Sains Malaysiana 51(12)(2022): 3909-3922
http://doi.org/10.17576/jsm-2022-5112-04

Assessment of Governance and Ecological Status of Terengganu Marine Park, Malaysia: Toward Marine Spatial Planning

(Penilaian Pengurusan dan Status Ekologi Taman Laut Terengganu, Malaysia: Ke Arah Pembangunan Reruang Laut)

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Received: 5 April 2022/Accepted: 6 September 2022

ABSTRACT

Terengganu Marine Parks (TMP) is a 591.37 km^2 marine protected area. TMP are popular tourist destinations that significantly generate revenue to the government and local businesses through tourism sector. However, the anthropogenic activities have contributed to TMP's declining ecosystem health, particularly the coral reefs. Therefore, a sustainable ecosystem-based management is required to maintain the ecosystem. In this study, we identify issues related to the marine park's governance, development on islands, tourist activities and coral health status in the TMP for assessing potential management strategy for conserving the ecosystem. The findings on management in TMP found that there is an overlapping in managing the marine park between the federal and state government. Unintegrated development to accommodate rising number of tourist and their activities in the marine parks are identified as the factors contributing towards degradation of the ecosystems. Relatively, reef areas close to these local pressures are in 'poor' condition, indicating that threats arising from the activities affecting the marine ecosystem. Hence, this study analyses the potentials in adopting Marine Spatial Planning (MSP) in the TMP for managing the conflict between user and the ecosystem. The Australian Great Barrier Reef Marine Park which applied the zoning of marine area is used as a benchmark to examine the best practices of MSP to govern the TMP. At present, we suggest using coral reef health status as an early alternative and best practice to provide different zoning criteria for strategic marine protected area (MPA) management for TMP.

Keywords: Coral reefs; environmental management; marine protected area; ocean governance; South China Sea

ABSTRAK

Taman Laut Terengganu (TMP) ialah kawasan perlindungan marin seluas 591.37 km^2. TMP merupakan destinasi pelancongan popular yang menjana pendapatan ketara kepada kerajaan dan peniaga tempatan menerusi sektor pelancongan. Walau bagaimanapun, aktiviti antropogen di TMP ini dilihat sebagai faktor yang menyumbang kepada kemerosotan kesihatan ekosistem marin, terutamanya terumbu karang. Oleh itu, pengurusan yang mampan perlu dikenal pasti bagi menjaga kelestarian ekosistem marin ini. Dalam kajian ini, kami mengenal pasti isu berkaitan tadbir urus taman laut, pembangunan di pulau, jumlah pelancong serta kesihatan terumbu karang di sekitar kawasan TMP bagi menilai pengurusan yang berpotensi untuk menjaga kelestarian ekosistem marin ini. Hasil kajian pengurusan tadbir urus di TMP mendapati terdapat pertindihan pengurusan antara kerajaan persekutuan dengan kerajaan negeri. Pembangunan tidak bersepadu untuk menampung peningkatan jumlah pelancong dan aktiviti pelancongan di taman laut

dilihat sebagai faktor yang menyumbang kepada kemerosotan kesihatan ekosistem. Secara relatifnya, kawasan terumbu karang berdekatan dengan kawasan pembangunan ini berada pada tahap kesihatan yang 'tidak baik', menunjukkan ancaman daripada aktiviti setempat yang mempengaruhi ekosistem marin ini. Justeru, kajian ini mencadangkan pelan pengurusan berdasarkan kepada Perancangan Spatial Marin (MSP) untuk TMP bagi menguruskan konflik antara pengguna dan ekosistem ini. Pengurusan MSP oleh Taman Laut Australia Great Barrier Reef yang menggunakan kaedah pengezonan kawasan marin dijadikan sebagai penanda aras untuk kaedah MSP bagi mentadbir taman laut ini. Pada masa ini, kami mencadangkan pengezonan kawasan taman laut berdasarkan status kesihatan terumbu karang boleh menjadi alternatif kepada pengurusan kawasan perlindungan marin (MPA) yang strategik untuk TMP.

