were conducted with the MPA officials, ecologists, tourism providers and local people at initial stages of the field surveys. The discussions focused on historical and current changes in biodiversity, livelihoods of the local communities and ecotourism management in and around the MPA. Semi-structured questionnaires were applied to tourism providers to identify: (1) what and how tourism activities impacts biodiversity, (2) if tourism providers have contributed to biodiversity conservation and in what ways. Semi-structured household questionnaires were also conducted to clarify how well-being that the communities are since the tourism has introduced. Convenient samples of 147 households and 32 tourism providers were selected.

Result

Biodiversity and tourism’s impacts

Searching for biological evidences

The assessment of marine biodiversity of Nha Trang Bay was initially undertaken in 1993 by WWF (1994) and then followed up every year from 2002 to 2007 by Institute of Oceanography as part of the implementation phase of the Hon Mun MPA pilot project. These assessments were kept carrying out during years later but not in 2014. There were 8 site
locations assessed. Among these, 4 locations were considered as tourism attraction areas: Hon Mieu, Bai Lan (Hon Tam) and Hon Mun (2 locations).

The biodiversity in the islands of NTB MPA are evaluated to be different. Regarding species abundance of coral, Hon Mun island has the highest species in number with 197 species, Hon Mieu and Hon Tam have 70 and 71 species in particular (Tuan et al., 2005). Areas of coral reef is about 731 ha in which 194 ha locates mainly in ecotourism islands. With respect to reef fish, …

It is reported there is a depletion of coral cover in the main tourism islands of the NTB MPA. The average degradation of hard coral, soft coral and live coral was evaluated at 16.3%, 13.1% and 3.1% during the period 1994-2007. Figure 7 presents changes in cover (%) of hard coral over coral in different islands. While some areas showed maintenance or improvement in the volume of coral cover, there were significant increases in dead coral cover at some sites. The cover of hard coral over total coral in Hon Mun, the core zones, (42%) is much higher than in Hon Tam and Hon Mieu, the buffer zones, (17%). These indicate that setting core zones is helpful to protect the coral even if tourism is introduced in this area. Hard coral reef cover in Hon Mieu was reported to be decreased heavily, from 27% in 1994, down to 10% in 2002, and 3.8% in 2009. The Acropora is in degradation and even dissapeared in some sites, while others also go down dramatically (see Figure 8). It is noted that, unlike in Hon Tam and Hon Mun, there are human settlements in Hon Mieu and therefore the coral has been made worse not only by tourists but also by inhabitant activities.
Figure 7: Changes in cover (%) of hard coral over coral in Nha Trang Bay MPA during the period 1994-2010

(Source: Tuan, 2011)

Figure 8: Changes in cover (%) of Acropora coral (Acr) and other corals (Non-Acr) over coral in Hon Mieu, Nha Trang Bay MPA, during the period 2001-2010

(Source: Tuan, 2011)

*Acropora* species are one of the major reef corals responsible for building the immense calcium carbonate substructure that supports the thin living skin of a reef. They are also considered as the crown jewel of the small polyp stony world (http://en.wikipedia.org/wiki/Acropora, 2015).
Figure 9: Changes in reef fish density (fish per 100 m$^2$) in main tourism islands in Nha Trang Bay MPA during the period 1994-2007

(Source: Tuan et al., 2007)

Figure 9 presents changes in reef fish in main tourism islands in NTB MPA. The figure indicates that there is a slightly increase in reef fish over the period 1994-2007, however, this is statistically insignificant. In addition, no evidence of valuable species such as Turtle, Triton shell (Charonia Tritonis), and Giant clam (Tidacna Maxima) were reported in 2009 (Tuan, 2011). There are changes of fish compositions in which abundances of Butterfly fish (Chaetodontidae) and Surgeonfish (Acanthuridae) are depleting while those of Scaridae, Sigaridae, and Labridae are increasing (Long, 2009). This indicates a slow recover of reef fish. This might be a consequence of overfishing for several years in one hand, and that small restricted areas, the core zones, have not generated spill-over effects for neighbouring ones in the other.

