# Stakeholder Perception of Coral Reef Management Policy Implementation Along the Eastern Coast of Thailand

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## ABSTRACT

Coral reef-related tourism contributes to economic development and strengthens local community livelihood opportunities; however, it is not environmentally neutral, and it needs an integration of policy and management actions to harmonize tourism benefits and coral reef health. Thailand is among the top tourism destinations in the world, and the east coast has experienced a doubling of tourism activity in the past decade. A socio-ecological study explored the perceptions of stakeholders concerning coral reef management policy implementation in Marine Protected Areas in the Eastern Coast of Thailand. Coral reef managers and users were interviewed about their perceptions of the planning, process and outcome of coral reef management policy and regulations. Users largely felt that they were left out of the decision process in coral reef management and they are unlikely to participate in conservation activity because of the lack of communication between managers and users. The adversarial perceptions between managers and users possibly undermine the success of coral reef management. Managers perceived gaps between institutional policies and implementation priorities, which frequently deprioritized conservation. This study suggests that success of marine resource management needs comprehensive policy together with close communication between managers and end users to get strong support from local communities.

**Keywords:** Marine National Park, Marine and Coastal Resources Management, Coral reef tourism, Eastern Thailand, Management Effectiveness Evaluation

## INTRODUCTION

Coral reef has long been a focus of tourism marketing for countries such as Thailand, largely because of perceived economic benefits for coastal communities (Kim *et al*., 2012), many of which have been disadvantaged by the impacts of industrial fishing (Pomeroy and Cruz-Trinidad 1996). Coral reef-related tourism contributes to economic development and strengthens local community livelihood opportunities; however, it is not environmentally neutral, and it needs an integration of policy and management actions to harmonize tourism benefits and coral reef health.

Marine Protected Areas (MPAs) are regarded as effective tools to protect and manage coral reefs; in the best case, such management can yield a significant increase of coral reef resources (McClanahan *et al*., 2015). Thailand long ago recognized a need to manage and restrict the rampant coastal development seen in other tropical nations (and the concomitant rapid decline in their ecosystem services), and in the last quarter of the 20$^{th}$ century placed as many of the coastal islands as possible under explicit institutional management. A successful

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MPA benefits not only resource conservation, but also benefits local stakeholders and communities, by leading to empowerment, improved governance, and alternative livelihoods (Bennett and Dearden, 2014). Yet, studies reveal that management of more than half of the world's MPAs have not effectively met their desired goals (Leverington *et al*., 2008). Ineffective management of MPAs is frequently a result of a lack of appropriate policy or fragmentation of policy among relevant agencies, and this produces an MPA unable to deliver the expected improvement in ecosystem goods and services to local stakeholders. Furthermore, poorly-managed MPAs engender a diminishment of local support for protective measures (Bennett and Dearden, 2014).

Management effectiveness evaluation aims to assess the capacity of the management agency to manage a designated protected area (PA), and to determine the degree to which the protected area has achieved its management goals and objectives (Hockings *et al*., 2006). However, there is an argument that the independence or clarity of data on PA management effectiveness might be criticized because it relies on the responses of PA managers, and achievement ratings based on their own perceptions (Eklund and Cabeza, 2017). The weakness of an approach relying solely on managers' perceptions is that the managers may be entirely unaware of the effectiveness of the PA in a wider stakeholder context; they may in fact be delivering on their own (internal) management goals without ever addressing the concerns of local stakeholders, or potential threats to the PA that originate outside their area of immediate control. Effective management not only depends on the capacity of PA managers, but also on the degree of local support, influenced by perceptions of stakeholders affected by the PA (Bennett and Dearden, 2014).

Community/stakeholder opinions can reflect the process and outcomes of management policy implementation. A necessary first step in determining the success of policies is to assess the ways in which policies are perceived by stakeholders–not just whether they agree or disagree with the principles, but how these policies affect the stakeholders' ability to conduct their businesses. Understanding the issues associated with management of coral reef areas, both inside and outside MPAs from the point of view of the different levels of management and end users implies integrated management policy and implementation that encompasses the whole ecosystem, including humans, to maximize long term benefits.

This study aims to examine perceptions of stakeholders toward coral reef policy implementation in the eastern coast of Thailand. We also investigated how synergistic or antagonistic interactions among different stakeholder groups are influenced by management decisions by the different management agencies at each level.

## MATERIALS AND METHODS

*Study sites*

The east coast of Thailand has long been a desired destination of those who love diving or seeing beautiful underwater life. Coral reefs can be found scattered along the coastline and around many of the islands in Chonburi, Rayong and Trat provinces (Chansang *et al*., 1999). Water-based activities that exploit the perceived aesthetic values of the coastline, especially diving activities (both snorkeling and SCUBA) have become popular. Non-diving activities–beachside sunbathing, outdoor restaurants and souvenir shopping–provide additional opportunities for local businesses to benefit from ecosystem management by local authorities in those areas. Additionally, dormitory businesses, both within and outside national parks are lucrative. Within national parks, accommodation is a monopolistic enterprise administered by agents of the DNP; outside parks, large and small hotel chains and local businesses provide a wide range of accommodation.

