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Tourism in marine protected areas: Can it be considered as an alternative livelihood for local communities?

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ABSTRACT

The promotion of tourism has been considered to be a key strategy in reducing people's dependence on marine resources and for creating alternative livelihoods for the communities living in Marine Protected Areas (MPAs). This paper studies the determinants for the decision of participation in tourism-related activities and examines whether tourism could be regarded as an alternative livelihood for the local people living in the MPAs. The propensity score matching approach is employed and a case study of Nha Trang Bay MPA is used for analysis with data from 140 locals. The results show that the tourism industry in the MPAs does not secure a better income for the local people if they stop their traditional livelihoods and enter the tourism industry. In other words, tourism should not be viewed in isolation with other existing income generating activities. Furthermore, low education, long distances between home and tourism destinations, and the pressure of supporting the whole family are the primary rationales preventing local people living in MPAs from participating in tourism industry. This paper discusses implications for the management of MPAs in developing countries, where tourism is used as the main strategy to diversify the local people out of traditional fishing or aquaculture.

1. Introduction[1]

Most small-scale coastal fishers rely on marine resources for their income [1,2]. Therefore, they normally occupy and use areas of high marine biodiversity [3]. If they use it intensively without conservation initiatives, then the ecosystem could be threatened, which in turn influences the economic well-being of the local communities.

Marine protected areas (MPAs) have thus become a common tool for the conservation of areas that have high biodiversity [4–7]. There are many types of MPAs. They vary in size, conservation focus, and the level of protection, but preventing overexploitation of marine resources is frequently an important goal to pursue. However, the establishment of MPAs could put poor people at a greater risk of losing their jobs. Therefore, developing alternative livelihood programs are important to help diversify the local people out of the fishing industry without impairing the livelihood of the coastal communities.

In many countries, tourism is often used as a livelihood strategy complementary to conservation of biodiversity in protected areas [8,9]. Particularly, its aim is to replace traditional income generating activities in the area and to improve the well-being of the communities, eventually reducing poverty and alleviating threats to the biodiversity. Over the years, there has been a lot of debate over the role of tourism in the protected areas. Both theoretical and empirical literature reviews that address this topic give conflicting answers that range from a negative to a positive appraisal. Several researchers argue that tourism is widely believed to help generate employment and improve the incomes and living standard of the residents (e.g., Refs. [10,11]. Also, tourism has the potential to enhance the economy of the region [12]. While positive effects of tourism development in protected areas are pointed out, others claim that implementing tourism projects in the MPAs that could benefit the local people might be challenging in practice [13]. Furthermore, such projects could not compete with income gained from fisheries [14], and they might increase income inequality [15], lead to conflicts among users [16], and result in erosion of cultural values [17]. These projects can also increase living costs and create a shortage of certain commodities [18,19].

Like many other coastal states, Vietnam has established a network of MPAs. Nha Trang Bay MPA (NTB MPA) was the first MPA in Vietnam and it was established by the government in 2001 with support from the two international donors, the Danish International Development Agency

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[1] This paper follows up and expands on an issue only briefly dealt with in Pham [31]

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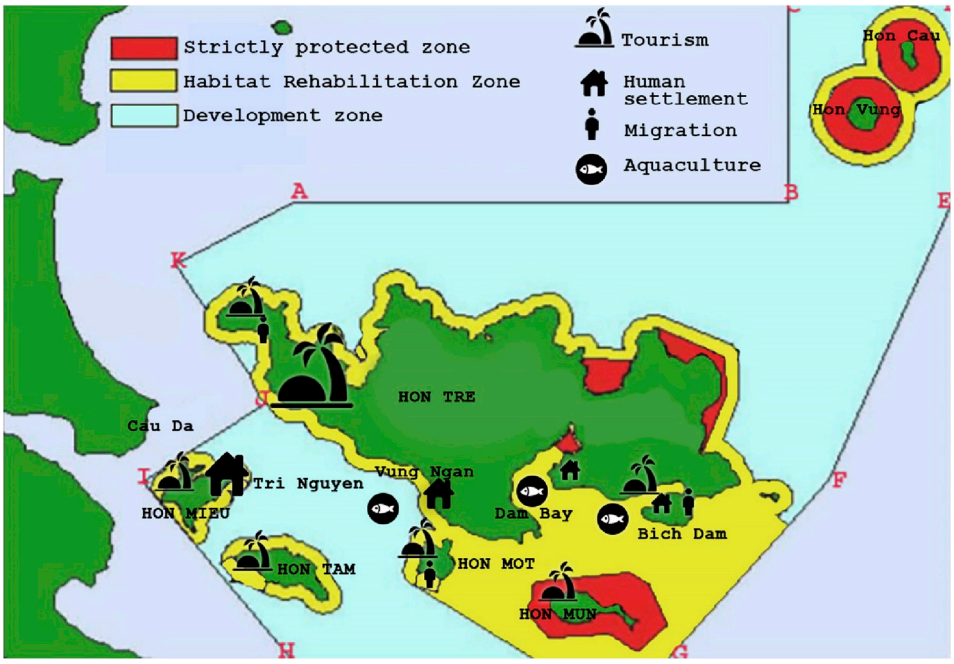

