



Tourism in Marine Protected Areas: Experiences from Nha Trang Bay, Vietnam

Pham Thi Thanh Thuy



Published by WorldFish (ICLARM) – Economy and Environment Program for Southeast Asia (EEPSEA). EEPSEA Philippines Office, WorldFish Philippines Country Office, SEARCA bldg., College, Los Baños, Laguna 4031 Philippines; Tel: +63 49 536 2290 loc. 196; Fax: +63 49 501 7493; Email: admin@eepsea.net

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ISBN: 978-621-8041-004

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Suggested Citation: Pham T.T.T. 2016. Tourism in marine protected areas: Experiences from Nha Trang Bay, Vietnam. EEPSEA Research Report No. 2016-RR15. Economy and Environment Program for Southeast Asia, Laguna, Philippines.

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Pham Thi Thanh Thuy

October, 2016

Comments should be sent to: Dr. Pham Thi Thanh Thuy
Department of Fisheries Economics and Management, University of Nha Trang, 02 Nguyen
Dinh Chieu, Nha Trang, Khanh Hoa, Viet Nam
Tel: 0084-915837236
Fax: 0084-58-3831147
Email: thanhthuypt@ntu.edu.vn

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EEPSEA is supported by the International Development Research Centre (IDRC); the Swedish International Development Cooperation Agency (Sida); and the Canadian International Development Agency (CIDA).

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ACKNOWLEDGMENTS

This research was implemented using funding from the Economy and Environment Program for Southeast Asia (EEPSEA).

I would sincerely like to thank Heminia A. Francisco, Nancy Olewiler, and Pham Khamh Nam, and all of EEPSEA technical group, who provided insights and their expertise, which greatly assisted this research.

My grateful thanks are also extended to Peter Arbo and Claire Armstrong from The Arctic University of Norway for their valuable comments and discussions in previous versions; to my colleagues Dang Hoang Xuan Huy and Phan Kim Lien from the University of Nha Trang; and to my students Phan Thi Thu Dung and Tran Manh Linh for their assistance in collecting data. Any errors that remain are the sole responsibility of the author.

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TOURISM IN MARINE PROTECTED AREAS: EXPERIENCES FROM NHA TRANG BAY, VIET NAM

Pham Thi Thanh Thuy

EXECUTIVE SUMMARY

This study examines how tourism affects biodiversity conservation and the well-being of local communities in Nha Trang Bay marine protected area in Viet Nam. Data was collected from 140 households, various industries, and government bodies. Secondary data were also used. The findings show that tourism is a mixed blessing. The tourism industry has had a negative impact on marine biodiversity, whereas the effects on communities' well-being are both positive and negative. Hence, the paper questions the notion of "ecotourism" and discusses what can be done to make tourism more sustainable.

1.0 INTRODUCTION

Marine protected areas (MPAs) are of growing interest globally and have become a common tool for the conservation of coastal and marine resources (Dudley 2009; Fernandez and Pham Do 2010; Gossling 1999; Halpem 2003; Pauly et al. 2002). There are many types of MPAs, varying in size, protection focus, and level of protection; but the prevention of overfishing and destruction of vital spawning and nursery grounds are important goals. In order to reach these goals, an accompanying strategy has been to diversify local communities out of the fishing industry. Likewise, tourism has been identified as a way to provide alternative employment and income for the local population (UNEP 2000; Weaver 1999).

Tourism is widely believed to have the potential to enhance the well-being of local people and to reduce pressure on the natural environment. However, this assumption has been criticized by scholars (Cater 1994a, 1994b; King and Stewart 1996; Wall 1997; Wheeler 1992), who have argued that although tourism offers a practical solution for promoting economic growth in many developing countries, the industry comes with multiple negative impacts—the social, political and environmental costs can also be high. Based on the insight that the environmental consequences of this rapidly growing industry cannot be ignored (e.g., Hunter and Green 1995), "sustainable tourism" has become a key concept. The World Tourism Organization defines this as "tourism that takes full account of its current and future economic, social, and environmental impacts; addressing the needs of visitors, the industry, the environment, and the host communities" (UNEP and UNWTO 2005).

Viet Nam, like many other coastal states, has established a network of MPAs. Currently, there are nine MPAs in Viet Nam. The first pilot project, which set out the terms for subsequent national MPA initiatives, was launched on the island of Hon Mun in 2001. The MPA was extended and renamed Nha Trang Bay (NTB) MPA in 2004, which encompasses Hon Mun and some neighboring islands. The project was funded by the Global Environmental Facility of the United Nations through the World Bank and the Danish International Development Agency. The Vietnamese Ministry of Fisheries, the People's Committee in Khanh Hoa province, and The World Conservation Union were responsible for implementing the project. Hon Mun was selected for the first comprehensive preservation project because this area is estimated to have 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 mollusks, 18 species of echinoderms, and 62 species of algae and seagrass have been recorded (Tuan et al. 2004) at this location.

The main aim of establishing the MPA, as formulated at its inception, was to enable the local island communities to improve their livelihoods and, in partnership with other stakeholders, effectively protect and sustainably manage marine biodiversity (Tuan et al. 2004). The promotion of ecotourism has been a key accompanying strategy, and since its declaration as an MPA, tourism has flourished and has become an important industry in the NTB MPA.

The main objective of this paper is to examine if the aims of the MPA have been met. Particularly, the paper analyzes the effects of tourism on biodiversity conservation and the well-being of local communities in the NTB MPA. Based on both primary and secondary data, an assessment is made as to how biodiversity has been affected and whether or not local communities are better off after the introduction of tourism to the area. The paper also highlights other pressures that have affected local biodiversity, and asks if the notion of "ecotourism" really makes sense in the case of the NTB MPA. Moreover, the paper discusses how responsibility is divided among stakeholders with the aim of making tourism more sustainable. Although I focus on a single MPA in one country, I believe that this case is widely applicable because it demonstrates challenges that are common to many developing countries.

The remainder of this paper is structured as follows. First, I present the NTB MPA and provide a brief overview of the development of the tourism industry in the area. Next, I outline the conceptual framework. In the Methodology and Data section, I discuss the challenges associated with measuring the effects of tourism on biodiversity conservation and communities' well-being and explain the method employed in this study. After that, the main findings are presented. Finally, I discuss the implications for sustainable tourism management in the MPA and the responsibilities of key stakeholders.

2.0 NHA TRANG BAY MARINE PROTECTED AREA, VIET NAM

The NTB MPA is located south of Nha Trang City. Its total area is approximately 250 km², of which 38 km² is land, including 14 islands; 212 km² is the water surrounding the islands. The biggest island in the NTB MPA is Hon Tre (34 km²) and the smallest island is Hon Noc (1 km²) (Figure 1).

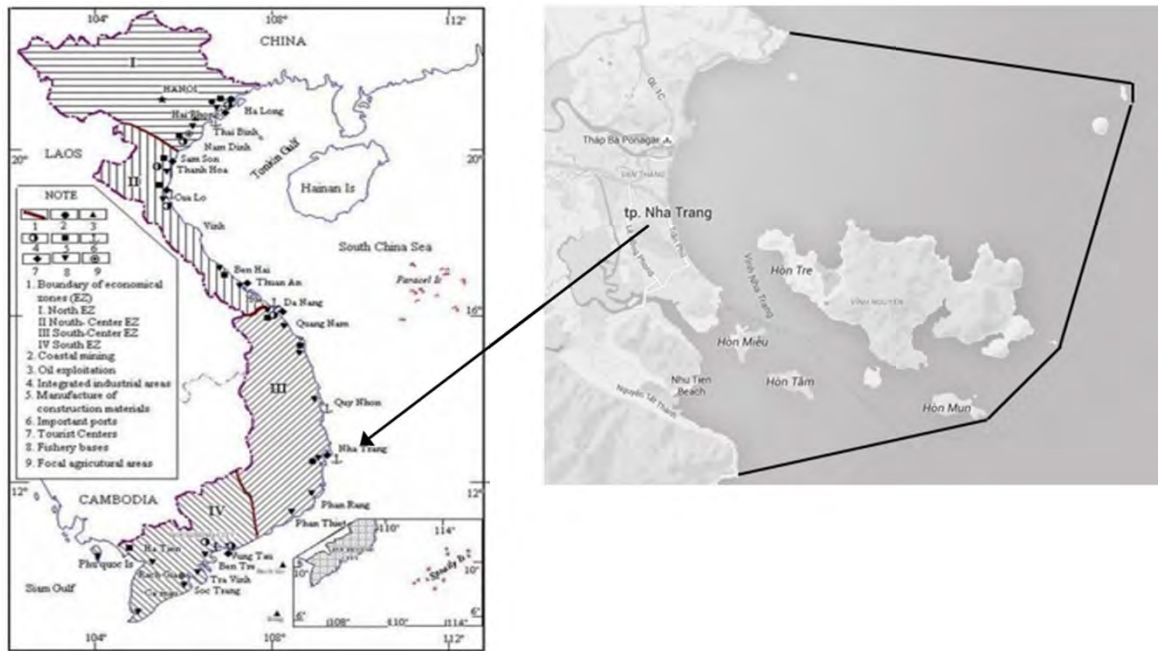


Figure 1. Map of Nha Trang Bay (MPA)

With the establishment of the MPA, a zoning scheme was introduced, which comprises of a core zone, a buffer zone, and a transition zone. In 2014, the names of the three zones were changed and their boundaries were adjusted. Currently, the regulated zones are called the strictly protected zone, the ecological rehabilitation zone, and the development zone. As previously, the strictly protected zone encompasses Hon Mun, Hon Noc, Hon Cau, and Hon Vung as well as the areas of sea of up to 300 m around these islands. The zone is now extended northward from Hon Mun and includes the whole area east and southeast of Hon Tre. The ecological rehabilitation zone includes islands and waters within 300 m of Hon Tam, Hon Mot, Hon Mieu, the remaining part of Hon Tre, and additional waters of 300 m surrounding the core zones. The rest of NTB makes up the development zone.