Size of fish changes

Searching for wildlife area lost by tourism

It is reported that 50 ha of NTB which were under 8 tourism projects have been on reclamation since 2001. Especially, they were Hon Tam resort occuring West Northern Hon
Tam and Vinpearl resort occurring at Dam Gia and Vung Me, West Northern Hon Tre in 2005.

Table 5: Damage of biodiversity due to activities in Nha Trang Bay

<table>
<thead>
<tr>
<th>Location</th>
<th>Area (ha)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Gia (Hon Tre island)</td>
<td>500</td>
<td>Dead coral and seagrass due to tourism construction</td>
</tr>
<tr>
<td>Bich Dam (Hon Tre island)</td>
<td>360</td>
<td>Dead coral due to lobster aquaculture</td>
</tr>
<tr>
<td>Mui Ke Ga</td>
<td>1500</td>
<td>Dissapearance of coral due to Rusalka tourism project</td>
</tr>
<tr>
<td>Bai Tien</td>
<td>2100</td>
<td>Dissapearance of coral due to tourism activities</td>
</tr>
<tr>
<td>Song Lo</td>
<td>3000</td>
<td>Dead coral due to Song Lo tourism activities</td>
</tr>
</tbody>
</table>

(Source: Khanh Hoa Environmental and Resource Department, 2013)

Threats associated with tourism

Direct impacts

Direct impacts associated with tourism activities often occur in the developing countries like Viet Nam. The most obvious impacts on biodiversity are diving, snorkeling, swimming. These impacts result in changes to the ecosystem, reduction in cover, and change in species composition. These activities can also be associated with changes to the hydrology of the site, soil conditions including nutrients.

First, direct physical damages from snorkeling and diving are well documented. The damage inflicted by divers and snorkelers consists mostly of breaking fragile, branched corals or causing lesions to massive corals. The number of divers has increased over years. At present, about 20 diving clubs have regular operations within the MPA with about 100 divers
per day and often serve approximately 9,800 dive trips annually. Most divers were foreigners, 13,500 foreigners compared with 4,500 Vietnamese divers (Michael, 2005). On the daily survey carried out in July 2006, a total number of 83 divers were observed at eight diving clubs and Cau Da port. This corresponded to 7 to 22 divers per diving club per day.

Second, physical damage from anchors and especially boat groundings can be severe. Anchor damage is proportional to the size of the boat (i.e. weight of the anchor and length of anchor chain) and is further dependent on the type of coral community. It is recorded that, within Hon Mun MPA, there were 60 traces of anchorings/boat groundings in 2002, 148 traces in 2005, and 3 traces in 2007. This indicates that damage was increased in the early stage of tourism booming, but goes down afterwards, probably because mooring buoys was established within the core zones.

Although fishing has caused declines in reef fish stocks, the direct role of ecotourism in fishing-related decline is most likely insignificant. Indirectly, however, tourism increases the demand for seafood and does have an impact on reef fish resources. Many commercial reef fish is being caught. Live grouper, lobster become favoured food for tourists and being harvested because of high prices (Tuan, 2011). Collecting of marine souvenirs by tourists is not clearly indicated but there is still a market for marine curiosities in response to a certain tourist demand.

*Indirect impacts*

Associate with direct impacts, there are indirect impacts associated with infrastructure from tourism. The most obvious impact is probably reclamation to provide infrastructure for tourism. Although tourism infrastructure within the MPA is limited, there are often tracks, trails, roads accommodation provided, all of which have impacts. In the construction of huts, lodges, hotels, and other facilities, native environment was cleared and replaced by a non native environment.
Damage is not just restricted to the initial removal of native environment but also coastal development and the construction and operation of related tourism infrastructure can cause increased runoff and sedimentation (Buckley and Pannell, 1990; Spellerberg, 1998; Newsome et al., 2002a). Sedimentation is one of the main reasons for reef degradation. Increased sediment loading of coastal waters increases turbidity, leads to stress on corals, usually expressed by "bleaching" of corals. Heavy sediment loading may also cause corals to suffocate and die. Other documented impacts of sedimentation on corals include lower growth rates, reduced productivity and reduced recruitment.