Fig. 1. Nha Trang Bay MPA[2].

and the Global Environmental Facility. The main aim of this establishment, as formulated by its inception, was to enable local island communities, in partnership with other stakeholders, to effectively protect and sustainably manage the marine biodiversity [20]. Tourism was introduced shortly afterwards and identified as a major tool for creating an alternative livelihood to compensate for lost opportunities in the communities, and hence to reduce people's dependence on marine resources in the MPAs. Nevertheless, it is a fact that a large number of local people still stick to traditional fishing and aquaculture livelihoods. This may indicate that the alternative livelihood goal of tourism has failed. This is an interesting question that will be addressed in this paper.

The objective of this paper is to examine whether tourism livelihood could be regarded as an alternative livelihood for the local people living in the MPAs. Particularly, we examine the following: (1) whether the income of local people who are involved in tourism activities is better than those who are not involved; (2) the determinants for community participation in tourism activities. Although the study focuses on a single MPA in one country, the author believes that this case has a more general applicability because it demonstrates the challenges that are common to many developing countries.

The study employs propensity score matching (PSM) developed by Rosenbaum and Rubin [21] for estimating the causal effects on income of the local people who are involved in tourism activities. This method has been used widely in evaluation studies (e.g., Refs. [22,23]. To the best of the author's knowledge, the PSM method is relatively new in tourism at MPAs. In particular, no one has used this quantitative method to identify the effects of the development of the tourism industry on villagers' income.

The remainder of the paper is organized as follows. Section 2 provides an overview of the Nha Trang Bay MPA and the development of the tourism industry in the area. Section 3 describes the methodology. Section 4 focuses on the main results, while discussion and concluding remarks follow in the last section.

2. Tourism and marine protected area in Nha Trang Bay

2.1. Marine protected area in Nha Trang Bay

The focus of this study was NTB MPA which is situated in the south of Nha Trang city. It encompasses 38 km^2 of land including 14 islands and 212 km^2 of waters surrounding these islands. The biggest island in NTB MPA is Hon Tre (34 km^2) and the smallest one is Hon Noc (1 km^2).

With the establishment of the MPA, a zoning scheme was introduced. It is comprised of a strictly protected zone, an ecological rehabilitation zone, and a development zone. The regulations pertaining to the three zones are different. In the strictly protected zone, all marine resource extraction activities and aquaculture are forbidden. The only exemption is a traditional set net fishery which uses an environmentally friendly fishing gear. Tourists are allowed to access the strictly protected zone and can take part in all kinds of water sports except for motorized sports. In the ecological rehabilitation zone, the same rules apply to fishing, but aquaculture is permitted in designated areas. Motorized sports can take place, and it is also possible to set up hotels and restaurants. In the development zone, no activities are excluded but there are stricter rules on environmental protection and aquaculture facilities than in the areas outside the MPA. Destructive fishing as well as polluting activities are forbidden in all three zones. An overview of NTB MPA with different zones and different activities are presented in Fig. 1.

As of 2017, the NTB MPA has a resident population of 4793 people living in 1159 households [24]. The number has decreased by 17% since 2004 due to lower birth rates and out-migration. The population is concentrated in four communities (Bich Dam, Dam Bay, Vung Ngan, Tri Nguyen), which are located on two islands (Hon Tre 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 the adults have only completed primary school (i.e., schooling for young people aged 6 to 10). The educational level is lower for women than for men. At present, there are primary schools and kindergartens in all five communities, but only Hon Mieu has a secondary school. Thus, children from the other islands have to move if they wish to continue their studies after finishing the primary level. Electricity is available to the local population only for

[2] The map is based on an old one presented in Haynes and Tu [20]. The author has redesigned it with the new zoning schemes and the current locations of tourism, aquaculture, and migration. The size of symbols reflects size of the tourism area and of the human settlement population.