This study was carried out in two well-known destinations for reef-related tourism (Figure 1): Khao Laem Ya Mu Ko Samet MNP (hereafter; KS) in Rayong Province, and Mu Ko Chang MNP (hereafter; KC) in Trat Province. KS and KC are popular Marine National Parks (hereafter; MNP);

each receives more than 300,000 tourists per year. KS and KC have been recognized for their relatively pristine and easy accessible coral reefs and beautiful beaches. KS comprises a group of islands surrounded by fringing coral reefs. The biggest island of the group is Samet Island, which is partly occupied by a local community and extensive tourism development along the beaches. Tourism is the major livelihood of local community members on this 13 $km^2$ island. KC comprises of group of 40 islands which are surrounded by fringing coral reefs. The biggest island, Chang Island, is the second largest island in Thailand, with a total area of 429 $km^2$.

KS and KC both have areas that overlap with the local community, where there has been a great expansion in tourism business development during the last two decades. Local community members in these MNPs are often former fishermen who changed their livelihood to a tourism-related business (tour boats, accommodation, etc.). A large proportion of the coastal area in both locations was converted into tourism infrastructure to serve an increasing demand.

*Defining stakeholders*

In this study, stakeholders were defined as managers and users (who include business owners who derive benefit from the resource). The descriptor "coral reef manager" in eastern Thailand includes various national-level agencies: Department of National Parks, Wildlife and Plant Conservation (DNP) and Department of Marine and Coastal Resources (DMCR), both under the Ministry of Natural Resources and Environment (MONRE). These national agencies are supported by provincial and local agencies including Provincial Environment Office (PEO) and Sub-district Administration Organization (SAO).

The local agencies under DNP that are responsible for coral reef management in eastern Thailand are the two previously mentioned MNPs (KC and KS) and a Marine National Park Operation Center (MNPO). The mandates of the MNPs are to protect and conserve coral reef resources in order to enhance ecological value, aesthetic value and recreational value. The MNP has full authority to

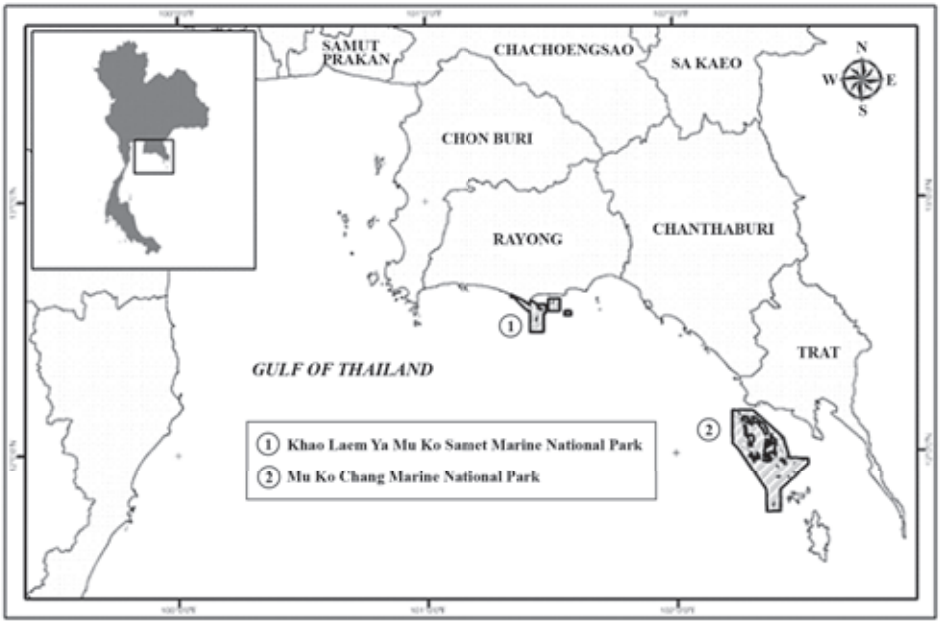


Figure 1. Study sites where stakeholder perceptions of resource management were polled, including 1) Khao Laem Ya Mu Ko Samet MNP in Rayong Province and 2) Mu Ko Chang MNP in Trat Province.

manage coral reefs within the National Park area as the sole agency, not requiring input from any other agency. The MNPO is responsible for technical support to MNP such as research and monitoring, although its de facto role includes provision of technical advice and services to MNPs.

Coral reefs outside national parks are the administrative responsibility of the Department of Marine and Coastal Resources (DMCR) at the national level. DMCR is the agency responsible for management, conservation and rehabilitation of coral reef resources in Thailand. The structure of DMCR in Eastern Thailand consists of the Office of Marine and Coastal Resources Management (MCRM) and the Marine and Costal Resources Research and Development center (MCRR). The MCRM has a mandate to protect and conserve coral reefs, to control and surveil illegal practices in coral reefs, and to promote public participation and awareness in coral reef management in areas not otherwise administered under DNP auspices. The MCRR has a mandate to conduct research for conservation and rehabilitation of coral reef resources. The jurisdiction of the DMCR literally extends over all marine and coastal areas of Thailand, excepting only MNP areas.

The Provincial Environment Office (PEO) is the agency assigned as a coordinating body for any agency under the Ministry of Natural Resources and Environment (MONRE) at the province level. The PEO has no specific mandate on coral reef management, but acts as a coordinating body among relevant agencies for environmental management according to the requirements of MONRE and province administration policy. It has specific roles during handling of urgent issues such as oil spills. The Sub-district Administration Organization (SAO) is an administrative body at the sub-district (tambon) level. Their mandates involve regulation of construction, solid waste and wastewater management (planning, design and deployment of infrastructure).