In 2014, the regulations pertaining to the three zones were also adjusted. In the strictly protected zone, all marine resource extraction activities and aquaculture are strictly forbidden. The only exemption is traditional dam dang fixed-net fishery, which employs a passive gear. Tourists are allowed to access the strictly protected zone and can take part in all kinds of water sports except motorized sports. In the ecological rehabilitation zone, the same rules apply to fishing; but here, aquaculture is permitted in designated areas. Motorized sports can take place, and it is also possible to set up hotels and other tourist

destinations. In the development zone, no activities are totally excluded, although there are stricter rules on environment protection and aquaculture facilities than in the areas outside the MPA. Destructive fishing and polluting activities are forbidden in all three zones.

In 2005, international donors withdrew from the project. Since then, the People's Committee in Khanh Hoa province has been responsible for the management of the NTB MPA. Daily operations are managed by the Nha Trang Bay Authority along with the provincial Department of Natural Resources and Environment; the Department of Agriculture and Rural Development; and the Department of Culture, Sport, and Tourism. The departments serve as the enforcement agencies. When it comes to sanctions, the Nha Trang Bay Authority only has an advisory function. In total, the Nha Trang Bay Authority has a staff of 40 people. The main administrative center is located in the city of Nha Trang, the office for issuing tourist boat permits is in the harbor, and the office for tourist permits is on Hon Mun island.

As of 2015, the NTB MPA has a resident population of 4,709 people, living in 1,045 households (Nha Trang Bay Border Defense 2015). In 2004, the population was 5,647 people. The number has decreased due to lower birth rates and net out-migration. The population is concentrated in five communities (Bich Dam, Dam Bay, Vung Ngan, Hon Mot, Hon Mieu), which are located on three islands (Hon Tre, Hon Mot and Hon Mieu). More than half of the population lives in Hon Mieu, the island closest to the mainland. Although the overall literacy rate is high (95%), the level of education is generally low. About 65% of adults have completed only primary school, i.e., schooling from age 6–10. The educational level is lower for women than for men. At present, there are primary schools and kindergartens in all five communities, but a secondary school is organized only in Hon Mieu. Thus, children from the other islands have to move if they wish to continue their studies after finishing education at primary level. Electricity is available to the local population for a limited time each day. The water supply is based on rainwater collected in storage tanks provided by the United Nations Children's Fund and the local government. During the dry season, households have to purchase water from the mainland or from families who live near public wells and have pipeline systems. Only 40% of households have their own septic toilets (Nha Trang Bay Border Defense 2015).

In the MPA, the vast majority of the population relies on fishing for their primary livelihood. The supply of commercial fish products was about 30,000 tons in 2015, representing 30% of the total landings in Khanh Hoa province (KHSO 2016). The fishing vessels used are mostly small-scale wooden boats with simple equipment. From the mid-1990s onward, aquaculture has developed rapidly in the Nha Trang Bay. Today, aquaculture is a significant source of income for approximately 30% of households in these island communities. Similar to fisheries, aquaculture is small-scale and run by families (Van 2013).

The establishment of the MPA affected local fishers and aquaculture farmers in several ways. The fishing area was reduced, former aquaculture locations had to be abandoned, and some activities deemed harmful to marine resources (e.g., destructive fishing and the collection of seashells) were prohibited. In general, local people were subject to stricter requirements with regard to environmental protection.

At the same time, tourism developed rapidly. Tourism now plays a central role in Nha Trang Bay. In 2014, 720,480 tourists visited the NTB MPA, up from 400,000 in 2004 (NTB MPA Management Board 2014; Tuan et al. 2004). Before the MPA was established, the number of tourists was quite modest, with only 30,000 in 1995 (Tuan et al. 2004). The bulk of the tourists are domestic, and the islands of Hon Mun, Hon Mieu, Hon Tam, and Hon Tre are their favorite destinations. Since Hon Mun has the highest biological diversity, this particular island attracts tourists interested in water-based activities such as swimming, snorkeling, and diving. Hon Tam and part of Hon Tre are well known for their luxury accommodations and catering. These islands are also popular when it comes to both motorized and non-motorized water sports. Tourism used to be less developed in Hon Mieu than in the other islands. In recent years, however, this island has become more popular and now offers an aquarium, water sports, and catering services. Tourists coming to the NTB MPA can join daily boat excursions or can take longer holidays at the resorts.

Many actors supply tourism services linked to the NTB MPA. Currently, there are 114 travel service companies, of which 20 are international. Eight companies offer diving services and seven offer sports activities on the water. Furthermore, 30 companies and 67 households provide transport services mainly for tourists within the MPA. The dominant actor in the NTB MPA is Vingroup Joint Stock Company (Nha Trang Border Defense 2015). Vingroup is the leading enterprise in Viet Nam in the field of real estate and hospitality development. Vinpearl Premium Nha Trang Bay is one of the most valuable properties of the Vingroup, and it includes a number of luxury hotels, villas, and restaurants. Alongside Vinpearl Premium Nha Trang Bay, Vinpearl Land is also a popular destination for tourists—it is a huge amusement park, located close to the company's other facilities on Hon Tre island. In 2015, Vingroup bought the Hon Tam resort, and the company will soon—based on a contract with the provincial government—take care of Hon Mun island and run all the tourism services there. For the moment, there are three large tourism projects under construction within the MPA; Vingroup owns two of them, located on Hon Mot and Hon Tre. The third tourism project is on Hon Mieu and is operated by the Maico Dalat company. A general characteristic of the tourism industry in the NTB MPA is that it has been developed by companies from outside the area, not by local villagers.

3.0 METHODOLOGY AND DATA

Assessing the real impacts of tourism on biodiversity and communities' well-being is not easy. There are challenges associated with conceptual definitions as well as with data. In this section, I highlight these challenges and explain how this study has been carried out.

3.1 Conceptual Framework

How does tourism within the NTB MPA affect biodiversity and communities' well-being? Figure 2 provides a conceptual framework to grasp the main linkages and effects. As illustrated, the establishment of the MPA has several direct and indirect effects that may lead to different outcomes. In addition, developments within the MPA can be influenced by other factors, which I will return to later.

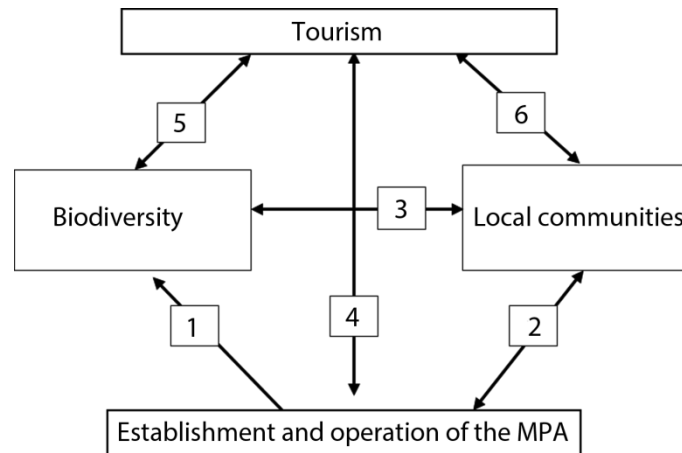


Figure 2. The conceptual framework

The establishment and operation of the MPA is meant to protect and have a positive effect on biodiversity (1) (Figure 2). This is to be achieved through a set of regulations that usually impose restrictions on the kinds of activities that local people are allowed to undertake, which can lead to adverse social and economic impacts (2). This development can be balanced by the inclusion of local people in the planning and management of the protected area and by a more flexible interpretation of some MPA regulations (2). If the MPA is working well, then local fishers and marine farmers may benefit from the increased stocks, greater biodiversity, and less pollution in the areas where they can operate (3). However, local communities can also undermine the biodiversity of the area if they have few income-generating alternatives—they ignore the rules, their activities are badly monitored and controlled, and there are no effective sanctions (3).

As pointed out in the previous section, tourism may benefit from the establishment and operation of the MPA. The area becomes a brand and more tourists are attracted (4). Tourism operations can assist the protected area by providing increased opportunities for educational services and by raising revenue from entrance and license fees (4). However, the tourism industry can also become a powerful player, affecting the management of the MPA (4). If the MPA preserves biodiversity and increases the quality of the ecosystems, this is beneficial to the tourism industry (5), but if tourism expands rapidly with little control, this can have negative effects on biodiversity (5). Finally, the tourism industry can have both negative and positive effects on the economic activities and livelihoods of local households (6), and a deteriorating situation for local communities can be bad for the tourism industry (6).

3.2 Methodology

Biodiversity is a compound concept, including ecosystems, species, and genes. This means that the effects of tourism on biodiversity can be studied at several different levels. It is not clear what level to select and, whatever level is chosen, lack of good data and time series can hamper assessments. The assessment of the marine biodiversity of the NTB MPA was initially undertaken in 1994 by World Wide Fund for Nature (WWF). Since 2002, the Institute of Oceanography has carried out annual assessments, except in 2008 due to lack of funding in that year. The assessments have mainly focused on the status of coral reefs and reef fish. Five of the sites regularly surveyed are tourist attraction areas (Appendix Figure A1). Unfortunately, the data on coral and reef fish for the years 2011–2014, a period in which the tourism industry flourished, has not been made publicly available. Thus, missing data makes it difficult to draw conclusions regarding the effects of tourism on biodiversity.