Table 1
Sites with differing characteristics and tourism scales.

Island	Community	Tourism	Population	Fishing	Aquaculture	Out-migration due to tourism
Hon Mun	–	High	–	–	–	–
Hon Tam	–	High	–	Yes	–	–
Hon Mot	Hon Mot	Low	–	Yes	–	Migrated
Hon Mieu	Tri Nguyen	Moderate	Very high	Yes	Moderate	–
Hon Tre	Vung Ngan	Very low	High	Yes	High	Being migrated
	Bich Dam	–	Moderate	Yes	Low	–
	Dam Bay	Low	Very low	Yes	Very low	Migrated
	Vung Me	Yes	–	–	–	Migrated

a limited time each day. The water supply is based on rainwater collected in storage tanks provided by UNICEF and the local government. In the dry seasons, the households have to purchase water from the mainland or from families who live near public wells and have pipeline systems. Only 40% of the households have their own septic toilets at the time of the data collection.

In the MPA, 70% of the population relies on fishing, 20% is dependent on aquaculture, and the rest participate in other sectors. In 2017, the catch exploited from this area was about 30,000 tonnes which represents 30% of the total landings in the province [25]. Both fishing vessels and aquaculture farms are mainly small-scale with simple equipment. The establishment of the MPA affected the local fishers and aquaculture farmers in several ways. The fishing area was reduced, some of aquaculture locations were abandoned, and activities deemed harmful to the marine resources, such as bottom trawling and cyanide fishing, were prohibited. In general, the local people were subjected to stricter regulations regarding environmental protection.

2.2. Tourism in the NTB MPA

Since the NTB was declared an MPA in 2001, tourism has flourished and has become an important industry in the MPA. In 2017, 720,480 tourists visited NTB MPA, up from 400,000 in 2004 [24,26]. Before the MPA was established, the number of tourists was quite modest with only 30,000 in 1995 [26]. The bulk of the tourists are domestic. The islands of Hon Mun, Hon Mieu, Hon Tam, and Hon Tre are the favourite destinations. Since Hon Mun has the highest biological diversity, this island is regarded as the most attractive one for tourists. It has different water-based activities such as swimming, snorkelling, 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 compared to the other islands. But in recent years, this island has become more popular and now offers an aquarium, water sports, and catering services. The tourists coming to the NTB MPA can join daily boat excursions or they can take longer holidays at the resorts. Islands in the MPA with scales of tourism, fishing, and aquaculture as well as characteristics of the population and out-migration due to tourism are summarised in Table 1.

Many tourism services are operating in NTB MPA. Currently, there are 114 travel service companies of which 20 are international. Eight companies offer diving services, seven run water sports activities, and 30 companies and 67 households provide transport services. Vingroup Joint Stock Company is the dominant actor in the MPA. This company owns the luxury resort Vinpearl Premium Nha Trang Bay and a huge amusement park Vinpearl Land; both attract thousands of tourists every day. Currently, there are three large tourism projects under construction within the MPA. The Vingroup owns two of them. A general characteristic of the tourism industry in the NTB MPA is that it has been developed by companies from outside the protected area, not by local villagers.

The development of tourism industry has definitely created positive effects on the well-being of the local residents such as new jobs and new income. The fishermen or aquaculture farmers have become more involved in various tourism activities, and they can choose to work for companies (e.g., chambermaids, cleaners, gardeners, diving instructors, canoe captains, bodyguards, …) or create self-employment in small and medium-sized income-generating activities (e.g., selling handcrafts, touring bamboo boats, …). Nonetheless, most jobs are seasonable and this makes the income unstable. The chances of obtaining a full-time job are rather small and the monthly salaries are modest (about USD 200–300).

Nevertheless, the tourism industry has also brought several negative effects for villagers. The land-use pattern has been dramatically restructured, leading to strong interference with traditional livelihoods. When the MPA was set up, there were six villages located within the protected area. Of these, three has already been relocated to the mainland and one is being migrated (see Table 1). The aquaculture farms in Vung Me were initially relocated to Vung Ngan, but they will soon again be moved to a new location. The relocations are to make space for tourism projects. Many local residents, after being unable to adapt to their new lives in the mainland, have subsequently resettled to Hon Mieu. 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.