Kata kunci: Kawasan perlindungan marin; Laut China Selatan; pengurusan persekitaran; tadbir urus lautan; terumbu karang

Introduction

Marine protected area (MPA) is a specific management tools for zoning a marine ecosystem in order to minimize the impact of anthropogenic activities, induce recovery of ocean ecosystem and enhance its services to nature and human needs (Leenhardt et al. 2015). Even though the establishment of MPAs have covered huge marine area, less than 2% of the world's oceans are fully protected (Halpern, Lester & McLeod 2010). Different countries using different approaches to design their MPAs depending on the political and economic context of each region. For example, the Australian Government enacted the Great Barrier Reef Marine Park (GBRMP) Act, 1975 (the Act) for long-term conservation and protection of the reefs (Hassan & Alam 2019). GBRMP has adopted marine spatial planning (MSP) via zoning strategies to minimize multiple conflicts to effectively manage 344,400 km^2 of a large marine ecosystem (Kenchington & Day 2011).

Malaysia has one of the largest continental shelf areas in the tropical area and harbour high biodiversity of marine organisms (Mazlan et al. 2005). Malaysia has signed and ratified the Convention of Biological Diversity (CBD) in 1992 and 1994, respectively, for a broader conservation and protection of biodiversity in the region. It has given impetus to the development of the 1998 National Biodiversity Policy. It has also culminated in the amendment and adoption of several existing and new federal laws including the Wild Life Conservation Act 2010, Environmental Quality Act 1974, Fisheries Act 1985, Continental Shelf Act 1966, Biosafety Act 2007 and the latest, Access to Biological Resources and Benefit Sharing Act 2017. The CBD has become the catalyst to the increment of marine parks in Malaysia. To date, there are 42 marine parks in Peninsular Malaysia, covering 2,357.23 km^2 of marine space. Meanwhile, the marine parks in Terengganu cover a designated area of 591.37 km to protect and conserve the marine habitats (Department of Fisheries 2022).

Malaysia is a federal country with the Federal Constitution as the highest law of the land. Article 76(1) of the constitution provides the power for the federal and state governments to legislate laws in accordance with the division of powers specified under the Ninth Schedule. In theory, the Ninth Schedule provides clear demarcation of jurisdictions between the federal and state governments. However, in practice, there appears to be overlapping jurisdictions, which complicate implementation and enforcement of these constitutional powers.

Terengganu Marine Parks (TMP) are popular destinations among domestic and international tourists, generating handsome revenues to the state and federal governments (Jaafar & Maideen 2012). However, anthropogenic pressure arises from tourism development on islands and nearby mainland has affected the health of the surrounding marine ecosystems, particularly the coral reefs (Akmal et al. 2019; Islam et al. 2013; Safuan et al. 2021). Issue on coral reefs degradation has been raised worldwide. It is estimated that the multiple-effect of disturbances will threaten about 99% of the ecosystem in which more than 80% of the reefs classified as high, very high, or critical levels by 2030 (Bruno & Selig 2007; Burke et al. 2011).

The degradation of marine ecosystem indicates an inadequate ocean governance to successfully support for the healthy ecosystem. Accordingly, MSP has been suggested as a management process to deal with this issue (Foley et al. 2010). Thus, understanding the complexity of the ecosystem is crucial for the MSP planners and managers in implementing the best

approach to adopt the ecosystem-based management (Crowder & Norse 2008). As reviewed by Foley et al. (2010), four basic ecosystem principles are proposed to guide ecosystem-based MSP namely: native species diversity, habitat diversity and heterogeneity, key species, and connectivity. For instance, the GBRMP applies an ecological parameter to determine the zoning criteria to maintain the resilience of the coral reef ecosystem (Day et al. 2019). Meanwhile, similar ecological principals have also been applied in the Mediterranean Sea as the key ecological principle to determine the ecosystem-based MSP in managing their deep-sea ecosystem (Manea et al. 2020).

In view of effective management of MPA, the Ministerial Statement at the CBD COP meeting held in Jakarta in 1995 announced the global consensus on the importance of marine and coastal biodiversity (CBD 2000), which is to be managed in an integrated manner (De Fontaubert, Downes & Agardy 1996). Since then, the World Summit on Sustainable Development (WSSD) 2002, participated by over 100 countries has agreed on several targets (Sherman 2006), including halting the decline of marine biodiversity by 2010 and establish MSP based on scientific information by 2012 (Frank 2007).