Environmental assessments were carried out in 18 monitoring stations within NTB during the last years. The record showed that tourism construction project could result in heavy siltation leading to coral death. This was reported in Hon Mieu and South Hon Tam (Tuan 2011). The high percentage of heavy metals in water (Zn, Pb) was founded in Hon Tam after 3 years that the resort operated. Tourism projects involved extensive earthworks including coastal reclamation along the coast facing the south-western side of the MPA (Tuan et al., 2007). An Vien resort was evaluated as not harmful for marine biodiversity but lead to pollution of the area. The provincial government intended to enforce environmental impact regulations in future, however this commitment would be too late for the coral reef to VinPearl and Hon Tam.

Nevertheless, tourism is not generally a source of petroleum hydrocarbon pollution, other than on a small scale when oil or fuel spills from recreational vessels and marinas occur. The effects of petroleum hydrocarbons on corals has been recorded, producing evidence that chronic oil pollution is more harmful than a single exposure, and that dispersants and emulsifiers used to combat spills are more toxic to corals than oil alone. It was reported the oil concentration in water in the MPA is much higher than its standard in 2007 (see Index 1). This is due to increasing density of tourism boats.
Tourism is obviously a source of sewage and solid waste pollution (see Figure 10). A very large percentage of the sewage generated by hotels and recreational vessels is discharged in the NTB MPA without adequate treatment. The main impact of sewage pollution is nutrient enrichment, which favours certain species (algae in particular) at the expense of corals. Its impact also depends on the level of treatment before discharge and the degree of natural flushing by tides and currents at the point of discharge. Solid waste, the impacts of which depend very much on the method of disposal. If disposed of inappropriately, leaching of toxic substances may harm corals. Of particular concern is the "accidental" waste - plastics in particular - that is blown into the ocean from beaches or vessels and has a detrimental effect on corals and other marine life.

Figure 10: Environmental impacts of solid waste and sewage in NTB during 2010-2014

(Source: own calculation⁴)

Tourism impacts on community’s well-being

A common goal of ecotourism is the generation of economic benefits for the local people. However, during the period 2002-2004, the tourism boom in adjacent Nha Trang city did not automatically transfer into economic benefits for the residents living around the MPA.

⁴ The calculation is based on a reported estimation of 0.7 kg solid waste per capita per day, and 0.8*120 litter sewage per capita per day
Despite increases in tourist visitation to Hon Mun MPA, there are no assurance that benefit from these tourists accrued to local villagers living on the islands. Very few people living within the MPA benefited from tourism in terms of income generation and alternative livelihood creation. Access to the tourist market remains the largest barrier for local people. While the local communities in the mainland could capture benefit from tourism adjacent to MPAs through sales of t-shirts, handicrafts, shuttling of tourists between MPA sites, and employment in resorts, the local villagers were not able to do the same (Haynes and Tu, 2005). This might due to low education, and then ability of accessing into a new market is limited for the local people.

10 years after, associated with tourism development, more are more local residents involve in tourism activities. Their income gained from ecotourism is mostly derived from seasonal employment. These are unskilled works serving for constructions of tourism companies. Only few island inhabitants have permanent jobs at the tourism companies. Women, who often stayed in door before now have chances to work in tourism companies or tourism activities organized by women association.

**Biodiversity conservation- Who paid for this?**

One question is that who receives the rents and who pays for biodiversity conservation. When an industry generates economic rent, there will always be a struggle to capture the rent. In the bioeconomic models, it has been assumed that the rent accrues to the resource users. However, the rent can end up many other places. In the context of this study, the rent can be captured by local residents who are fishers and farmers, tourism providers, MPA authority, and the government by means of taxation.