3. Methodology

3.1. Model framework

In order to determine the factors associated with participation in tourism activities, we present a model wherein individual i is contemplating whether to participate or not to participate in tourism activities based on the information available at the time of deciding:

$$I_i^* = \alpha Z_i^D + \beta Z_i^H + \gamma Z_i^P + \delta Z_i^S + u_i \quad (1)$$

where Z_i are the vectors of individual-specific and observable variables that might affect the decision. These vectors are the demographic attributes of the individual (Z_i^D), attributes of the human capital[3] (Z_i^H), attributes of the physical capital[4] (Z_i^P), and attributes of the finance capital[5] (Z_i^S). $u_i$is the random error. A decision of individual i, I_i, is defined as equal to 1 if a decision to participate is in operation and it is equal to 0 otherwise (i.e., non-participation).

It is assumed that voluntary decisions for being involved in tourism activities depend on the expected income. Let Y_1 denote the income for the group if the treatment has occurred ($I = 1$) and Y_0 denote the income for the control group ($I = 0$). If one could observe the treated and the control states, the average treatment effect, τ, would equal $Y_1 - Y_0$.

[3] The skills and knowledge to labor in order to pursue different livelihood strategies.

[4] The basic infrastructure (e.g., transport), and means that enable people to pursue their livelihoods.

[5] The economic resources (measured in terms of money) such as assets that help people to access different livelihood options.

However, only Y_0 or Y_1 are identified for each observation, and $\tau \neq Y_1 - Y_0$ because the treatment condition is not randomly assigned. In order to solve this problem, individuals are randomly assigned to either participating or not participating and then an unobserved counterfactual is constructed using the randomly assigned non-participants.

As shown by Rosenbaum and Rubin [21]; if data justify matching on some observable vector of covariates, Z, then matching pairs on the estimated probability of selection into treatment or control groups based on Z is also justified by applying the PSM method. The validity of the PSM method is based on two assumptions: (1) the Conditional Independence Assumption (CIA) and (2) the Common Support Condition (CSC). The CIA requires that Z must include all factors that affect both the decision of tourism participation and the income. By matching the participant group with the non-participant group with similar estimated propensity scores, we control for the effect of these factors on the income. The CSC allows for ensuring a positive probability of being in both tourism participants and non-participants and a sufficient overlap in the characteristics of the two groups.

Given that the CIA and CSC are satisfied, the impact of tourism participation on the income therefore can be averaged across the participants. This will then give the average treatment effect on the treated group (ATT). This is, indeed, the difference in the average income between the tourism participants and non-participants:

$$ATT = E(Y_1|I=1) - E(Y_0|I=1) = E\{E(Y_1|I=1, P(I=1|Z)) - E(Y_0|I=0, P(I=1|Z))|I=1\} = E(Y_1 - Y_0) \quad (2)$$

where $E(Y_0|I=1)$ is the expected unobserved income of participants and $E(Y_0|I=0, P(I=1|Z))|I=1$ is the mean constructed counterfactual using the matched non-participants with the same propensity scores.

The selection of matching methods depends on the distribution of the estimated propensity scores. In this paper, the author employs two alternative matching estimators which are commonly used: nearest-neighbour matching and kernel matching. The use of the different matching methods could help test the robustness of different effect estimates [32], although each method has its own strengths and limitations [33]. With nearest-neighbour matching, for each participant the counterfactual income comes from the closest non-participant, where proximity is defined in terms of the distance between the propensity scores. This matching method often leads to a bias when the distribution of the estimated propensity scores between participants and non-participants is incompatible. Kernel matching works well with asymmetric distributions because it uses additional data where they exist but excludes bad matches. Therefore, the results of this method are often better than those of the nearest-neighbour matching in terms of covariate balance after matching.

There are some limitations to the PSM method used. First, this method relies on the assumption that the appropriate observable control variables are selected. Since previous literature provides only limited guidance on which variables should be included in the conditioning set, a matching method does not necessarily solve the fundamental selection problem. Second, tourism participants and non-participants might also systematically differ in some unobserved characteristics; for example, some of the villagers are risk-averse and thus they may hesitate to leave traditional jobs to participate in tourism and this is difficult to measure. Third, the PSM can only estimate treatment effects where there is a support region for the participants among the non-participants. In practice, participants not only have a direct impact on their income, but they might also indirectly affect the income of the non-participants.