The users in the tourism sector were defined for the purposes of this study as tour operators and hotel operators who gain benefit from coral reefs. The majority of tour operators in the east are dive operators whose business relies entirely on coral reefs. In many parts of the world, such businesses are often associated with damage to coral, anchoring damage, feeding of marine fish and waste discharged from the boat (Dinsdale and Harriott, 2004; Milazzo *et al*., 2006; Reopanichkul *et al*., 2009; Hannak *et al*., 2011). The remainder of the "user" group are hotel operators who provide dormitory services for tourists who travel to access the services of the tour operators. A considerable body of literature exists documenting the extent to which coastal infrastructure creates impacts to the coral reef and its immediate environment, associated with sedimentation during construction, waste water and solid waste discharged to the sea (Reopanichkul *et al*., 2010; Bessell-Browne *et al*., 2017).

*Data collection*

To collect the socio-ecological data for this study, structured interviews were conducted with the resource managers and resource users to examine perceptions of management policy implementation. Between the two provinces, a total of seven resource managers and 72 users were interviewed.

A questionnaire to elicit perceptions of key management indicators was designed according to IUCN-WCPA management effectiveness evaluation framework (Hockings *et al*., 2006). It was possible to frame the study in terms of three major indicators: context and planning for intended use, implementation process, and perceived outcome (Table 1). Coral reef managers were interviewed on all of these three elements and users were interviewed with focus on process and outcome, since early interviews revealed that they uniformly had no insight at all into the planning and contextual elements.

*Data analysis and interpretation*

Stakeholder perceptions were scored using ordinal Likert-type scores. Therefore, descriptive statistics were used for central tendency and frequencies (Boone and Boone, 2012). Chi-square test was performed to compare perceptions between stakeholder groups and between types of

Table 1. Questions used to interview stakeholders regarding management of two Marine Protected Areas in eastern Thailand.

| Question | Target respondents | |
|---|---|---|
| | manager | user |
| **1. Perceptions of context and planning** | | |
| 1.1 Is there policy and an action plan for coral reef management available? | / | |
| 1.2 What are the threats to coral reefs and to what level do the threats harm coral? | / | / |
| 1.3 Are there plans to prevent or to manage consequences of threats? | / | |
| 1.4 Are there plans for stakeholder engagement? | / | |
| **2. Perceptions of process** | | |
| 2.1 Are the users aware of the existence of the MPA? | | / |
| 2.2 How often have joint user conservation activities occurred? | / | / |
| 2.3 How often have joint user activities involved management decision making? | / | / |
| 2.4 Have the management's regulations impacted user's business? | | / |
| **3. Perceptions of outcome** | | |
| 3.1 Do users agree that the management can conserve coral reefs? | | / |
| 3.2 Are the resources important to the user's business? | | / |
| 3.3 What is the current condition of resources? | / | / |
| 3.4 Has the resource condition changed over time? | / | / |
| 4. **Perceptions of proposed measures to manage coral reef environment.** | | |
| Do you oppose or support? | | |
| 4.1 Increased enforcement of existing rules/regulations? | / | / |
| 4.2 Stricter control of sources of pollution to preserve water quality? | / | / |
| 4.3 More restrictions on construction practices to prevent sediment going into the sea? | / | / |
| 4.4 Limits on recreational use? | / | / |

users (tour operators and hotel operators). All statistical tests were performed using SPSS V.11.5 (SPSS Inc., 2002).

*Limitations*

This study was not intended to in any way evaluate management effectiveness or performance of management agencies. The results of the study, which include the perceptions by stakeholders of policy implementation, based on their personal experience and attitudes, do not reflect actual performance of any given agency or agent. The study is necessarily limited to the agencies and stakeholders identified above, and does not reflect the opinions or perceptions of other groups of stakeholders (such as local fishermen or tourism-affiliated businesses), who may peripherally benefit or be disadvantaged by the policies described here. It was initially considered that a survey such as this should be as inclusive as possible, but–after preliminary surveys were undertaken – we found that expansion of the survey beyond the present set of respondents did not improve the clarity of the data, and served only to dilute the story discovered here.

## RESULTS

*Perceptions of plan for coral reef management*

The area of concern most-discussed among managers was that, while there is policy involving natural resource management, there is no specific plan for coral reef management (57% response). DMCR has policy specifically related to coral reef management, but it primarily focuses on research, monitoring and rehabilitation. It is the only agency that has a 5-year master plan and annual action plan for their day-to-day management activities, all following the 20-year master plan of

MONRE. The management plan objective related to coral reefs is "to increase coral and coral reef area", which is the currently-implemented policy of the DMCR. To meet this objective, DMCR has promoted rehabilitation projects and promotes the designation of MPAs according to the Enhancement of Marine and Coastal Resources Management Act, B.E. 2558 (2016). Therefore, staff believe that coral reef transplantation is the priority task for coral reef management within MCRR and MCRM (Table 2).