The cost of biodiversity conservation can also be covered in different ways. The cost may be borne by the tourists, the inhabitants, the tourism providers or by the government. The question is if the costs of biodiversity are higher than the value of the rent. If all the
stakeholders have to pay, another question is how much they should pay. If they have to repay the rent they gained, normally all activities in the MPA do not change. In reality, the costs of management of the MPA are borne by tourists through user fee, but mostly for salaries and regular activities at the MPA. The earning generated from user fee during the period 2006-2009 was approximately 11 billions Vietnamese dong (VND), equivalent to 518,000 USD, with an average of 129,000 USD per year. However, aiming of tourism promotion, only core zone has been applied for user fee instead of the whole NTB MPA since 2010. The earning thus goes down to only 1.3 billions VND, equivalent to 61,300 USD in 2011. This is even more difficult for the MPA authority in allocating a fund for activities of biodiversity conservation.

Cost for activities related to biodiversity conservation at present is little and subsidized by the government. The cost could be the amount diminished from government’s earnings of all users at the MPA. These are: (1) monthly tax for tourism transporters including 400,000 – 600,000 VND per vehicle depending on its scale; (2) income taxes of tourism companies and households; (3) environmental fees including solidwaste and sewage fees imposed to all stakeholders and individuals. It also could be a small amount extracted from the MPA authority’s earning. However, the earnings are very small compared to the total rent that the stakeholders received, especially tourism providers. Even though tourism providers have benefited economic values of the MPA, they do not have to pay any additional taxes/fees, ex. biodiversity conservation fee, compared to other industries.
Figure 11: Stakeholders’ payments for biodiversity conservation

(Source: own calculation)

It is also noted that there has been no regulation imposed on redistribution of economic rent from the tourism sector to the local communities. This regulation is still under discussion by Khanh Hoa Provincial People’s Committee. According to the plan, a conservation fee is expected to introduce for the whole reserve and 15% of that is for community development.

Who takes the rent? The fact is that the rent from tourism is not equitably shared among stakeholders. Figure 12 indicated the main beneficiary is the tourism industry (78%), which is a small group of people in the society, while communities take the smallest share of the rent (5%).
Biodiversity conservation - What has government done?

Awareness of environment and biodiversity has been gradually received interests by the government. Several regulations, decisions regarding marine environmental protection have released. User fee, solidwaste fee and sewage fee are notable regulations for the NTB MPA that the government launched.

The user fee for visiting NTB firstly raised in the temporary decision in 2002. However it is detailed and carried out in reality after the resolution in 2004, to prepare a fund for management of the MPA after DANIDA project finished. There were 3 adjusted resolutions launched afterwards: 2007, and 2009 and 2013. At the beginning, only 5% of the revenues generated from user fee is for the MPA authority, the remaining must be sent to the government and then goes back to MPA afterwards to carry out activities including conservation programs. This proportion is adjusted up to 55% and 45% in 2008; 100% and 0% in the decision of 2010. Compared to previous resolutions, the decision in 2010 is considered as a starting point for action plan on biodiversity conservation, environmental protection as well as development of social economic activities of NTB MPA (see Figure 4).
The regulation on fee protecting the environment was firstly launched in 2005 and adjusted every year afterwards. At the first three years, only water discharged was asked to pay. Figure 14 and 15 show changes on sewer discharge and solid waste discharge since these are introduced. Aquaculture farmers also have to pay a fee for using water surface areas in 2009.