3.2. Data

The data was collected in 2014 with a few supplements in 2015. First, field observations were carried out to get an overview of activities that were taking place within the MPA. Second, a semi-structured questionnaire was used to collect cross-sectional data from 140 locals in different communities. The questionnaire focused on various aspects of the villagers consisting of attributes of demography, human capital, physical capital, finance capital, income, and institution matters.

The data can be split into two groups: one group takes part in the tourism industry and the other does not. The respective groups are made up of 36 tourism participants and 104 tourism non-participants. Of 36 tourism participants, 26 (72%) regard tourism as their sole occupation. They currently work fulltime for the tourist companies or are self-employed and earn money from the sale of products and from providing transporting services associated with tourism. Ten (28%) consider tourism as a supplementary activity in addition to their existing occupations. They keep fishing and/or aquaculture farming as their main livelihood, but at the same time they get opportunities to work for tourism, such as simultaneously running aquaculture and floating restaurants on the farming cages.

To explain participation decisions in tourism activities, the following observable covariates were included in line with the predictions in equation (1): *age, gender, and household size* to control for a person's demography; *education* is as an indicator of human capital; and *location* is as power of physical capital. The dummy variables of *fish_asset* and *aqua_asset* represent financial resources that might help local people access different livelihood options. The outcome variable was the self-reported average incomes of the tourism participants and non-participants of the survey year.

The summary statistics of the variables included in the decision model are provided in Table 2. The table shows notable differences in terms of characteristics between the different groups: (1) tourism participants; (2) tourism non-participants; (3) participate in tourism activities only; (4) participate in both tourism and fisheries/aquaculture activities. Descriptively, the residents who participate in tourism activities are normally younger, better educated, come from a larger household size, and live closer to the tourism hotspots than those who are not involved in tourism. At first glance, the income of the tourism participant group is, on average, greater than that of the tourism non-participant one. However, people working solely for tourism experienced a lower income than those who are not involved in tourism activities or stay with traditional occupations. Meanwhile, people taking part in both tourism and existing occupations gain greater income than the other groups.

4. Results

Table 3 presents the probit estimates of the propensity score for the three comparison groups: Model 1- either participate or not participate in tourism activities; Model 2- participate in tourism activities only or in fisheries and aquaculture activities only; Model 3- either work simultaneously with tourism, fisheries and aquaculture activities or stay with traditional occupations only. The estimates of the parameters in equation (1) are shown in the form of coefficients. The algebraic signs express the direction of the effects of corresponding factors on the decision of tourism participation. As expected, the coefficients of *education, age, and gender* have the right sign and are statistically significant at the 1%, 5%, and 10% levels in at least in one of the models. This suggests that women, young people, and those with high education are likely to participate in tourism activities. The *location variable* has a statistically significant impact on the decision of whether or not an individual should involve in tourism activities in both models 1 and 2. The further they live from tourism destinations, the less likely they are to join tourism activities. This is due to the inconvenience of transportation between the islands. Truly, at the time of the data collection, no one from Bich Dam and only few people in Vung Ngan, the two islands that are far from the tourism destinations, take part in tourism activities. The local workforce engaged in tourism is mainly from Hon Mieu which is very close to tourism areas and transporting vessels to and from this island operate more frequent. *Household size* is a variable that negatively affects the

Table 2
Characteristics of residents involved or not involved in tourism activities: summary statistics (Standard deviations in parentheses).

	Unit	Total population (N = 140)	Tourism non participants (N = 104)	Tourism participants (N = 36)	Participate in tourism activities only (N = 26)	Participate in both tourism and fisheries/aquaculture activities (N = 10)
Age	Years old	41.10 (8.79)	42.64 (8.60)	36.64 (7.88)	35.84 (8.39)	38.7 (6.27)
Household size	People	4.72 (1.26)	4.88 (1.15)	4.28 (1.47)	4.19 (1.02)	4.50 (2.32)
Location (1–4: close-far from tourism hotspots)	–	2.18 (1.05)	2.39 (1.07)	1.56 (0.69)	1.38 (0.57)	2.00 (0.82)
Gender (1 = female, 0 = male)	–	0.11 (0.32)	0.08 (0.27)	0.22 (0.42)	0.19 (0.41)	0.30 (0.48)
Education (1 = Secondary school, 0 = Illiteracy or primary school)	–	0.10 (0.30)	1.03 (0.17)	1.33 (0.48)	0.27 (0.45)	0.40 (0.52)
Aqua_asset (1 = Yes, 0 = No)		0.12 (0.33)	0.11 (0.31)	0.17 (0.38)	–	0.60 (0.52)
Fish_asset (1 = Yes, 0 = No)		0.46 (0.50)	0.61 (0.49)	0.06 (0.23)	–	0.20 (0.42)
Income	Mil. VND/ year	114.25 (112.90)	97.08 (65.81)	163.89 (185.66)	95.15 (66.41)	342.60 (269.56)

Table 3
Propensity score estimation results.