MNP (a subset of DNP) and DMCR are the key management agencies directly involved in coral reef management. Each MNP has a resource management policy, but no specific plan for coral reefs. The master plans that MNP use for day-to-day management were prepared by the DNP head office, and are comprised of certain common tasks for local managers; as such, they represent more of a "general practice" policy rather than explicit statements of intent, and contain no performance assessment criteria or priority actions. Several "emerging issue" codices were added to the basic master plan documents, in response to policy updates from the head office (Bangkok) of the National Parks department, or as a reflection of new policies the department had adopted in response to international agreements.

The park managers interviewed mentioned that when the DNP central authority completes the drafting of the new 5-year master plan, the local Park will adopt it as their action plan to guide day-to-day management. Currently, there is no up-to-date master plan available; the current plan has been used since 2003–2008. Additionally, the prioritization of policy has changed over time due to a somewhat unstable governance system; for example, the superintendent of KS was directed to solve problems in the tourism sector (i.e. encroachment on crown land, construction and renovation of hotels without permission); one comment was that "our priority is to get all business in order under the national park regulations, therefore we don't have enough staff for coral reef management for a while". All were in agreement that clear and long-term policy is needed in order to secure continuity of MNP management.

The remaining managers, from PEO and SAO, had no mandate for coral reef management. PEO is the coordinator for all levels of relevant agencies under MONRE at the province level, and is responsible for the "provincial environment management plan" and the "provincial natural resources management plan". As the provincial coordinator, PEO would have opportunity to

Table 2. Perceptions by resource managers of policy and planning for coral reef management in two Marine Protected Areas in Eastern Thailand.

| Management agencies (manager) | Level of policy availability* | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| MCRM | 0 | 0 | 1 | 0 |
| MCRR | 0 | 0 | 0 | 1 |
| MNP | 0 | 1 | 0 | 0 |
| MNPO | 0 | 1 | 0 | 0 |
| PEO | 1 | 0 | 0 | 0 |
| SAO | 0 | 1 | 0 | 0 |
| PM | 0 | 1 | 0 | 0 |
| % of total managers | 14 | 57 | 14 | 14 |

*Level of policy availability; 1 = no policy available for coral reef management, 2 = there is policy for management natural resources but no specific policy for coral reefs, 3 = there is policy for coral reef management but strategy and objectives are insufficient to guide day-to-day management, 4 = there is a specific policy for coral reef management; strategy and objectives are sufficient to guide day-to-day management.

make a comprehensive plan for natural resource management in the province, and would have the inter-agency oversight to optimize its coverage. In fact, PEO is largely a rebadged provincial forestry office with similar resourcing; the problem that interviewees mentioned is that there are insufficient staff and funding to achieve comprehensive planning. SAO is the local administrative unit at the sub-district level responsible for community well-being, waste management and management of infrastructure within its jurisdiction; and, while there is standing policy to conserve natural resources, there is no specific policy for coral reef management, and few if any of the SOA-level administrators have sufficient academic background in marine policy to create them. Ko Chang Tai SAO (the southern portion of Chang Island) is located in the middle of the MNP area. The failure to link SAO and MNP policy means that it is inevitable that their policy and management output would have direct impact to Mu Ko Chang MNP.

*Perceptions of potential threats to coral reefs*

Perceived threats to coral reefs were similar across all groups of respondents. Resource managers and tour operators had similar perceptions of the threats that directly impact coral, whereas hotel operators had a slightly different perception. The result may indicate the level of experience of respondents with coral reef environments. Tour operators who had direct experience with coral reefs responded that any threats that impact coral directly would be perceived to have large impact. Hotel operators appeared to have the least experience with coral reefs, and their typical response was that only threats that they were familiar with (such as garbage) were perceived to have large impact. Perceptions of respondents of tourism ($\chi^2 = 23.46$, $p = 0.003$) and feeding of reef fish ($\chi^2 = 24.91$, $p = 0.002$) were different across types of respondents. Managers perceived that tourism has extreme impact on coral reefs but hotel operators perceived that its impact is unremarkable. Managers perceived that feeding of reef fish has strong impact on coral reefs but tour operators and hotel operators perceived that the impact of fish feeding is unremarkable (Table 3).

*Perceptions of level of participation*

MNP, MCRR and MCRM have policies for stakeholder engagement, NPOC has no policy to engage stakeholder participation although they have occasionally requested particular stakeholders for participation, while PEO and SAO have no policy or plan to engage stakeholders. The results of this survey showed that managers were unlikely to experience any significant success in engagement of local people to take part in coral reef management. Perceptions by managers of the level of participation

Table 3. Perceptions of threats to coral reefs by managers and users in two Marine Protected Areas in eastern Thailand.

| Threats | Perceived level of impact* | | | $\chi^2$ | F - value |
|---|---|---|---|---|---|
| | Manager mode | Hotel operator mode | Tour operator mode | | |
| Coral Bleaching | 3 | 2 | 2 | 6.77 | 0.561 |
| Tourism | 4 | 2 | 3 | 23.46 | 0.003** |
| Trampling | 2 | 2 | 3 | 8.81 | 0.391 |
| Feeding of reef fish | 3 | 2 | 2 | 24.92 | 0.002** |
| Anchoring | 2 | 2 | 2 | 3.68 | 0.884 |
| Waste water | 3 | 2 | 3 | 7.35 | 0.499 |
| Coastal development | 3 | 2 | 1 | 6.51 | 0.589 |
| Garbage | 3 | 3 | 3 | 10.44 | 0.235 |
| Fishing | 2 | 2 | 2 | 7.09 | 0.526 |

*Level of impact; 0 = no idea, 1 = no impact, 2 = impact is unremarkable, 3 = strong impact, 4 = impact is extreme.
** indicates significance level $\alpha = 0.05$

they had received from users were significantly different from what users perceived of their own participation in both conservation activity ($\chi^2$ = 16.83, p = 0.002) and activity involving decision making for management regulation implementation ($\chi^2$ = 26.64, p < 0.001) (Table 4).