An alternative approach to overcome these drawbacks is to identify the specific tourism activities that may cause biodiversity loss and to try to assess their footprints. Yet, this is a complex task, as tourism may have a number of different effects on biodiversity. These can be positive or negative, direct or indirect, temporary or lasting, and they can vary in scale from local to global.

The composition of the tourism industry complicates measuring impacts (Dietvorst and Ashworth 1995; Lash and Urry 1994; Tremblay 1998). In its most simple form, tourism consists of transport, lodging, and recreational activities. When we want to measure the relationship between tourism and biodiversity, the impacts of both construction and maintenance of tourism infrastructure as well as the use of these facilities by tourists should be taken into account.

Communities' well-being is also a broad and complex concept. Well-being, according to the Millennium Ecosystem Assessment (MEA) (2005), requires the fulfillment of basic material needs for a good life, health, good social relations, security, and freedom of choice and action. It is obvious that many of these aspects are difficult to measure adequately. What some people may define as progress and improvement in their living conditions and well-being, others may see as a loss of community, authenticity, and meaning. This can cause uncertainty and gaps in our understanding. Tourism can affect the local economy and social and cultural life in many ways. Tourism can also increase or reduce pressures from other industrial activities and influences.

In short, measuring the impacts of tourism on biodiversity and communities' well-being is challenging and costly. In this paper, I try to assess the local ecological footprints of the tourism industry by focusing on how various activities both directly and indirectly contribute to biodiversity loss, and by seeking evidence of such losses (cf. arrow 5, Figure 2). As tourists are particularly interested in coral reefs and reef fish in MPAs, the status of these species are highlighted in the study. It is obvious that snorkeling, diving, and motor boating/yachting can cause direct physical damage to coral reefs. Fishing and collecting marine species can also contribute to the exploitation of reef ecosystems and threaten the survival of endangered species. Tourism can lead to increased consumption of seafood, higher demand for seafood, and rising prices for seafood, which make fishing in the protected area more attractive for fishers. Additional indirect effects are related to

the development, construction, and operation of tourism in general (e.g., resorts, marinas, ports, airports, etc.), leading to changes in the hydrology of sites and soil conditions, including changes to nutrients.

Regarding the impact of tourism on the well-being of local residents, there can be both positive and negative effects (cf. arrow 6, Figure 2). Tourism can offer direct benefits in terms of new employment opportunities and potentially higher incomes, and indirect benefits in terms of more outlets for local products, better infrastructure, and improved social services (e.g., transport, hospitals, and schools), which contribute to the improvement of rural livelihoods (Lindberg and Enriquez 1994). The negative impacts can be competition for space and resources, congestion, higher costs of living, and no tangible benefits from tourism, despite expectations of this.

3.3 Data

The data were collected using various approaches:

1. Field observations were carried out to identify activities that are taking place and their status within the MPA. Personal observations also allowed me to determine the accuracy of the information gained by other means.
2. Second, in-depth interviews were conducted with six representatives of the fishing industry, eight representatives of the tourism industry, and with three government agencies and two research institutions. In the interviews, I focused on the social, economic, and ecological development of the MPA.
3. Third, I used a semi-structured questionnaire to collect cross-sectional data from 140 households across three communities bordering the tourist destinations: Hon Mieu, Hon Mot, and Vung Ngan. The semi-structured household questionnaire focused on various aspects of the local communities, such as demography, livelihoods, income, and villagers' perceptions of biodiversity change caused by tourism and the government's role in sustainable management.

The data collection mainly took place in 2014, with a few supplements in 2015. The study sites were selected based on different scales of tourism and socioeconomic characteristics, such as population, fishing and aquaculture activities, and out-migration due to tourism (Table 1). At the study sites, a stratified sampling method was used in the selection of households for interviews (Appendix Table A2).

Table 1. Sites with differing characteristics and tourism scales

Island	Tourism	Local Inhabitants	Fishing	Aquaculture	Outmigration Due to Tourism
Hon Mun	High	No	No	No	–
Hon Tam	High	No	Yes	No	–
Hon Mot	Low	Low	Yes	Low	Moving
Hon Mieu	Moderate	Very high	Yes	Moderate	–
Vung Ngan (Hon Tre)	Very low	High	Yes	Very high	Moving
Bich Dam (Hon Tre)	No	Moderate	Yes	High	On the plan
Vung Me (Hon Tre)	Yes	No	–	–	Moved

4.0 TOURISM AS A DRIVER OF CHANGE

In this section, I present the main findings. I start by looking at the impacts of tourism on biodiversity. I then outline how tourism has affected the well-being of local people.

4.1 Tourism and Biodiversity Degradation

Tourism includes many activities and initiatives with a possible bearing on biodiversity. Some of these activities are based on major infrastructure developments, while others take place more or less without fixed infrastructure. Snorkeling and diving are two tourist activities that do not require heavy infrastructure. Nevertheless, it is well documented that these activities may damage coral reefs (UNEP 2015). The damage inflicted by divers and snorkelers mostly consists of breaking fragile branched corals or causing lesions to massive corals. In the case of the NTB MPA, the number of divers and snorkelers has increased over the years. In 2004, 9,800 divers were reported. This figure reached 200,000 in 2015. The annual number of snorkelers was up from 28,800 in 2004 to 600,000 in 2015 (Diep 2015; Hayens and Tu 2005; Pham 2005). Moreover, the number of diving centers has risen sharply from six in 2004 to 20 today, whilst the number of diving sites has only increased from six to seven. This has led to competition for diving space between visitors and diving centers.

Increased tourism has gone hand in hand with a reduction in the hard coral cover in the five main areas attracting tourists (Hon Mieu, Hon Tam, Bai Lan, West South [WS] Hon Mun, and West North [WN] Hon Mun) (Figure 3).

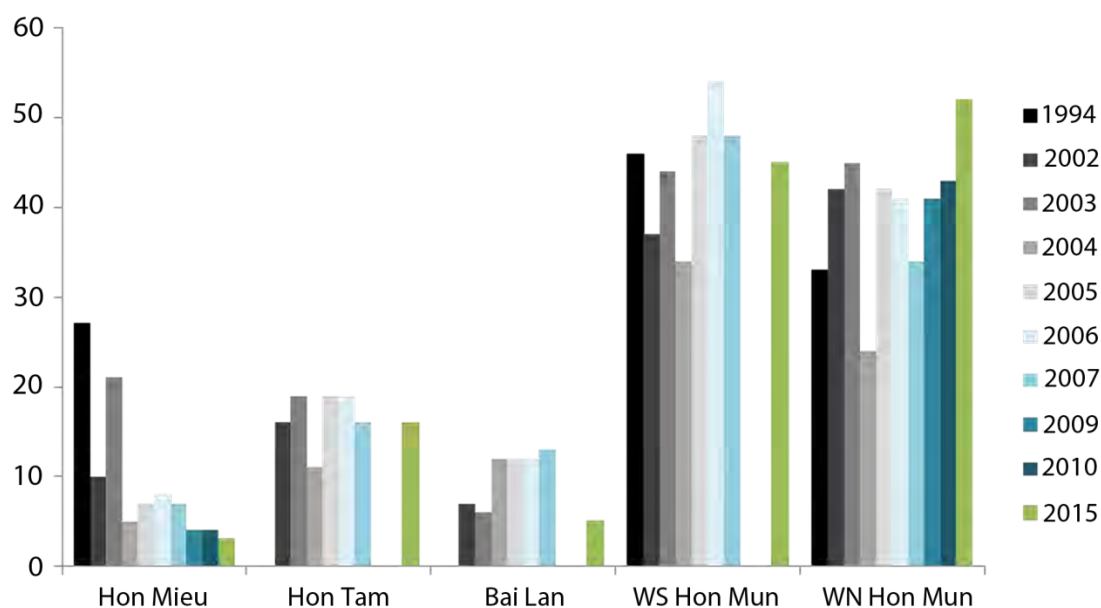


Figure 3. Changes in hard coral cover (%) at tourist destinations in NTB MPA, 1994–2015

Sources: Tuan (2011); Ben et al. (2015)

In 2015, the cover of live coral, hard coral, and soft coral were 19%, 18% and 3%, respectively. Furthermore, the coral cover varied across the monitoring sites. The protected areas (WN Hon Mun and WS Hon Mun) had the highest live coral cover (more than 50%) and Hon Mieu the lowest (3%). Over the period 1994–2010, there has been an average degradation of 16% in the hard coral cover. The biggest decline occurred in Hon Mieu, where hard coral cover went down from 27% in 1994 to 10% in 2002 and 4% in 2009. The *Acropora*,¹ which is considered the crown jewel of the small polyp stony world, completely disappeared after 2002. Quantities of all other types of corals also dramatically decreased (Appendix Figure A2). Unlike in Hon Tam and Hon Mun, there are human settlements in Hon Mieu. The fact that the areas around this island saw the biggest reduction in coral cover may therefore be due both to tourism and to the activities of the local inhabitants.