In addition to imposing tax, new non tax regulations are applied. Transporting boats has been required to have solid waste containers since 2014. Education and propaganda for environment protection enhanced. However, waste is still thrown directly into the sea, especially by domestic visitors. Discarded plastic, polymer bags and drinking bottles left in the islands eventually spill into the sea.
Figure 14: Changes of sewage fee during the period 2005-2014

Figure 15: Changes in solid waste fee during the period 2008-2014

There are reasons for it. The surveillance for all activities practising in the MPA is weak. MPA authority is functioning to guide all the stakeholders working in the MPA comply MPA regulations. However, it does not have function of fine or withdrawing/offering certificates for all activities in the MPA. The patrols could not control a large area due to limited number.
**Biodiversity and tourism - non related impacts**

However, it is admitted that there might be other threats that affects health of biodiversity such as aquaculture pollution, overfishing and climate change.

**Fisheries related impacts**

Overfishing is a big issue in all the coastal provinces in Viet Nam. The “Temporary Regulation and Zoning Scheme” applied in NTB MPA in 2002 suggests a detailed zoning of fishing areas and regimes but this is not respected in practice. The use of dynamite and chemicals for fishing is prohibited but poaching and destructive fishing in the core zone still take place.

Fishing within the MPA is characterized by a diversity of gears and species. There are about 1,400 vessels associated with 11 types of fisheries practising in total. All of them are in small scale with lower 90 HP. However, there are strong suspicions that the total number of fishing boats was underestimated and several boats registered outside but operating inside the MPA. Trawling, purse seine and gill net and light fishing are common practices in the MPA, with a variety of marine organisms being harvested (see Table XXX). 46% of fishers have own boats, while the remaining ones work as hired crew members (Dinh, 2005a; Dinh, 2005b; Tung, 2002). Poison and blast fishing were still conducted illegally by several divers and poor fishers in 2003 (Dinh, 2003). These illegal fishing practices were, however, not detected in the monitoring programme in 2005 (Dinh, 2005a; Dinh, 2005b; Tuan, 2005b).

*Table XXX: Main fishing activities and marine resources collected in Nha Trang Bay MPA*

<table>
<thead>
<tr>
<th>Fishing activity</th>
<th>Vessel</th>
<th>Main marine organism</th>
<th>Fishing season</th>
<th>Fishing ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trawling</td>
<td>227</td>
<td>Trash fish</td>
<td>The whole year</td>
<td>South of Hon Tre island</td>
</tr>
<tr>
<td>Purse seine</td>
<td>643</td>
<td>Anchovy, scad, ribbon</td>
<td>The whole year</td>
<td>Nha Trang Bay</td>
</tr>
</tbody>
</table>
Aquaculture related impacts

A rapid development in the number of culture cages during the last years, a high demand on wild seeds and utilization of ‘trash fish’ as cheap food for aquaculture have impacted to the marine biodiversity: water pollution, fish depletion, seabed damage, or even created presence of dangerous species for marine resource. There was about 6700 tons of waste feed discharged directly to marine every year (MPA authority, 2008). Conflicts between islanders and outsiders in using marine resources for aquaculture increased water pollution and disease spreading. A large number of households were hit by a shrimp diseases during 2007-2008 (Lan, 2009).

(Source: Van, 2013)
Cage aquaculture has been developing since 2000s in Nha Trang Bay MPA with main species including lobsters, groupers. Their juveniles are collected from coral and rocky reefs. This might a cause to biodiversity. Invasive organizms were decreased during the period 1999-2001 because of catching for lobster culture (Tuan et al., 2002).

Figure 17: Aquaculture cages in Nha Trang Bay MPA during the period 2003-2014
(Source: Nha Trang Bay MPA border defense, 2015)

Figure 18: Aquaculture cages in active in Nha Trang Bay MPA during the period 2001-2014
(Source: Thao, 2009 and Nha Trang Bay border defense, 2015)

Climate change impacts
Climate change had been recorded as a culprit of new diseases, dangerous species. For example, Sea urchin appeared during the period 2004-4005. Diseases for coral reef have increased recently without clear reasons. 18% of coral reef was reported to be bleaching in Hon Mun in 2004. Chocolate chip starfish was recorded as 174 in numbers in 2002, reduced to 94 in 2005, and only 52 in 2007 (Tuan, 2011). Nevertheless, no clear evidence of sea level rise was reported in NTB MPA.