In light of the situation discussed, this study analyses the issue related to governance, human activities and ecological status of the TMP and proposes the adoption of MSP as a solution to overcome the multiple-use conflicts. The aims of this study were: to evaluate the governance of MPA, to assess the ecological status, particularly on coral reef health and potential threats to the ecosystem as well as to provide best approach to deal with the issues in TMP through MSP. GBRMP as the first MSP adoption in the world is used as the benchmark to examine the potential and best practices in TMP.

Materials and Methods

Study Area

There are four popular marine park islands in Terengganu among domestic and international tourists as described in Table 1 namely Perhentian, Redang, Kapas, and Tenggol, located in the South China Sea of the east coast of Peninsular Malaysia (Figure 1). The two most popular islands are Perhentian and Redang. Both islands have better infrastructures with wider range of accommodations.

TABLE 1. Brief description of marine parks in Terengganu

Marine park	Gazetted (Year)	Location	Size (ha)	Distance from Mainland (km)	Islands
Perhentian	1996	Besut District 5°54’35.09”N 102°44’16.77”E	1365.64	± 16.0	Perhentian Besar, Perhentian Kecil, Susu Dara
Redang	1994	Kuala Nerus District 5°47’2.68”N 103° 0’25.75”E	2581.79	± 23.0	Redang, Pinang, Ling, Ekor Tebu, Kerengga Besar, Kerengga Kecil, Paku Besar, Paku Kecil, Chupak, Yu Kecil, Yu Besar dan Lima Limau)
Kapas	1994	Marang District 5°13’8.35”N 103°15’53.82”E	204.94	± 5.0	Pulau Kapas, Pulau Gemia
Tenggol		Dungun District 4°48’27.23”N 103°40’45.19”	204.09	± 28.0	Tenggol, Nyireh

Data Analysis

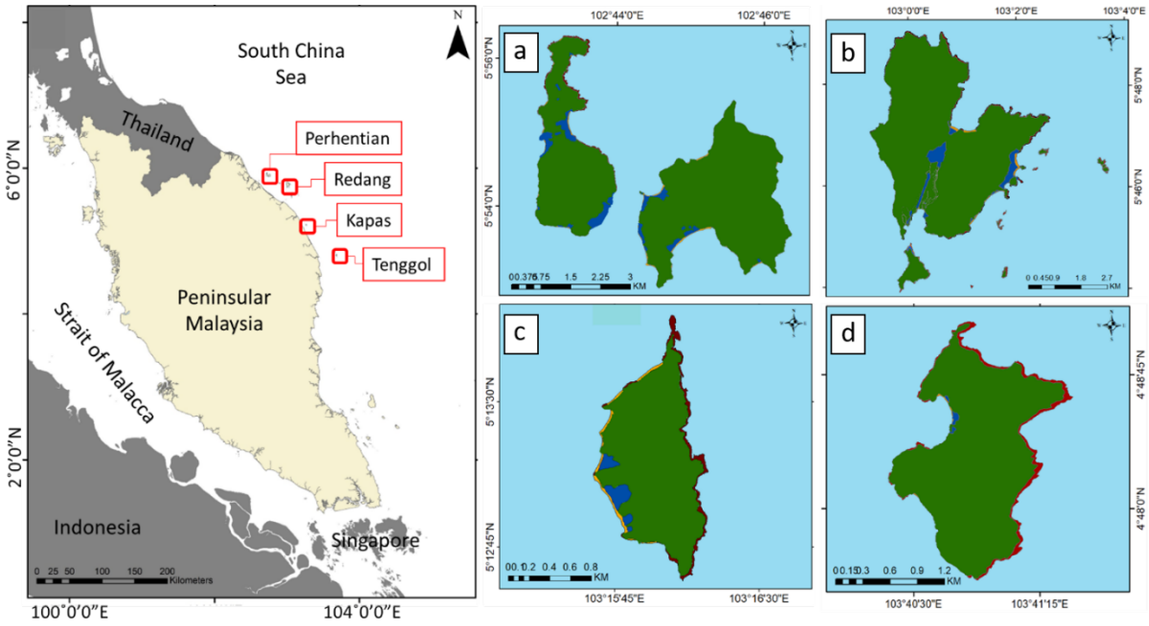

FIGURE 1. Location of four major marine parks in Terengganu at the east coast of Peninsular Malaysia (a) namely Perhentian (b), Redang (c), Kapas and (d) Tenggol