Coral reef degradation is closely associated with reef species degradation. Valuable demersal species such as Turtle (*Testudines*), Triton shell (*Charonia tritonis*), and Giant clam (*Tidacna maxima*) used to be abundant in the MPA; however, these were no longer found in 2009 and 2010 (Tuan 2011). The composition of the fish population has also changed. Species that depend on coral reefs for their food and habitat (e.g., Butterflyfish [*Chaetodontidae*] and Surgeonfish [*Acanthuridae*]) have decreased, whereas species that feed on corals (e.g., Parrotfish [*Scaridae*], Rabbitfish [*Siganidae*], and Wrasses [*Labridae*]) have increased (Long 2009).

Over the period 1994–2015, there has been no clear evidence of a general reef fish degradation in the MPA. In the years 1994–2007, however, the densities of species of more

¹ *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.

than 20 cm in length decreased, and this was statistically significant. The densities of commercially valuable species were low, with an average of 27 individuals per 100 m² during the period 2002–2007, and 19 individuals per 100 m² in 2010 (Tuan et al. 2007; Tuan 2011).

Densities of reef fish vary across the NTB tourist destinations (Figure 4). Densities have increased in the core zone (i.e., WS Hon Mun and WN Hon Mun), but a similar development is not evident in the buffer zone around Hon Mieu and Hon Tam, even though pressures from tourism are relatively lower in this area. This indicates that the establishment of the core zones has been helpful in protecting the coral reefs and the reef fish, despite the fact that tourism has flourished in this zone. It is frequently assumed that the restrictions imposed in the core zones would have beneficial effects in the neighboring zone due to larvae dispersal and migration of fish (Agardy 2015). However, no spillover effects could be found in the case of the NTB MPA (Ngoc et al. 2009). One explanation may be that the restricted area is too small to allow for such effects. Another explanation could be that the intensity of fishing and other activities in the buffer zone is so high that all possible spillover effects are undermined.

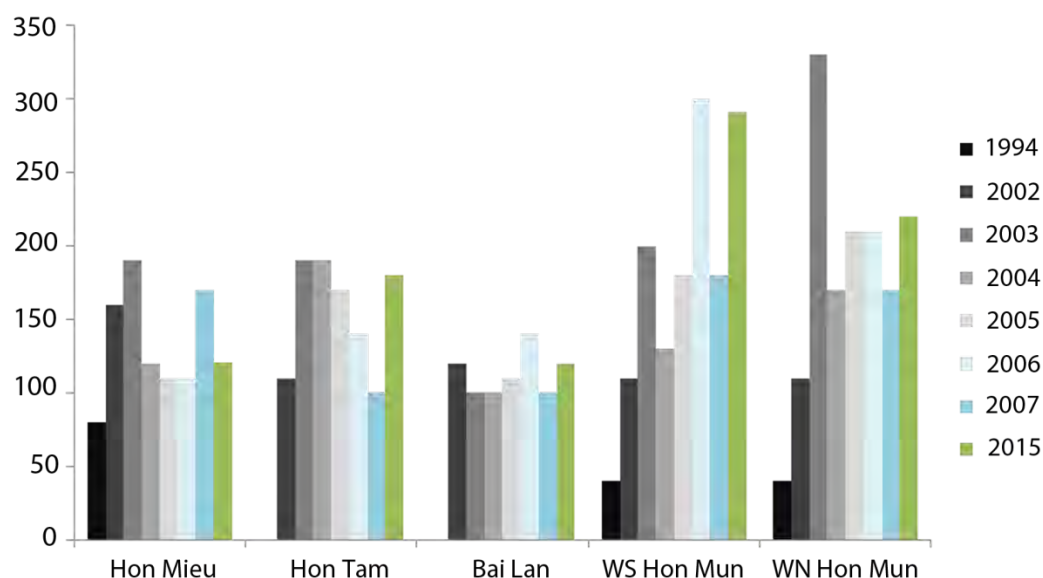


Figure 4. Changes in reef fish density (fish per 100 m²) at tourist destinations in NTB MPA, 1994–2015

Sources: Tuan et al. (2007); Ben et al. (2015)

Tourism may affect the marine resources of the NTB MPA both directly and indirectly through the demand for seafood and marine souvenirs. Reef species such as grouper, lobster, and snapper are very popular among tourists, which has led to higher prices and increasing commercial exploitation. There is no clear evidence that tourists are picking and collecting seashells, corals, and other marine souvenirs; but the fact that there is a market for marine curiosities indicates a tourist demand. Unlike many other places, recreational fishing represents no great pressure on marine biodiversity in the NTB MPA at present.

4.2 Tourism and Pollution

Waste and sewage pollution are considered severe environmental threats from tourist visits to the NTB MPA. Sewage is dumped into the sea without the proper treatment and removal of toxic substances. The main impact of sewage pollution is nutrient enrichment, which favors certain species (algae in particular) at the expense of corals. On average, it is estimated that each person generates 0.7 kg of solid waste and 96 liters of sewage per day (Khanh Hoa Department of Natural Resources and Environment 2009). In other words, in 2014, tourists produced approximately 5,700 tons of waste and 780 million liters of sewage, which is equivalent to 16 tons and 2 million liters per day, respectively. During the survey, the author found that litter from tourists was clearly visible in Hon Mun and Hon Mieu. Discarded plastic, polymer bags, and drinking bottles are left on the islands, which eventually spill into the sea. Likewise, there is no formal mechanism for handling garbage on the islands. In general, the facilities at Hon Mun are run down, and wastes are scattered across the island. The information boards have not been renewed and updated since the establishment of the MPA.

The increase in the number of tourists means an increase in boat trips to the protected area. Currently, 233 tourist boats are operating in the MPA. Most of them are either old wooden fishing vessels or pre-used small speed boats converted into tourist boats. Thus, they are of poor quality and are more prone to accidents. First, anchors and boat groundings have inflicted major marine damage. Anchors can smash even the sturdiest coral. Anchor chains and lines can scrape corals, remove the living tissue, or can wrap around coral, thus breaking off coral colonies as boats sway back and forth pulling on the line. In 2002, 60 cases of damage resulting from anchoring and boat groundings were reported, and up to 148 cases were reported in 2005. This went down to three in 2007. Note that the number of these incidents decreased in the core zone after 2002 because anchoring was forbidden in this area.

Second, tour boats are an important source of petroleum hydrocarbon pollution, especially when oil and fuel spills occur (Loya and Rinkevich 1980; UNEP 2015). At all water quality monitoring sites within the NTB MPA, oil contamination increased during the period 2004–2008 (Khanh Hoa Department of Natural Resources and Environment 2009). In 2007, oil contamination was five times higher than the standard level (570 µg/l). North of Hon Tre, which is a popular tourist destination, the water is contaminated by both coliforms and hydrocarbons at certain times of the year (Tam et al. 2013).

Third, tour boats leave a considerable amount of sewage and waste in the MPA. A large percentage of the sewage generated by the tour boats is discharged into the sea without adequate treatment. This has led to eutrophication and substantial negative effects on the ecosystem. Although bins and toilets have been requested on board all tour boats since 2013, these requirements have not been fully implemented. As has been observed, solid waste is still dumped into the sea in the harbor by irresponsible vessel owners.

In addition to the impacts of tourism activities that require no fixed infrastructure, such as boating, there are impacts associated with tourist facilities. Tourist infrastructure development can involve extensive earthworks that have detrimental effects on biodiversity and ecosystems. There are often tracks, trails, roads and accommodation

provided in tourist areas. In building huts, lodges, hotels, and other facilities, the natural environment has to be cleared and replaced by a non-native environment. It is estimated that approximately 100 ha of the NTB MPA has already been reclaimed for tourism projects.² In 2007, 7 ha of coral and seagrass were removed in Dam Gia to create beaches for the Vinpearl resort; in 2008, the development of the Hon Tam resort at West North Hon Tam led to 12 ha of dead coral (Hayen and Tu 2005; Tuan et al. 2007).

Damage is not only restricted to the initial removal of the natural environment but also to coastal development. The construction and operation of tourism infrastructure usually causes an increase in runoff and sedimentation (Buckley and Pannell 1990; Newsome, Moore, and Rowling 2002; Spellerberg 1998). This can lead to bleaching or suffocating of corals. According to the NTB MPA management board (2011), the contamination of marine sediment has been high during the last year. This has been caused by construction activities on the islands and on the mainland. Many of these projects have been tourist resorts, such as the An Vien resort. Although there is no clear evidence of eutrophication, there has been a significant increase in heavy metals (e.g., As, Cu, Pb) and a decreasing trend for total suspended solids, Ammonia and HC during the last decades (Linh et al. 2015; Phuong 2014; Tam 2013). High concentrations of heavy metals (Cu, Fe, Pb, Zn) and high levels of organic compounds (C, N, P) have been found in the swimming areas at the Hon Tam resort and Vinpearl (Tam et al. 2013; Tuan 2011). In addition, there have been evidence of heavy siltation in Hon Mieu and South Hon Tam in 2009 (Tuan 2011).

The various islands of the NTB MPA face different environmental threats. The situation is less severe in Vung Ngan than in Hon Mieu. Vung Ngan is located far from the tourist areas and the mainland. Here, fishing is maintained as a traditional practice, and very few residents participate in tourism activities. In contrast, Hon Mieu borders tourist destinations, is located only 10 minutes from the mainland, and has the most numerous population. In this area, there is a significant environmental pressure from industrial activities, such as oil leaking from boats, consumption discharges, and other kinds of water pollution. The environmental condition of the area is so poor that few tourists visit.

4.3 Tourism and Community Well-being

Tourism has been widely declared to be the key to the development of the region. The benefits can be tangible or intangible, and they can flow into various sectors. The salient question in this context is whether or not these benefits have accrued to the communities of the MPA.