Users (49 %) perceived that they had occasionally participated in conservation activities hosted by MNP. The common reason was that they had not been informed when activities were held; such events were usually corporate social responsibility (CSR) programs of private companies (often with no other links to the areas). Tour operators mentioned conservation campaigns, noting that "reef cleaning is a kind of conservation activity that yields no concrete outcome, the amount of food containers that were left behind on the island was even more than the garbage they have collected, and since there was low enforcement to control sources of that garbage, you will be always see garbage in coral reefs".

Perceptions by users of their involvement in making decision on policy implementation were occasionally (45.8 %) or never (40.3 %), as was expressed in a remark that "they (MNP) did what they wanted to do, they just informed us", whereas managers perceived that they received participation from users in almost all activities. Each MNP has a group known as the Protected Area Committee (PAC) as the park's consultants in planning, implementation and evaluation. The typical PAC consists of representatives from various stakeholders, including government, local community, academic and business sectors. However, the typical MNP was unlikely to succeed in engagement of users in coral reef management.

DMCR agencies (MCRR and MCRM) have policy and strategy to promote stakeholder participation, particularly involving representatives from the local coastal community, according to the Enhancement of Marine and Coastal Resources Management Act, 2015. Local stakeholders have the opportunity to be part of the "provincial marine and coastal resources committee" and the opportunity to gain technical and funding support from DMCR in aid of resource management. Since coral reef management policy of DMCR is skewed significantly to more specifically involve research and conservation, rather than control and regulation, it is more possible for DMCR policymakers to get collaboration and compliance from local stakeholders.

*Perceptions of impact of MNP management regulation implementation on users' business*

Perceptions by users of the impact of MNP regulations on their business were diverse, ranging from no impact (33%), unremarkable impact (23%)

Table 4. Perceptions by managers and users of participation by users in conservation activity and decision making activity.

| respondents | Level of participation in conservation activity (%)* | | | | | $\chi^2$ | p - value |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | | |
| Managers | 30 | 10 | 30 | 20 | 10 | 16.83 | 0.002** |
| User | 1 | 22 | 49 | 11 | 17 | | |
| **respondents** | **Level of participation in decision making (%)*** | | | | | **$\chi^2$** | **p - value** |
| | **0** | **1** | **2** | **3** | **4** | | |
| Managers | 20 | 10 | 20 | 50 | 0 | 26.64 | 0.000** |
| User | 4.2 | 40.3 | 45.8 | 4.2 | 5.6 | | |

*Level of participation; 0 = no idea, 1 = never, 2 = occasionally, 3 = almost all activity, 4 = all activity.
** indicates significance level α = 0.05

to significant impact (28%) (Table 5). Although it was statistically insignificant (because of bimodality among some groups), perceptions of management regulations by users varied across types of users. Hotel operators generally perceived that park regulations have "no impact" or "unremarkable impact" on their business. They mentioned only the long process they must undertake when they request permission to modify or renovate their hotels. Tour operator perception equally fell into two categories: "no impact" and "impact is remarkable". Tour operators at Ko Chang MNP complained of loss of access to certain coral reefs due to the park regulations, while the reefs they were allowed to access were over-crowded. SCUBA operators have had to move to the other dive sites out of the MNP area to accommodate the desire of tourists to dive at relatively uncrowded sites. The other complaint made was a lack of transparency for the outcome and method of collection of entrance fees. Tour operators expect that the entrance fee is collected for the purpose of improving infrastructure for their benefit, but there were still not enough mooring buoys at dive sites. Others complained that the method of collection of entrance fees is inappropriate, since their customers need to pay for diving and for accessing waterfalls separately, even though both attractions are within the same MNP.

*Perceptions of current condition of natural resources*

Stakeholders perceived that coral, fish, beaches and adjacent water are all in good condition (Table 6). However, perceptions of change in resource condition were different between managers (mode = perceived to be good) and users (mode = perceived to have become worse).

Managers perceived that the current condition of coral reefs, fish and water were better than in the past 10 years, and that the quality of beaches had not changed. DMCR interviewees mentioned that coral reefs were degraded after the 2010 bleaching event, and recovered afterward to the extent that now they are healthier than at any time in the past 10 years. All groups of users perceived coral reefs, fish, beaches and water to be worse compared to the past 10 years.