This study employs qualitative approach on primary and secondary data. The primary data was derived from focus group discussion (FGD) and observation survey methods. The secondary data was extracted from various government official documents, empirical reports and scholarly published works through desktop study, and was analysed using content analysis method.

The FGD was conducted on 30th October, 2017 in Kuala Terengganu with the purpose to investigate the issues and challenges in governing and managing the TMP as well as to find answers from the stakeholders of what their roles were about as well as how and why they performed their particular role. It enables inferences to be analysed of the stakeholder's views of the marine zoning functions. The FGD was conducted and guided by a list of key themes, issues and questions. Content analysis was used to examine and assess the functionality of the discussion for better understanding of stakeholders' roles. Using content analysis through qualitative approach allows wider interpretation of content and analysis of the discussions. The voice of stakeholders was triangulated to analyse and interpret their coherent viewpoints. The FGD conducted, however, was not meant to study different motivation and voice of the stakeholders.

Four main marine park islands were discussed namely Perhentian, Redang, Kapas and Tenggol. The FGD involved different stakeholders from government agencies, NGOs, selected community representatives and tourism operators. The government agencies in attendance were the Kuala Terengganu City Council, Marang Local Council, Dungun Local Council, and Besut Local Council, five District and Land Offices namely from Besut, Marang, Kuala Nerus, Kuala Terengganu and Dungun. Other agencies were Department of Marine Park (now placed under the Department of Fisheries Malaysia - DOFM), Tourism Terengganu, PLANMalaysia Terengganu, Forestry Department, Department of Irrigation and Drainage, and Department of Chemistry. Meanwhile, the local communities were represented by community leaders from Redang and Perhentian, and the NGOs were WWF-Malaysia and Reef Check Malaysia. The tourism operators were represented by the accommodation and transportation operators from the four marine parks, respectively.

To corroborate the primary data, related government documents; policies, procedures, and legal documents were analysed using content analysis method. The Federal Constitution of Malaysia as the highest law of the land is a vital reference in this study in order to comprehend the complexity of governing the marine parks in Malaysia, and the content analysis was guided by the doctrine of Statutory Interpretation.

The coral survey data of the selected islands were obtained from published works by Akmal et al. (2019) and Safuan et al. (2021), with additional data based on a report by Reef Check Malaysia (2020). Their works are used as a baseline information on coral health status in the study area. Despite the data were collected in different time series and survey method, it sufficiently provides an overview on coral health status in the marine parks. Relatively, there are no drastic changes of the percentage cover of live coral over the past five years (2016 – 2020) as indicated by Reef Check Malaysia (2020).

Results

Managing different levels of governance within the Terengganu Marine Parks

The policies, laws and development plans in marine parks management are often interrelated. They are collectively designed to balance between the physical development, people's wellbeing and sustainable ecosystems. The main policies and plans under the federal government's jurisdiction in environmental planning and management also involved with the marine parks. To date, five national policies (National Physical Plan, National Landscape Policy 2011, National Urbanization Policy 2006, National Environmental Policy 2002, and National Biodiversity Policy 2016-2025) are recognized as interrelated with the management of the MPA in which all of them are interrelated with nature-based management (Figure 2).