In the first years after the NTB MPA was established, the tourism boom brought few economic benefits to the people living there. Despite increasing tourist numbers, local villagers saw little change in their daily lives. Most boat trips did not take their clients to villages within the MPA, there was little contact between the visitors and local people, and there were few opportunities for locals to earn money. Hence, as seen from the point of view of local communities, tourism did not provide new jobs and additional income.

² Based on discussion with Mr. Truong Kinh, Director of the Nha Trang Bay Authority.

Access to the tourist market remains an important barrier to local inhabitants. Whereas people on the mainland were soon able to capture benefits from tourists via the sale of t-shirts, handicrafts, the shuttling of tourists between MPA sites, and finding employment in new resorts, local villagers were not able to do the same (Haynes and Tu 2005).

Over the years, however, along with the further development of tourism, the local residents have become more involved in various tourism activities. Tourism has become extensive, and local people can now choose to work for tourism companies or create self-employment in small and medium-sized income-generating activities. Nonetheless, the chances of obtaining a full-time job are rather small. At the time of the field works, in total, 23 islanders were recruited by Vinpearl land, four were employed in the Hon Tam resort, and 20 were working in the Tri Nguyen aquarium area. All the men involved were former fishers, whereas the women were previously housewives. Women and men hold different jobs within companies—women are employed as waitresses, chambermaids, cleaners, gardeners, travel agency sales persons, etc.; men are employed as diving instructors, canoe captains, bodyguards, construction workers, gardeners, etc. Their monthly salaries are about USD 157–268, plus additional welfare benefits such as insurances and free meals. The daily wages for seasonal employees are rather good compared to market prices (USD 10); however, this work is not regular, which makes the monthly income unstable.

The tourism sector definitely provides new entry points for the employment of women. The industry has opened a path toward poverty reduction and toward strengthening women's societal role. Many women now have the opportunity either to work for companies or to participate in tourism businesses organized by women's associations. There are currently two such women's associations within the MPA, which are engaged in touring in bamboo basket boats in Hon Mieu and in making marine handicrafts in Bich Dam. The first association includes 30 women, whereas 100 are involved in the latter association. Both types of work give a monthly income of about USD 67. Over the years, the income from making marine handicrafts has increased fivefold; however, income from bamboo basket boat tours decreased by half. The income from the boat tours has dropped because the surface water is so polluted near the island that the village has become less attractive to visitors. However, 12 new floating restaurants run by aquaculture households have created more jobs for approximately 70 women. Their monthly income is about USD 22–45.

The household data collected from the survey shows that, of 140 households, 41 households have family members working in the tourism industry. Of these, 54% currently work full-time for tourist companies, the rest are self-employed and earn money from the sale of products and from provision of services associated with tourism, such as transport and running floating restaurants. About one-third of the households involved in tourism have this as an extra income-generating activity in addition to their traditional occupations such as fishing or aquaculture (Appendix Table A2).

The data analysis indicates that tourism activities have a significant impact on household income. The estimates using different matching methods show that the total income variable, which stands as a proxy for the average treatment effect of households involved in tourism, is statistically significant. Specifically, income is significantly higher for households working simultaneously in the tourism industry and in other occupations. In

addition, the insignificant variable of tourism income emphasizes that working in the tourism industry only does not secure a better income than working in fisheries or aquaculture. There are two contrasting views on this among the informants. On one hand, some people said that they accept working full-time in tourism because it is less risky and not as hard work as fishing or aquaculture. On the other hand, some people said that tourism does not provide a good and stable income; thus, they were rather skeptical of taking part in income-generating tourism activities. The bootstrapped standard errors in the kernel and radius matching methods are small, indicating that the results of the impact estimation based on these methods are good overall (Appendix Table A3).

However, the distribution of economic benefits to households from tourism is limited geographically. The economic impact of tourism on households decreases dramatically with distance from Hon Mun. The location variable has a statistically significant impact on the decision of whether or not to be involved in tourism activities. The data show that none from Bich Dam and only a few people in Vung Ngan take part in tourism activities; the local workforce engaged in tourism is mainly from Hon Mieu and from the mainland along the coast of Vinh Nguyen commune. As expected, the coefficients of education, age, and gender have the right sign and are statistically significant at the 1%, 5%, and 10% level, respectively. This suggests that these variables play important roles in tourism involvement decisions. Income-generating tourism activities are primarily preferred among women, young people, and those with higher levels of education. Household size is a variable that negatively affects the choice of a career in tourism. People with big families tend to stick to fishing and/or aquaculture because of the pressure to earn enough money to raise whole families (Appendix Table A3).

In addition to economic benefits, tourism has brought other benefits to local communities. For example, Vingoup is currently building the Vinmec hospital in Vinh Nguyen commune. This is a hospital of international standard, and it will increase capacity and help reduce the pressure on the other hospitals in Nha Trang. The hospital will serve Vingroup's own clients, but it will also provide better healthcare opportunities for local people.

Nevertheless, tourism has brought several negative effects for villagers. The land-use pattern has been dramatically restructured, leading to the erosion of local culture and strong interference with traditional livelihoods. When the MPA was set up, there were six villages located within the protected area. Of these, one has already been relocated to the mainland (Vung Me), two are about being closed and moved (Vung Ngan and Hon Mot), and one is earmarked for relocation in 2016 (Bich Dam). The removal of these settlements has been implemented to make space for Vingoup's tourism projects. The aquaculture farms in Vung Me were initially relocated to Vung Ngan and Dam Bay, but they will soon be moved to a new location. Among the people interviewed, 32 respondents were influenced by the resettlement measures. They said they were unhappy with relocating. The compensation they receive is relatively small and life on the mainland is very difficult for them. They find it hard to adapt to their new lives there. Hence, many have subsequently resettled to Hon Mieu, the island closest to the mainland. This has put even more environmental pressure on the most crowded island in the MPA. Local residents have raised their concerns and have protested against insufficient compensation schemes and deteriorating prospects for future livelihoods.

There are other negative problems associated with the tourism industry. Noise pollution reduces the tourist experience and general satisfaction for a number of visitors. The daily tour boats often play music very loud as they travel. The development of the tourism industry has led to higher living costs and housing prices. There is increasing pressure on local resources. Today, the beautiful beaches are occupied by hotels, are reserved for their guests, and are not available to local people as before. The Vinmec hospital can provide better healthcare opportunities for local people; however, the question as to whether the local people will be able to afford the hospital's expensive services remains. Interviews with local people gave no indication of other social problems, such as prostitution, drug dealing, etc.

4.4 Impacts Not Related to Tourism and Marine Biodiversity

Tourism has been a major driver of change in the NTB MPA. As pointed out, the industry has affected both biodiversity and the communities' well-being. However, other factors are also changing the social, economic, and environmental conditions of the MPA.

Overfishing is a global problem with many serious implications. The impact of fishing on the condition of ecosystems was highlighted for the first time in the 1995 UN Fish Stocks Agreement, and this issue has received widespread attention from scholars (Mathew 2001). Viet Nam is facing overfishing in all of its coastal provinces (Pomeroy et al. 2009). This is also the case for the NTB MPA. The fishing fleet has increased dramatically both in number and in capacity. Currently, the fleet operating within the MPA consists of 1,150 vessels. Among these, 90% are wooden boats with a hull length of less than 15 m, and 50% have engine power of less than 20 HP (Appendix Figure A7). These boats cannot go far from shore, and therefore have put great pressure on the marine environment and coastal resources. Multi-gear fishing (e.g., trawl, hand-line, lift net, and gill net) have created conflict between different gear groups. Since 2002, fishing has been forbidden in the strictly protected zone, but poaching and blast fishing still take place in the area to some extent (Van 2013). In interviews, fishers say that they have reduced the mesh size of their cod-ends from 20–25 mm to 15 mm in diameter as catches have become gradually smaller. According to Van (2013), the total catches of the demersal trawlers have decreased. Catches now contain only 20% economically valuable fish, with 40% of the catch being trash fish while the rest is waste. This development may partly be due to tourism, but overfishing is a big problem. In addition, growing demand for live lobster as seed for aquaculture farms has led to thriving lobster trap fishing activities. As these traps are made up of corals and are placed around coral reefs or on the seabed, they also contribute to damaging coral reefs. This is a considerable problem in the NTB MPA at the moment.

A rapid, more or less uncontrolled development of aquaculture in the NTB MPA during the last decade has contributed to biodiversity degradation and fisheries overexploitation. This has turned out to be harmful to the industry (Appendix Figure A8). The number of farming cages increased rapidly from 1,675 to 8,470 between 2001 and 2010, but then the number dropped to 3,068 in 2014 (Thao 2009; Nha Trang Bay Border Defense 2015). Uncontrolled aquaculture operations have spread parasites and diseases and have brought in invasive species. In 2007–2008, there was an outbreak of milk shrimp

disease (Lan 2009), and many farmers suffered massive losses and had to leave the aquaculture industry.

Likewise, there was evidence of heavy metals in the farming environment and in some selected aquaculture species in the NTB MPA in 2008. This indicates that the aquaculture activities themselves emit heavy metals into the environment (Nghia et al. 2009). Furthermore, it is reported that approximately 9 tons of organic waste is discharged directly into the sea every day from leftovers of aquaculture (NTB MPA Management Board 2009). Despite the high economic value of shrimp, there has also been a large shift from shrimp farming to fish farming since 2008. This is because fish adapts more easily to the environment than shrimp does. This shift also indicates that the water environment has changed and is becoming more unpleasant in the NTB MPA.