**Discussion and Conclusion**

The findings show that biological health of the MPA is large differences in the condition of the coral reefs, with indications that adverse impacts may be occurring due to tourism stress, lack of monitoring and enforcement of requirements of tour operators. There do not seem to be any exogenous stressors unrelated to economic activity (e.g., weather, climate change, species interaction). Ecotourism has risen steadily, with associated increases in use of the reef for diving and snorkeling, boats operating in unregistered diving sites, increases in solid waste and sewage in some of the sites. Regarding biodiversity conservation, the findings document where rents from MPA go, but there are questions about use of the rent – all administrative versus for research. The results indicate that contribution of tourism providers for biodiversity conservation are too little while the rents they take is the largest.

Ecotourism has both positive and negative influence on communities’ well-being. Impacts of ecotourism on the community are indicated by income levels (those involved in tourism have higher incomes than those who are not; more employment opportunities for women), but the loss of fishing grounds has left a number of men with no source of income. Some communities were required to move from their island homes to the mainland due to the MPA. Some of the farming activities have declined due to pollution that is from the tourist operators. The fishery remains open access with too many fishing vessels. The positive impacts are to those who have jobs in the tourist sector plus some beneficial infrastructure created by tourism.
Other pressures also effect biodiversity: fishing, aquaculture. Tourism-related impacts on marine biodiversity are significant, but they are also compounded by other impacts that are not easily distinguished from those of tourism. This does not mean that we must disregard the impacts of tourism activities. On the contrary, the tourism sector and the government involved in tourism development must try to eliminate or reduce those impacts that can be controlled, even if there is no 100% proof that a certain impact is directly related to a tourist activity.

By clarifying positiveness/negativeness of ecotourism on biodiversity conservation and community economic well-being, the study helps policy makers know if they should and how to encourage/discourage an ecotourism project in MPAs. The study identifies possible factors affecting decision of involving in ecotourism, which can be important inputs in designing a vehicle that encourage/discourage the communities involve in ecotourism.

*What is the role of tourism?*

*Is it sustainable in environmental and socio-economic sense?*

*What aspects are most critical and deserves more attention in the future?*

*Are there certain types of data needed or important issues for further inquiry?*

I am not sure if you should talk about tourism in general or immediately jump to the concept of ecotourism, however. You can think of this...
In the presentation of the area, you could have added a few words about the main livelihood of the local people. You just say fishing and aquaculture, but what does it mean? How is it organized? By which means? Is it for own consumption or for sale? Where are the goods then sold and how?

When it comes to the analytical framework and data I think you should be clearer on the indicators you have chosen and why.

In the following sections you should follow Nancy’s advice and take the main conclusions first. What do you find? Then you can present your data and how you substantiate your propositions. I am sorry, I still don’t see the relevance of the propensity score match. I think you should drop this. It is more important to demonstrate how tourism affects biodiversity and the well-being of local people.

By the end, you show that fishing and aquaculture also have serious consequences for the MPA’s ecosystems and biodiversity. On a balance, is this more important than tourism? In other words, are the local people really “the good guys” and the tourism industry “the bad guys”?

Your discussion of the fees and revenues is interesting. However, you probably have to say a bit more about the MPA management. Is it working? You should also indicate more clearly what can be done – or what are the preconditions - for operating the MPA better.

I generally agree with Nancy’s comments. You have to spell out the story more clearly, find a good structure, and document causations and effects as best as you can.
However, I am not sure I like the word trade-offs. Economists usually think in these terms. If one thing increases, some other things must decrease. By identifying and measuring what is gained and what is lost, the idea is that you can come up with the overall net benefit.