Variable	Model 1 Participate or not participate in tourism activities (N = 140)	Model 2 Participate in tourism activities only or in fisheries and aquaculture activities only (N = 130)	Model 3 Work simultaneously with tourism, fisheries and aquaculture or stay with fisheries and aquaculture only (N = 114)
Age	−0.028[c]	−0.338[c]	−0.023
Gender	0.929[c]	0.862[c]	1.340[c]
Household size	−0.009	−0.251[c]	−0.008
Education	0.891[b]	1.017[b]	1.988[a]
Location	−0.452[b]	−0.645[a]	−0.361
Aqua_asset	0.652[c]	–	2.196[a]
Fish_asset	−1.284[a]	–	0.093
Constant	1.366[c]	2.618[a]	−0.637
Log likelihood	−49.396	−43.739	−17.069
Pseudo-R2	0.381	0.328	0.496
LR chi	60.82	42.63	33.63

[a], [b], [c] Significant at the 1%, 5%, and 10% levels respectively.

choice of a career in tourism. This might explain that people who come from big families tend to stay in fishing and aquaculture farming because of the pressure to support their families. Interestingly, villagers who own aquaculture farms are more eager to participate in tourism activities; but this does is not true with those who have fishing vessels. This phenomenon was also observed during the investigation. The aquaculture farms could be run simultaneously as floating restaurants, whereas the fishing vessels are more difficult for villagers to combine with tourism services.

The average treatment effects on income between the different groups are presented in Table 4. Interestingly, the treatment effects of model 3 are significant at the 5% level only. The two methods show similar results and the same significance levels for all the estimates. At first glance, one can say that participating in tourism can deliver greater benefits than not participating in tourism (model 1). This implies that the strategy of developing tourism as an alternative means of livelihood in the MPA sounds efficient. However, if the local people switch from fisheries and aquaculture to tourism related livelihood activities, then their incomes are not statistically significantly improved (model 2). If they still keep their traditional occupations and at the same time work with tourism, then they will get the highest income (model 3). In other words, tourism has not been able to replace other forms of livelihood sustenance. This implies that, for management to be effective, tourism should not be viewed in isolation with other existing income generating activities.

The *t*-test for identifying probabilities of bias reduction in each

Table 4
Different average treatment effects on income.

Model	Nearest-neighbour matching				Kernel matching			
	Treated	Control	Diff.	SE	Treated	Control	Diff.	SE
Model 1	163.89 (104)	112.47 (36)	51.42	38.48	184.04 (104)	121.02 (31)	63.01	43.77
Model 2	95.15 (104)	86.73 (26)	8.42	20.81	92.86 (104)	93.96 (22)	−1.10	20.1
Model 3	342.60 (104)	126.90 (10)	215.70[b]	87.08	408.33 (104)	184.07 (6)	224.26[b]	128.94

Number of observations in the support region is in the parenthesis; [b] Sig. at the 5% level.

variable as well as covariate balancing tests before and after matching for both the Nearest-neighbour matching and Kernel matching methods show that the mean standardized bias is significantly reduced, the balance are greatly improved, and only few biases remain. The detailed results are presented in Appendix (Table A.1; Table A.2).

5. Discussion and concluding remarks

The paper discusses how the decisions of tourism participation are formed in local communities at MPAs and examines the linkage between decisions regarding tourism participation and local residents' income. NTB MPA in Vietnam is used as an illustrative case for analysis. The results provide evidence of higher income for those who work simultaneously in both traditional fishing or aquaculture farming and tourism and lower income for those who choose to join either with tourism or with traditional fishing or aquaculture workforce. Reasoning that tourism in the NTB MPA did not meet the potential in terms of delivering new employment opportunities and improving income to the local communities, the residents themselves attribute the limited benefits to their low level of education, long distance to the tourist attractions, and pressures to make a living for a big family. This demonstrates that leaving traditional livelihoods and entering the tourism industry does not secure the local people a better income. Therefore, it is important to understand that when making management decisions, tourism complements rather than displaces the existing traditional income generating activities.