*Perceptions by users of value of natural resources*

There were differences in the perception of the importance of resources to users' business (Table 7). Perceptions of the importance of coral reefs ($\chi^2 = 20.93$, $p < 0.001$) and coral reef fish ($\chi^2 = 10.96$, $p = 0.004$) were different between tour operators and hotel operators. Tour operators perceived that coral reefs and coral reef fish were important to their business, whereas hotel operators perceived coral reefs and coral reef fish were unlikely to be important to their business. Although it was not significant, the condition of adjacent beaches was much more important to hotel operators (61.4%) than tour operators (46.4%). They all agreed that good water quality is important to their business. Tour operators offer snorkeling and scuba diving to their customers, and so the condition of coral reefs, abundance of fish and cleanliness of the water have a strong influence on the satisfaction of customers. Tour operators therefore perceived that these parameters were important to their business. Hotel operators offer their customers nice accommodation and pleasant environments, which include a clean beach and clear water, therefore, they perceived beach and water cleanliness to be important to their business.

Table 5. Perceptions by users of impact of resource management regulations on their business in two Marine Protected Areas of eastern Thailand.

| Location (MNP) | Impact of MPA regulation on business (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| KS | 5.3 | 42.1 | 21.1 | 15.8 | 5.3 |
| KC | 10.0 | 26.7 | 23.3 | 33.3 | 10.0 |
| % within MNPs | 8.2 | 32.7 | 22.4 | 26.5 | 8.2 |

Level of impact; 0 = no idea, 1= no impact, 2 = unremarkable, 3 = remarkable, 4 = extreme

Table 6. Perceptions of current condition of natural resources and perceptions of change of natural resources by resource managers and users in two Marine Protected Areas in eastern Thailand.

| Resources | Perceived current condition of natural resources (Condition; 1 = poor, 2 = fair, 3 = good, 4 = excellent) | | | | |
|---|---|---|---|---|---|
| | Manager | Hotel | Tour | $\chi^2$ | p - value |
| Coral | 3 | 3 | 3 | 5.80 | 0.66 |
| Fish | 3 | 3 | 3 | 9.13 | 0.33 |
| Beach | 3 | 3 | 3 | 10.9 | 0.20 |
| Water | 3 | 3 | 3 | 7.5 | 0.47 |
| **Resources** | **Perceived change of natural resource = Mode (Level of change; 1 = worse, 2 = no change, 3 = better)** | | | | |
| | **Manager** | **Hotel** | **Tour** | **$\chi^2$** | **p - value** |
| Coral | 3 | 1 | 1 | 4.3 | 0.82 |
| Fish | 3 | 1 | 1 | 5.8 | 0.66 |
| Beach | 2 | 1 | 1 | 5.05 | 0.75 |
| Water | 3 | 1 | 1 | 4.92 | 0.76 |

Table 7. Perceptions by users (tour operators and hotel operators) of importance of natural resources to their business in two Marine Protected Areas in eastern Thailand.

| Are the following resources important to user's business? | Hotel (%) | | Tour (%) | | $\chi^2$ | p - value (2 - tailed) |
|---|---|---|---|---|---|---|
| | yes | no | yes | no | | |
| Coral | 38.6 | 59.1 | 92.9 | 7.1 | 20.93 | 0.000** |
| Coral reef fish | 31.8 | 65.9 | 71.4 | 28.6 | 10.96 | 0.004** |
| Beach cleanliness | 61.4 | 34.1 | 46.4 | 53.6 | 3.51 | 0.318 |
| Water cleanliness | 52.3 | 45.5 | 53.6 | 46.4 | 0.645 | 0.724 |

** indicates significance level $\alpha = 0.05$

*Recognition by users of management practices*

The users agreed that being a MNP can protect coral reef resources from illegal fishing and excessive tourist activity, since there are patrols for illegal fishing, and that collection of entrance fees might limit the number of foreign tourists. Sixty-seven percent of local users within the MNPs felt that the MNP imposed moderate to severe regulation of activities and practices, but largely did not recognize wider management goals. The interviewed users mentioned that the obvious policies of the MNP were the collection of entrance fees and the prohibition of particular activities (i.e. fishing in MNP, construction and renovation of houses and hotels along the coast).

*Perceptions of proposed management measures to manage coral reef environments*

When respondents were asked whether they support or oppose proposed management measures for coral reefs, there was general support for increased efficiency of enforcement, for control of point sources of pollution, and for strict control of sediment originating from coastal construction (Table 8).

Table 8. Perceptions by resource managers and users of proposed management measures to manage the coral reef environment in two Marine Protected Areas in eastern Thailand.

| Proposed conservation measures | respondents | Perception of respondents (%) | | | | | Mode | $\chi^2$ | p - value |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | | | |
| Increase enforcement | Manager | 20 | 20 | 0 | 40 | 20 | 3 | 11.55 | 0.172 |
| | Hotel | 9 | 7 | 16 | 55 | 14 | 3 | | |
| | Tour | 4 | 11 | 7 | 46 | 32 | 3 | | |
| Control pollutant sources | Manager | 30 | 0 | 10 | 30 | 30 | 3 | 27.05 | 0.000** |
| | Hotel | 0 | 0 | 5 | 45 | 50 | 4 | | |
| | Tour | 0 | 0 | 7 | 29 | 64 | 4 | | |
| Control coastal development | Manager | 30 | 0 | 0 | 40 | 30 | 3 | 9.20 | 0.326 |
| | Hotel | 11 | 23 | 9 | 39 | 18 | 3 | | |
| | Tour | 7 | 0 | 14 | 43 | 36 | 3 | | |
| Limit tourism use | Manager | 40 | 0 | 0 | 50 | 10 | 3 | 17.56 | 0.025** |
| | Hotel | 11 | 23 | 9 | 39 | 18 | 3 | | |
| | Tour | 4 | 39 | 18 | 32 | 7 | 1 | | |

Perception; 0 = no idea, 1 = oppose, 2 = neutral, 3 = support, 4 = strongly support.
** indicates significance level $\alpha = 0.05$

There was a difference of perception between managers and users, however, in terms of a willingness to limit use of coral reefs for tourism ($\chi^2$ 17.56, p = 0.025). Thirty percent of users (tour and hotel operators) were opposed to limited use of coral reefs, 12% were neutral, and 50% supported usage caps. On the other hand, 100% of managers strongly supported this measure. It is noted that whereas 23% of hotel operators were opposed to controls on coastal development, none of the tour operators involved in this survey opposed such measures.