My problem with this concept is that you are discussing qualities and aspects that hardly can be compared on one scale and monetized. The links are also more complex. I have tried to illustrate this in the attached figure.

I wonder if it is possible to take the discussion in two steps: First, what are the effects of establishing the MPA on the residents’ fishing and aquaculture activities? If the MPA has put restrictions on them which they don’t respect, and the MPA is badly enforced, this can undermine the goal of protecting the ecosystems and biodiversity by means of the MPA. Second, what are the additional effects of tourism on both the ecosystems and the well-being of local people?

From the point of view of the ecosystems, they can be threatened by fishing and aquaculture as well as by tourism (plus exogenous stressors). From the point of view of the local people, they can have disadvantages (but also advantages) from the MPA as well as tourism. But what about the tourism industry? Is fishing and aquaculture a problem to them, or is more tourism the main threat? Or perhaps a more stringent management of the MPA?

Reference


Doctoral Thesis.


UNEP. Tourism’s impacts on reef. At:


Table 6: Environmental indicators in Nha Trang Bay, 2007

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit</th>
<th>Standard index</th>
<th>Mean</th>
<th>Max</th>
<th>Min</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil concentration</td>
<td>Mg/l</td>
<td>100</td>
<td>570</td>
<td>864</td>
<td>310</td>
<td>144</td>
</tr>
<tr>
<td>Heavy metal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn</td>
<td>µg/l</td>
<td>10.3</td>
<td>22.8</td>
<td>6.6</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td>µg/l</td>
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<td>2.7</td>
<td>0.6</td>
<td>144</td>
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<tr>
<td>Pb</td>
<td>µg/l</td>
<td>0.9</td>
<td>2.4</td>
<td>0.3</td>
<td>144</td>
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<td>Nutritious salt</td>
<td></td>
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</tr>
<tr>
<td>pH</td>
<td>µg/l</td>
<td>7.95</td>
<td>8.11</td>
<td>7.78</td>
<td>6</td>
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<tr>
<td>DO</td>
<td>µg/l</td>
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<td>6.6</td>
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<td>BODs</td>
<td>µg/l</td>
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<td>0.7</td>
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<td>Coliform concentration</td>
<td>(MPN/100 ml)</td>
<td>0</td>
<td>15,000,000</td>
<td>130,422</td>
<td>144</td>
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</tbody>
</table>

(Source: Khanh Hoa Environmental and Resource Department, 2010)

Table 7: Water quality of coral reefs in Nha Trang Bay MPA

<table>
<thead>
<tr>
<th>Period</th>
<th>Sample</th>
<th>Temp. (°C)</th>
<th>Salt (%o)</th>
<th>pH</th>
<th>DO</th>
<th>BOD₅</th>
<th>LL</th>
<th>NO₂-N</th>
<th>NO₃-N</th>
<th>NO₃₋ᵣ₋N</th>
<th>PO₄-P</th>
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<tr>
<td>Mieu island</td>
<td>11/2006</td>
<td>30.1</td>
<td>33</td>
<td>8.12</td>
<td>4.99</td>
<td>-</td>
<td>-</td>
<td>1</td>
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<td>0</td>
<td>9.7</td>
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Comment [TH4]: Important indicators will be remained.
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<th>Date</th>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
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<td>7/2007</td>
<td>Tam island</td>
<td>1</td>
<td>29.6</td>
<td>34</td>
<td>8.03</td>
<td>6.72</td>
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<td>7/2009</td>
<td>Tam island</td>
<td>2</td>
<td>28.2</td>
<td>28.5</td>
<td>8.12</td>
<td>5.57</td>
<td>0.90</td>
<td>27.0</td>
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<td>8.21</td>
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<td>Mot island</td>
<td>1</td>
<td>30.15</td>
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<td>5.05</td>
<td>1.4</td>
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</tbody>
</table>

(Source: Report of environmental quality on coral reefs in Nha Trang Bay, 2010)