The tourism industry has been given priority in the MPAs in many developing countries, because it is recognized as one of the pillars for economic growth in the region. Whilst this is true for the case of NTB MPA, the main beneficiaries are the tourism investors outside of the protected area. The proportion of benefit that accrues to the local communities seems to be modest. In order to manage sustainably the MPA, the benefits exploited from the area should be shared equally among the stakeholders. If necessary, a mechanism of benefit redistribution, such as taxing industrial tourism activities to compensate the loss of the communities in the MPA, should be implemented. A profitable tourism sector cannot be explained as a wedge to eliminate the fishers and aquaculture farmers from the MPA. Excluding people from one form of livelihood does not mean they will be able to search for a different way of making living [27]. Instead, the tourism sector has to reach out to the fishers, who are normally considered as the poorest of the poor and the ones occupying and using the areas that are important to preserve [3].

It is clear that tourism cannot give a guarantee for the local residents in terms of economic well-being when they exit the fishing or aquaculture industry. Therefore, it is important that these resource dependants are able to sustain and afford their livings once tourism industry is introduced and prioritized in the MPAs. Assessing livelihood vulnerability should be one of the first steps before establishing full protection no-take areas and designing initiatives for tourism development. As indicated by Scheyvens [28]; livelihood vulnerability would decrease if tourism development could involve the poor. In other words, the ecosystem would be more valuable if the both industries can work well together. However, the lack of human capital in most communities might limit the ability of launching initiatives on their own. In NTB MPA, for example, low literacy levels, along with poor organization, impair communication and the ability to understand problems and make connections. Thus, aid from the government is needed in the early stages. Training programs for the fishers and aquaculture farmers (e.g., wildlife watching or hospitality training) could be organized so that they would be able to join the tourism workforce. Such courses might not only create potential employment for the local people but also enable them to be conscious of value of the MPA.

In short, sustaining tourism is not only sustaining a regional economy, but also sustaining the economic welfare of the local villagers and diversifying employment portfolios. It requires appropriate planning, monitoring, and enforcement. For instance, decisions such as moving fishers from the MPA to the mainland, cannot be made without consensus of fishers [11,29]. In other words, if tourism is encouraged, it must not be seen to take priority over existing traditional activities, but it should be promoted such that it is complementary with other resource-based users [30].

Despite the limitations, which should be kept in mind when interpreting the results, the PSM method is still considered useful for empirical examinations of the real effects of tourism activities on generating income for the local communities. The results obtained in this study can also make a broader contribution toward to other places that are going through the same process, specially pointing out the need of complementarity instead of exclusivity of activities. Future work could be an assessment of supporting programs offered by the local authorities and their effects on mobilizing local people to participate in tourism activities.

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Appendices.

Table A.1
Bias Reduction (%) for Distribution of the Variables[a] (p values from the *t*-test are in the parentheses)

Variable	Model 1	Model 2	Model 3
Age	48.2 (0.099)	66.1 (0.304)	74.6 (0.862)
Gender	−52.9 (0.002)*	−66.7 (0.018)*	10.3 (0.288)
Household size	20.9 (0.088)*	71.8 (0.508)	73.3 (0.905)
Education	90.0 (0.804)	84.0 (0.755)	100.0 (1.000)
Location	86.8 (0.539)	92.4 (0.643)	23.9 (0.382)
Aqua_asset	−128.1 (0.170)	–	79.8 (0.673)
Fish_asset	95.0 (0.56[a])	–	75.4 (0.628)

*: is not balanced after matching.
[a] For Nearest neighbour matching method. The results for Kernel matching are available upon the request.

Table A.2
Covariate balancing test before and after matching[a]

	Model 1		Model 2		Model 3	
	Before matching	After matching	Before matching	After matching	Before matching	After matching
Mean standardized bias	70.20	29.20	72.9	24.3	67.5	21.9
Pseudo-R^2	0.381	0.136	0.328	0.032	0.496	0.128
LR $\chi 2$ (p- value)	0.000	0.027	0.000	0.728	0.000	0.830

[a] For Nearest neighbour matching method. The results for Kernel matching are available upon the request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.marpol.2020.103891.

Author statement

Thuy Thi Thanh Pham conceived of the presented idea, developed the method and performed the computations. The author also investigated the findings, discussed the results and contributed to the final manuscript.

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