## DISCUSSION

Sequestration of marine resources into Marine National Parks represents an important policy mechanism for conservation of the marine environment, and they have positively contributed to social and economic development for local communities, however there are certain caveats to their success. For instance, it matters greatly if they are effectively managed and governed, and if local people's considerations are taken into account (Bennett and Dearden, 2014). Our findings here have identified some potential constraints to coral reef management in the east coast of Thailand, which were reflected by the perceptions of managers and users.

Users expressed a perception that MNPs can protect marine resources from destructive fishing and untoward tourism activity. Perceived importance of the value of coral reef ecosystem resources varies across types of user. Tour operators perceived that coral reefs and coral reef fish are important to their business, whereas hotel operators did not. This possibly indicates that the end user is concerned only about resources that directly benefit their own business, or indicates their limited ecology background. However, the lack of ecological concern is a barrier to resource management, since hotel operators may not be aware of the adverse consequences of untreated waste water drained into the sea adjacent to their facility. This is particularly true for small hotels and homestays, which seldom have a water treatment facility. Siriwong *et al*. (in press) reported that in the eastern coast of Thailand, coral reefs situated close to tourism infrastructure have higher prevalence of coral diseases and ill-health signs than coral reefs isolated from infrastructure. This presents a severe difficulty for

the managers of marine resources, since tourism development is seen (mostly) as a key to economic development, reflected by the increased construction of shore-based facilities.

Coral reef managers are not sufficiently equipped with locally-suited conservation policy or planning, something which possibly constrains success of coral reef management in the East. DMCR is seen to have comprehensive policy and plans for coral reef management, following MONRE's 20-year strategy plan, which is applied to all agencies under MONRE (including DNP), albeit unevenly. The plan that MNP had been using is not up-to-date and was not modified or enhanced by the paucity of feedback from local sites and stakeholders. Perceptions of local stakeholders regarding the level of participation involving decision-making and conservation activity were relatively low as managers only inform them before they implement any new regulation. To inform is the lowest level of public participation, which has no expectation for feedback (International Association for Public Participation, 2017).

Another potentially severe constraint on management success is that MNPs, which are notionally responsible for coral reef management, have insufficient coral reef expertise. This balkanization of management responsibility is unlikely to be appropriate for marine ecosystems where current-based connectivity plays an essential role in transporting larvae and pollutants a much greater distance compared to the terrestrial environment (Carr *et al*., 2003). MNP staff have a strong foundation in management of terrestrial National Parks, but generally have insufficient background in the ecology and environmental dynamics of marine ecosystems.

It is known that stakeholder support and compliance are essential for successful management, however, it is influenced by their perceptions (Bennett and Dearden, 2014). Users felt that they had limited opportunity to make decisions involving coral reef management, and they were unlikely to participate in conservation activity because there was little communication between managers and users. This was highlighted by a park manager's response that despite there being a mechanism to engage stakeholders, users had been engaged only when there was an important issue, in the manager's perspective.

Perceptions by stakeholders can compromise the health of marine ecosystems. As long as tour operators feel that the immediate environment is still in a good condition, they are likely to continue their business as usual, however destructive or cynical. Tour operators in KC keep advertising popular activities (such as feeding reef fish) (pers. obs.) to their customers because they perceive that feeding fish has little impact (mode = 2, Table 3) to coral reef health or viability. Moreover, there is a strong disconnect between their perception of the impact of pollution in a marine system. Small hotels and restaurants at KS and KC allowed the sewage from their businesses to drain directly into the adjacent sea (pers. obs.). When interviewed, hotel operators said "impact of waste water is unremarkable" (mode = 2, Table 2) indicating that these small operators were unlikely to connect the small point source of raw sewage with the concept of "pollution", and may not see how even many such small outfalls would make a difference in something as vast as the sea, although they were aware of issues such as industrial pollution. The reluctance of local people to comply with regulations that they see as unimportant or inexplicable greatly increases the difficulty of resource managers to develop and apply proactive conservation policies, and suggests that management agencies should expend resources to develop interpretive and explanatory material to educate and inform local people.

Protected areas contribute to improve marine environments and natural resources, and improve security of local livelihoods (Gell and Roberts, 2003; Lunn and Dearden, 2006; Lopes *et al*., 2015; Russi *et al*., 2016). The results of this study suggest that success of marine resource management needs effective management and comprehensive policy together with close communication between managers and end users to get strong support from local communities.

## LITERATURE CITED


Bennett, N.J. and P. Dearden. 2014. Why local people do not support conservation: community perceptions of Marine Protected Area livelihood impacts, Governance and management in Thailand. **Marine Policy** 44: 107–116.