Climate change is widely perceived to threaten the ability of MPAs to deliver the intended biodiversity and resource conservation outcomes (Davis 2015). There is no clear evidence that climate change has affected the NTB MPA. However, invasive species (e.g., sea urchin) and new diseases (e.g., coral reef bleaching) appeared in the area for the first time in 2004–2005. Coral reefs also seem to face a higher risk of contracting diseases. There is no good explanation for these phenomena. The possible effects of climate change on the marine biodiversity of the MPA therefore deserve further attention.

5.0 DISCUSSION

5.1 Ecotourism or Mass Tourism?

Whereas tourism in the NTB MPA is obviously nature-oriented, one can discuss whether the criteria for “ecotourism” are generally met. Ecotourism is understood as responsible travel to natural areas that aims to conserve the environment and improve the well-being of local people. These two aspects of ecotourism have been poorly implemented in the NTB MPA. Some tourists are careful and conscientious in their actions, but the majority of them demonstrate little environmental concern. Some larger tourism operators have tried to subscribe to the principles of ecotourism by using trained guides and by adding educational components to their tours to make the tourists aware of the environmental features and the cultural values of the area. However, several smaller operators undercut market prices and act as “free riders” on the ecotourism wave, e.g., by fishing marine species for food and by littering the area.

In addition, the NTB MPA tourist attractions have not fulfilled their potential in terms of delivering employment and income to local communities. The residents themselves attribute the limited benefits not only to their low level of education and relative distance to tourist attractions, but also to other factors such as the lack of revenue shared from entry fees, unmet promises of job creation, and a perceived lack of commitment from the government to improve local infrastructure and services. The perception among villagers is that ecotourism is a government project that excludes local involvement. All of these elements point toward the failure of ecotourism in the NTB MPA. A lack of clear policies to implement the concept of ecotourism has resulted in local

dissatisfaction through limited opportunities for engagement in tourism, limited benefits, and a feeling of being displaced. If these challenges are not addressed, tourism in the NTB MPA can hardly be called ecotourism and will not be a driver for conservation, social inclusion, and poverty reduction.

5.2 Management Deficiencies

The people's committee of Khanh Hoa province has tried to develop a management system for the NTB MPA that can protect the environment and biodiversity. The measures comprise fees for visitors when they access the strictly protected areas, for aquaculture farmers when they use the surface water, and for local people when they discharge waste. These fees have been amended several times (Appendix Figure A3, Figure A4). In order to avoid fisheries causing harm to the MPA, destructive fishing methods are banned, and there are restrictions on the fishing gear that can be used. With respect to aquaculture, steps have been taken toward area planning, regulating feed and chemicals that can be used, and clarifying the rights and responsibilities of farmers. There are also regulations as to what tourism operators are allowed and not allowed to do in the area. For example, since 2013, all tour boats have been required to have bins to reduce over-boarding littering. However, in order to promote economic growth in the region, government has given priority to the tourism industry. This has meant that strategies for sustainability in the MPA are influenced by tourism management strategies.

Although both the NTB MPA management board and the other local government units involved in the NTB MPA have made great efforts to improve the situation, problems still exist.

1. There is slow progress on new legislation and overlapping regulation, guidance, and functions between government agencies. For instance, a boundary for the NTB MPA was indicated in 2004; however, the detailed specification and regulation of the zones was not promulgated until 2014. Several noticeboards at the tourism sites have not been updated.
2. Enforcement and monitoring of compliance are rather weak. Many of the coastal reclamation and construction activities on the islands for tourism purposes have been carried out without any assessment of the adverse environmental impacts.
3. Third, cooperation between policy makers and researchers is not really effective—some effort has been made but inadequate resources and lack of coordination impedes environmental monitoring.
4. Lack of funding for management, a characteristic feature of protected areas in many developing countries (Shackley 1996), is also a major problem for the NTB MPA. The cost of management is covered mainly from two sources: one is from entrance fees borne by tourists, and the other is from an annual allocation from the government (Appendix Figure A5). The latter funding source is provided only when earnings from entrance fees are not sufficient to fund management activities.

During the period 2006–2009, annual earnings were approximately USD 129,500. The government decided to increase the proportion of earnings from visitor fees allocated to the NTB Authority from 5% at the beginning of 2004, up to 55% in 2008, and then up by 100% in 2010 in order to generate more funds for

management (Appendix Figure A6). The fees reached USD 134,228 in 2014. However, this amount is relatively small—it is enough to implement regular activities (e.g., paying salaries and buying basic facilities for staff members), but it is not enough to carry out biodiversity conservation programs.

Currently, biodiversity conservation programs depend on the state's budget. There are reasons for this. First, there is a lack of transparency with regard to the collection of fees. As observed at the time of survey, some earnings from entrance fees are not reported to the NTB Authority, but are instead shared between the ticket controllers and the boat captains. The tourists pay either the tour operators or the ticket controllers but they do not receive receipts, and the reported number of tourists is lower than the actual number.

Second, payments to stakeholders for biodiversity conservation are insufficient compared with the rent they gain. Rent, in a fisheries context, is defined by the distance between the total value of landings and the total cost (which accounts for the opportunity cost) (Flaaten 2011). When an industry generates rent, there will always be a struggle to capture the rent. The rent can end up in many places. In the context of this study, the rent can be captured by local residents, by tourism operators, by the NTB Authority through user fees, and by the government via taxation. The rent captured by the government is generated by taxing the income or profits from tourism operators or by collecting environmental fees from local people in the MPA.

Figure 5 shows the rent shared among the stakeholders in the MPA. The study shows that the main beneficiary is the tourism industry (78%), whilst the proportion of income that accrues to the government is modest (2%). A similar situation holds for the communities (5%). This indicates that rent has not been shared equitably among the stakeholders.

The cost of biodiversity conservation can be covered in different ways. The cost may be borne by tourists, by inhabitants, by tourism operators or by the government. But are the costs of conservation equitably shared among the stakeholders? If all the stakeholders have to pay, how much should they pay? The results show that tourism operators have taken the lion's share of the rent and they have paid back relatively little (45% versus 78%).

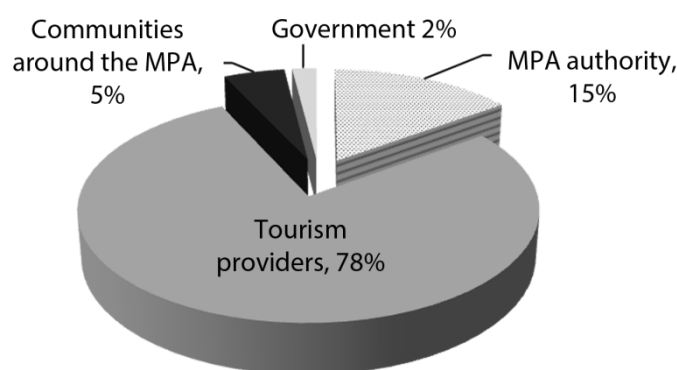


Figure 5. Sharing scheme of economic rent (%) among the stakeholders in the NTB MPA

Another issue is estimating if the government has paid enough attention to biodiversity conservation. The cost of biodiversity conservation makes up approximately 30% of the total management costs of the MPA. This amount is taken from 20% of earnings from tourism providers' taxes. The environmental fees collected from local communities are approximately VND 120 million per year (USD 5,373)³, which is not enough to clear up the 10 tons of garbage and trash generated every day on the islands from islanders and aquaculture farming activities. The government has therefore subsidized environmental cleanup to the sum of VND 620 million (USD 27,759), which accounts for 12% of the earnings from tourism providers' taxes, so that the Nha Trang Urban Environment Company can take care of waste. This also means that the government has allocated 68% of the government's income from taxes levied on tourism operators to other sectors of the economy.

An obvious consequence of the lack of funding is the poor provision of appropriate training and research opportunities. Another consequence is the poor level of interpretation and education material. This is unfortunate because there is a need to educate tourists about the importance of maintaining the environment in protected areas. In addition, unsatisfactory income and working facilities have led to a lack of accountability—implementation and control are weak and violations are not sanctioned.

5.3 Rethinking Ecotourism: The Way Forward

It should be clear that unless the value of the NTB MPA is protected, future tourism earnings are likely to diminish. Therefore, precautionary measures should be taken.

First, it is important to increase funding for management. Additional funds could be raised by increasing entrance fees for tourists. This should be applied to the whole NTB MPA and not just to the strictly protected zone. An increase in fees would not only potentially provide more funds for management but would also deter tourists from visiting the MPA, thereby relieving visitor pressure on the protected area. A substantial adjustment of the contribution made to biodiversity conservation should be implemented to balance the use of natural resources and the protection of natural resources for tourism operators and other stakeholders. This would help, on one hand, to increase the amount available for sustainable management and, on the other hand, would raise incentives for beneficiaries to become guardians of the resources they rely upon. In this way, the direct links between biodiversity conservation and tourism will be strengthened (Hall and Boyd 2005; Mathieson and Wall 1982).