Bessell-Browne, P., A.P. Negri, R. Fisher, P.L. Clode, A. Duckworth and R. Jones. 2017. Impacts of turbidity on corals: The relative importance of light limitation and suspended sediments. **Marine Pollution Bulletin** 117: 1–24.

Boone, H.N. and D.A. Boone. 2012. Analyzing likert data. **Journal of Extension** 50 (2). http://www.joe.org/joe/2012april/tt2p.shtml[8/20/2012.

Carr, M.H., J.E. Neigel, J.A Estes, S. Andelman, R.R. Warner and J.L. Largier. 2003. Comparing marine and terrestrial ecosystems: implications for the design of coastal marine reserves. **Ecological Applications** 13(1): 90–107.

Chansang, H., Satapoomin, U. and S. Poovachiranon. 1999. **Map of Coral Reefs in Thai Waters.** Vol. 1: Gulf of Thailand. Department of Fisheries, Bangkok. 284 pp.

Dinsdale, E.A. and V.J. Harriott. 2004. Assessing anchor damage on coral reefs: a case study in selection of environmental indicators. **Environmental Management** 33(1): 126–139.

Eklund, J. and M. Cabeza. 2017. Quality of governance and effectiveness of protected areas: crucial concepts for conservation planning. **Annals of the New York Academy of Sciences** 1399(1): 27–41.

Gell, F.R. and C.M. Roberts. 2003. Benefits beyond boundaries: the fishery effects of marine reserves. **Trends in Ecology & Evolution** 18(9): 448–455.

Hannak, J.S., S. Kompatscher, M. Stachowitsch and J. Herler. 2011. Snorkelling and trampling in shallow-water fringing reefs: risk assessment and proposed management strategy. **Journal of Environmental Management** 92(10): 2723–2733.

Hockings, M., S. Stolton, F. Leverington, N. Dudley and J. Courrau. 2006. **Evaluating Effectiveness: A framework for assessing management effectiveness of protected areas.** 2nd edition. IUCN, Gland, Switzerland and Cambridge, UK. 105 pp.

International Association for Public Participation. 2017. **Public participation spectrum.** http://www.lgnsw.org.au/files/imce-uploads/346/IAP2-Public-Participation-Spectrum-LGNSW-Amalgamation-Toolkit.pdf.

Kim, K., M. Uysal and M.J. Sirgy. 2012. How does tourism in a community impact the quality of life of community residents?. **Tourism Management** 36: 527–540.

Leverington, F., M. Hockings, M. Pavese, K.L. Lemos and J. Courrau. 2008. **Management effectiveness evaluation in protected areas - a global study.** Supplementary Report No. 1 : Overview of Approaches and Methodologies. The University of Queensland, Gatton, TNC, WWF, IUCN-WCPA, Australia. 145 pp.

Lopes, P.F.M., S. Pacheco, M. Clauzet, R.A.M. Silvano and A. Begossi. 2015. Fisheries, tourism, and marine protected areas: conflicting or synergistic interactions ?. **Ecosystem Services** 16: 333–340.

Lunn, K.E. and P. Dearden. 2006. Fishers' needs in marine protected area zoning: a case study from Thailand. **Coastal Management** 34(2): 1836–198.

McClanahan, T.R., N.A. Muthiga, C. Abunge, A.T. Kamukuru, E. Mwakalapa and H. Kalombo. 2015. What happens after conservation and management donors leave? a before and after study of coral reef ecology and stakeholder perceptions of management benefits. **PLoS ONE** 10(10): e0138769. doi:10.1371/journal.pone.0138769

Milazzo, M., I. Anastasi and T.J. Willis. 2006. Recreational fish feeding affects coastal fish behavior and increases frequency of predation on damselfish *Chromis chromis* nests. **Marine Ecology Progress Series** 310: 165–172.

Pomeroy, R.S. and A. Cruz-Trinidad. 1996. **Socioeconomic aspects of artisanal fisheries in Asia.** In: Perspectives in Asian Fisheries: A Volume to Commemorate the 10th Anniversary of the Asian Fisheries Society 239–258 pp. World Fish, Malaysia.

Reopanichkul, P., T.A. Schlacher, R.W. Carter and S. Worachananant. 2009. Sewage impacts coral reefs at multiple levels of ecological organization. **Marine Pollution Bulletin** 58(9): 1356–1362.

Reopanichkul, P., R.W. Carter, S. Worachananant and C.J. Crossland. 2010. Wastewater discharge degrades coastal waters and reef communities in southern Thailand. **Marine Environmental Research** 69(5): 287–296.

Russi, D., M. Pantzar, M. Kettunen, G. Gitti, K. Mutafoglu, M. Kotulak and P. ten Brink. 2016. **Socio-Economic Benefits of the EU Marine Protected Areas Institute for European Environmental Policy.** Report prepared by the Institute for European Environmenttal Policy (IEEP) for DG Environment.

Siriwong, S., J.D. True and S. Piromvarakorn. 2019. Number of tourists has less impact on coral reef health than the presence of tourism infrastructure. **Songklanakarin Journal of Science and Technology.** In press.

SPSS Inc. 2002. **SPSS for Windows,** Version 11.5. Chicago, SPSS Inc.