Second, limits must be imposed on visitors to the NTB MPA. An upper limit for the number of tourists that can be allowed to visit could be estimated by conducting carrying capacity studies. Even though measuring carrying capacity is challenging, limiting access has been successfully implemented in developed countries (e.g., Glick 1991) as well as in developing countries (e.g., Gonzalez and Otero 2002). For example, *The Guardian* (17 February, 2016) reported that there have been proposals for the roads leading to the Cinque Terre in Italy to be fitted with devices to gauge the number of people heading to the villages. Once a certain number has been reached, access will be closed. An effort

³ Exchange rate at Vietcombank Nha Trang 1 March: 1 USD = 22,335 VND.

should be made to selectively target ecotourism clients. This does not mean that only specialized groups who can assist the tasks outlined in this report should be allowed access, but groups with relatively low environmental and social impacts and high economic benefits should be given priority.

Third, in order to enhance the involvement of local people with income-generating tourism activities, hospitality training should be provided to villagers who are interested in working for the tourism industry. Such courses not only create potential employment for local people, but also enable them to think of the MPA as their property. Other protected areas have failed to produce conservation and development benefits from ecotourism because they have not included the local people in all aspects of the planning, operation, and management of ecotourism activities (Ceballos-Lascurain 1996).

6.0 CONCLUSION

As clearly witnessed in the case of the NTB MPA, the tourism industry diversifies the economy of the region, thereby improving infrastructure and economic well-being for local communities. Nevertheless, the NTB MPA is also facing a tension between mass tourism and ecotourism. Conflicts are likely to increase between competing industries, and there are threats to marine biodiversity, environmental degradation, and other hazards. In other words, it is feared that tourism in the NTB MPA, as in many other developing countries, is not being managed sustainably.

In order to avoid unfortunate consequences, tourism must be adequately controlled. However, the effective management of tourism requires more than legislation, enforcement, and monitoring to ensure that negative impacts are controlled. Effective tourism management also needs to ensure that stakeholders are able to reap the same benefits that are accrued by management. This is especially true for local residents, tourism operators, and tourists themselves.

Thus, conservation is of critical importance to local people, tourism operators, and tourists. Sustaining tourism not only sustains the regional economy, but also sustains resources and local communities, which provide the foundations needed for economic growth and the diversification of employment. These objectives cannot be achieved in the absence of appropriate planning, monitoring, and enforcement. Sustainable tourism development can be achieved when the behaviors of all the beneficiaries are ecologically, economically, and ethically responsible (Deng, King, and Bauer 2002). In other words, if tourism is encouraged, it must not be seen to take priority over existing traditional activities, but should be promoted so that it complements other resource-based users (Hall and Boyd 2005).

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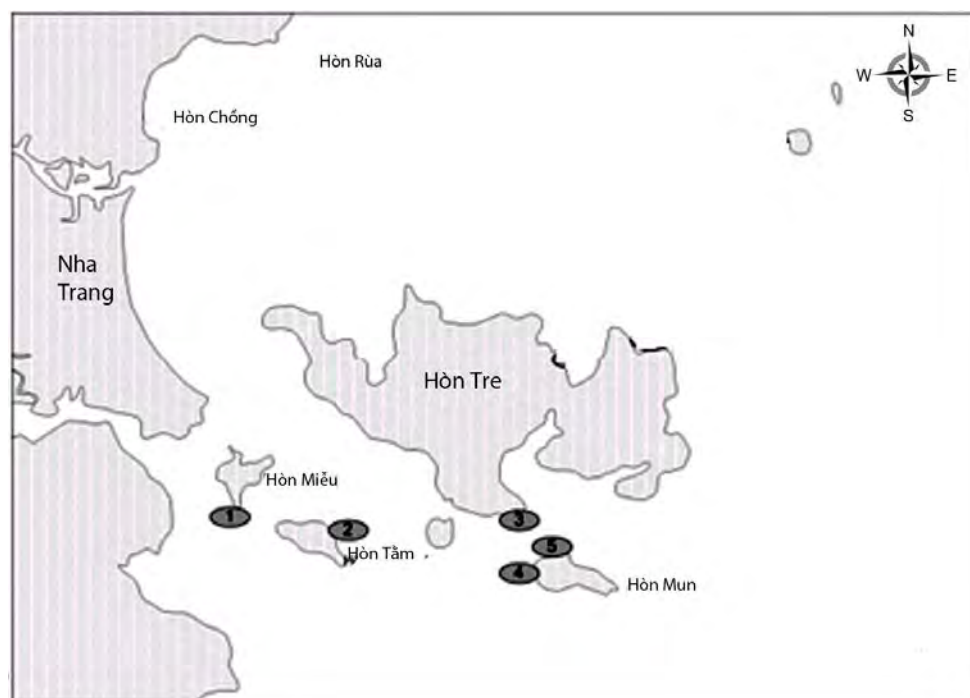
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APPENDICES

Appendix 1. Supplementary Figures



1 = Hòn Miếu, 2 = Hòn Tằm, 3 = Bãi Lan, 4 = West North Hòn Mun, 5 = West South Hòn Mun

Figure A1. Surveyed biodiversity monitoring sites

Source: Ben et al. (2015)

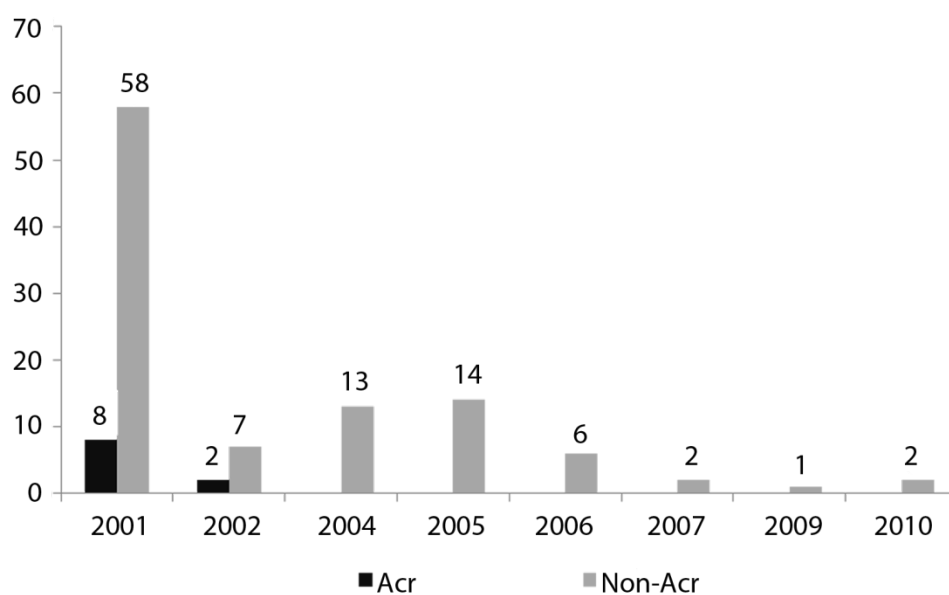


Figure A2. Changes in coral cover (%) of *Acropora* and non-*Acropora* in Hòn Miếu, NTB MPA, 2001–2010

Source: Tuan (2011)

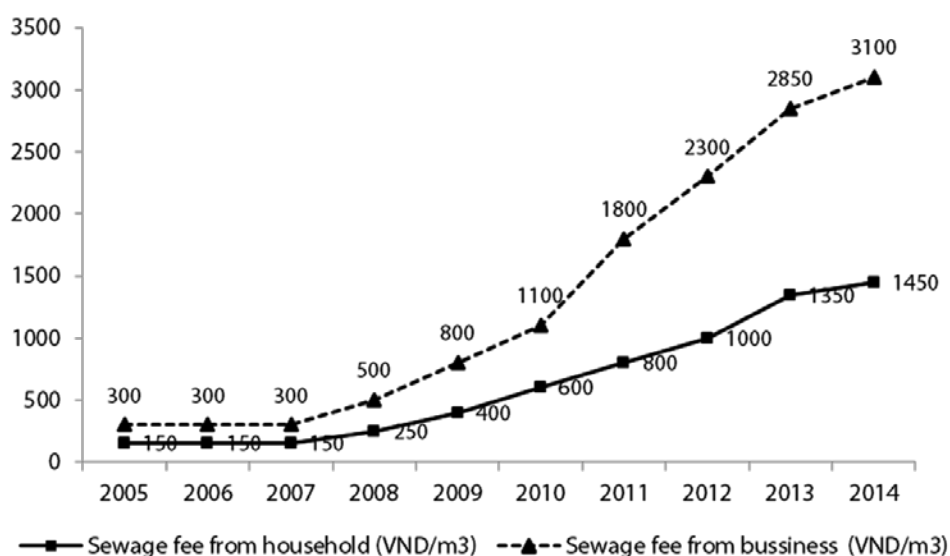


Figure A3. Changes in sewage fee, 2005–2014

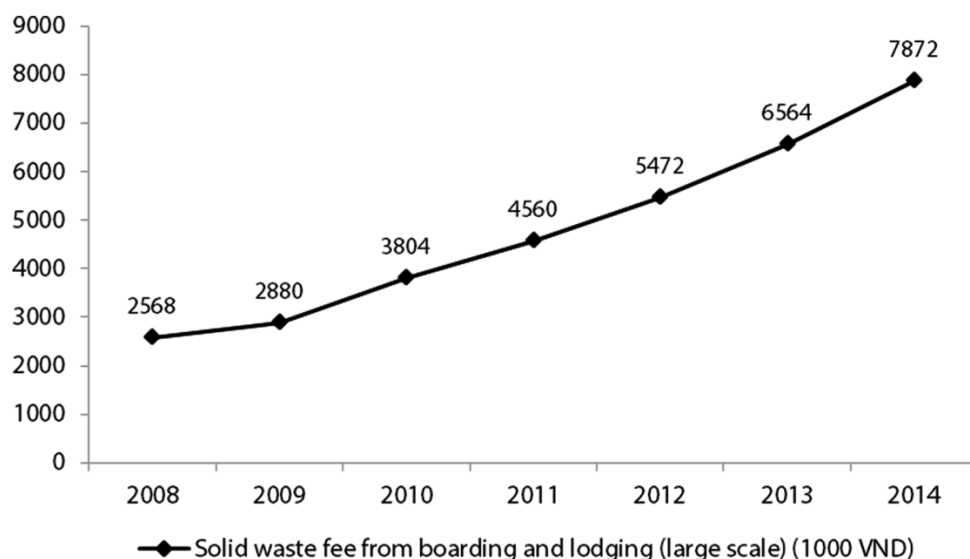


Figure A4. Changes in solid waste fee, 2008–2014

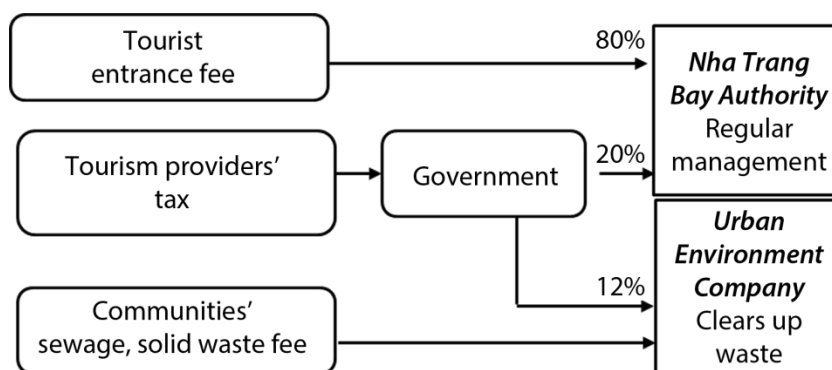


Figure A5. Stakeholder payments for MPA management

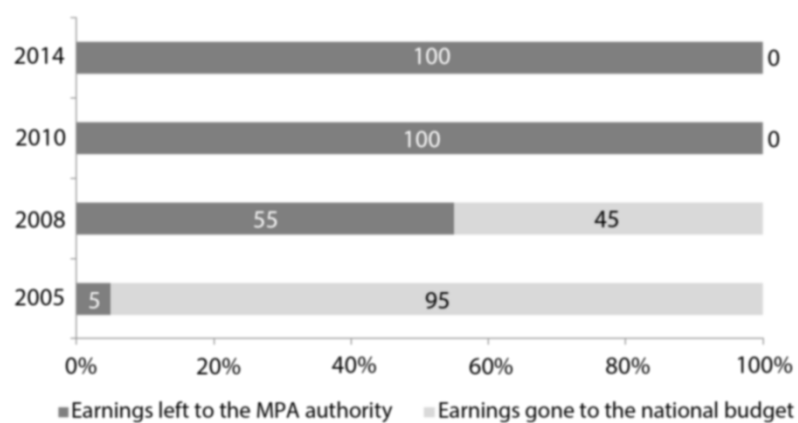


Figure A6. Changes in distribution of MPA Authority earnings, 2015–2014

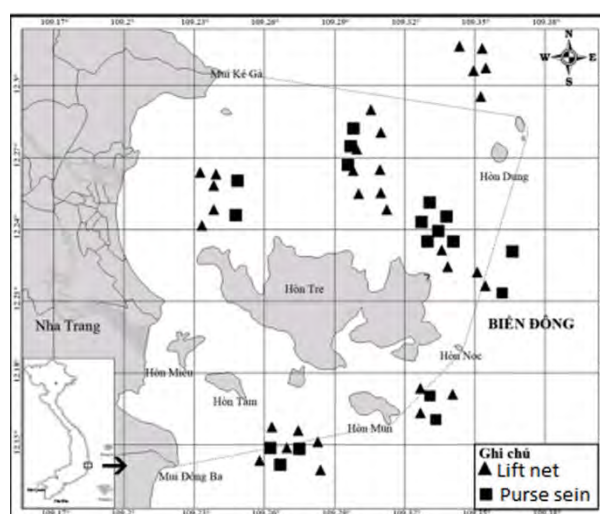


Figure A7. Fishing grounds of lift net and anchovy purse seine fisheries in NTB MPA

Source: Thinh et al. (2015)

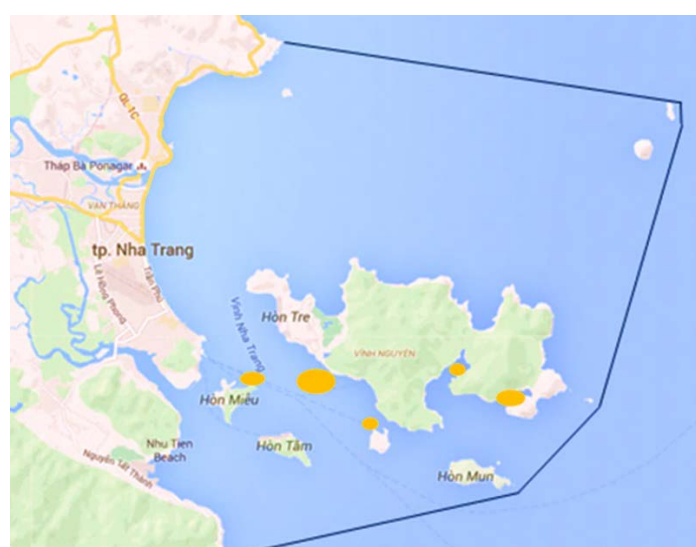


Figure A8. Distribution of aquaculture areas in Nha Trang Bay (indicated in yellow)

Appendix 2. Statistical Results

Table A1. Sampling size table

Region	Involved in Tourism		Not Involved in Tourism	
	Respondents	Rate (%)	Respondents	Rate (%)
Vung Ngan	10	24.39	20	20.20
Hon Mieu	7	17.07	33	33.33
Bich Dam	0	0.00	22	22.22
Others*	24	58.54	24	24.24
Total	41	100.00	99	100.00

Note: *Others include respondents living on the mainland along the coast of Vinh Nguyen commune and respondents forced to move due to out-migration policies for tourism projects.

Table A2. Occupation and ownership characteristics of surveyed households

Criteria		Population		Involved in tourism		Not involved in tourism	
		Respondents	Rate (%)	Respondents	Rate (%)	Respondents	Rate (%)
Occupation	Tourism	26	18.57	26	63.41	0	0.00
	Fishing	87	62.14	7	17.07	80	80.81
	Aquaculture	17	12.14	4	9.76	13	13.13
	Others	10	7.14	4	9.76	6	6.06

Table A3. Characteristics of residents involved in tourism and residents not involved in tourism: Summary statistics

Explanatory variables	Unit	All Residents	Residents with Tourism Involvement	Residents without Tourism Involvement
		(N = 140)	(N = 41)	(N = 99)
Labor attributes				
Household size	Person	4.77 (1.21)	4.51 (1.36)	4.88 (1.14)
Age	Years old	41.06 (8.80)	37.15 (8.82)	42.67 (8.31)
Gender (Male=0, Female=1)		0.11 (0.32)	0.22 (0.42)	0.07 (0.26)
Education (No education = 0; Primary school = 1; High school = 2)		1.13 (0.52)	1.41 (0.87)	1.01 (0.17)
Institutional attributes				
Local authority support		0.01 (0.12)	0.05 (0.22)	0.00 0.00
Location (dummy variable)				
Location = 1 (closed to tourism area)	Household	110.00	31.00	79.00
Location = 0 (far from tourism area)	Household	30.00	10.00	20.00
Others				
Out-migration	Household	32.00	9.00	23.00

Table A3 continued

Explanatory variables	Unit	All Residents	Residents with	Residents without
		(N = 140)	Tourism Involvement	Tourism Involvement
Economic performance				
Total income	VND per year per resident	115.77	162.09	96.58
		(118.12)	(185.58)	(66.81)
Income from fishing	VND per year per resident	85.88	135.96	80.44
		(79.91)	(181.86)	(59.62)
Income from aquaculture	VND per year per resident	152.73	253.66	119.09
		(123.62)	(161.00)	(90.01)
Income from tourism	VND per year per resident	95.62	95.62	–
		(107.40)	(107.40)	–
Income from others	VND per year per resident	48.82	50.00	96.58
		(48.50)	(65.83)	(66.80)

Note: Standard deviations are in parentheses.

Table A4. Propensity score estimation results

Variables	Estimated Coefficient	Standard Error
Labor attributes		
Household size	−0.01*	0.11
Age	−0.05**	0.02
Gender	0.80*	0.47
Education	1.87***	0.53
Location	1.25***	0.29
Constant	−1.27	1.00
Sample size	140.00	
Log likelihood	−55.57	
Pseudo-R ²	0.34	
LR chi ²	58.18	

Note: ***, **, * represents values that are significant at the 1%, 5%, 10% levels, respectively.

Table A5. Different average treatment effects on income

Matching	Total Income (in million VND)		Tourism Income (in million VND)	
	Estimate	Std. Err.	Estimate	Std. Err.
Nearest-neighbor matching	73.162***	(36.14)	19.77	(28.38)
Kernel matching	61.520*	(38.79)	−1.04	(30.91)
Radius matching	65.510**	(33.21)	8.64	(46.77)

Notes: (1) Bootstrapped standard errors are in parentheses; (2) ***, **, * represents the values that are significant at the 1%, 5%, and 10% levels, respectively.

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