At the district level, development planning is provided by local plan, which is a detailed interpretation of and translates the state's structure plan (Figure 2). It encompasses the policy and strategic planning of the land use map for the respective districts. The local plan is prepared by the local planning authority (i.e., the district council) but is subjected to the State Planning Committee's approval. There is a tendency to design the land use map based on the artificial boundaries of the district without factoring that hazards and pollution know no boundary. Another tendency is that the zones are mapped fragmentally. In TMP, each of the MPA is governed by different local plan based on their location (Table 1). For instance, the development planning on Perhentian is provided by local plan under the Besut Local Plan 2020, and Tenggol is under the Dungun Local Plan 2035. Even though those islands are under the Terengganu State government, the management of each MPA is also reflected by a localized management. Furthermore, the local plan reflects the state jurisdiction

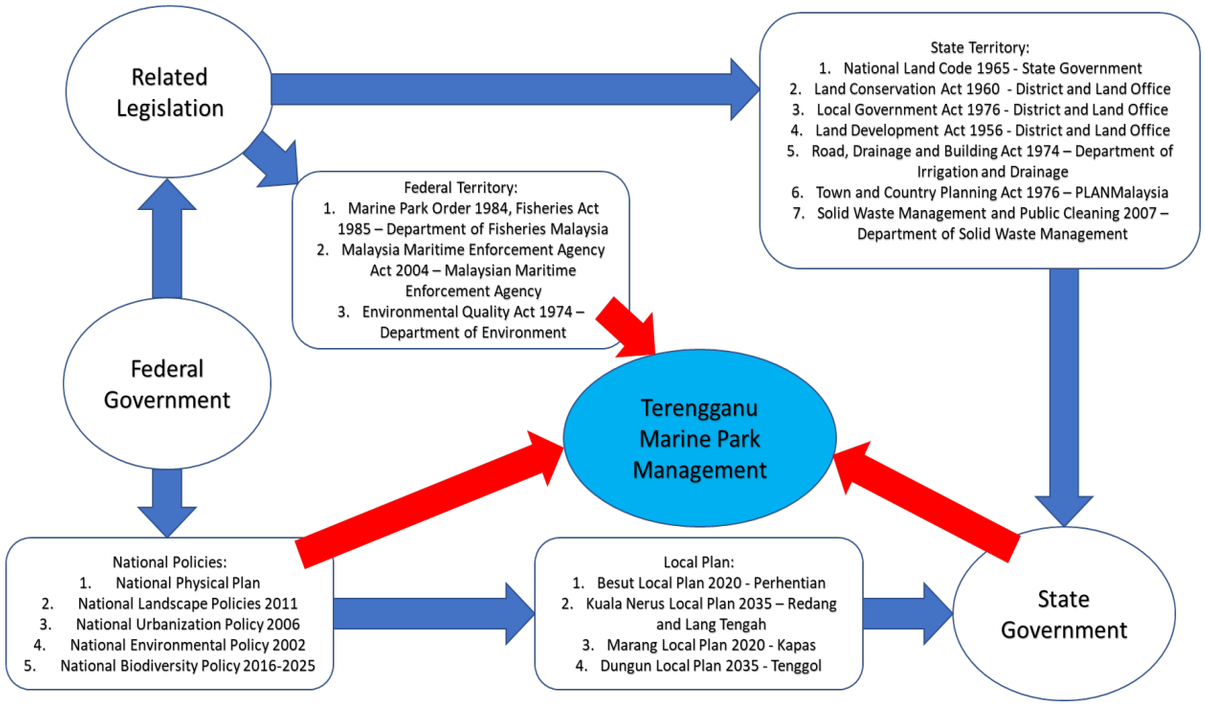

FIGURE 2. Interrelation of federal and state governments in managing the Terengganu Marine Parks

over the land as stated in the Ninth Schedule. Therefore, any land development on the marine park islands is within the purview of the district management, which answers to the state government. The Federal Constitution refers 'land' to include areas such as riverbed, coastal areas and seabed within the state's territory i.e. within 3 nautical miles from the baseline. Section 3 of Interpretation Act 1967 defines 'land' as the earth surface, including the flora and the elements therein. Hence, the state government can exercise of its statutory powers and duties on the islands. However, 'marine fisheries' are directly listed under the Federal List, where the DOFM can exercise its power to designate the area in the marine parks by virtue of Section 41 to Section 45 of the Fisheries Act 1985. This limits the jurisdiction of states from the 2 nautical miles waters of the marine parks. There are also several other laws governing the sustainability of the marine parks (Figure 2).

TOURISM DEVELOPMENT IN TERENGGANU MARINE PARKS

In TMP, all the islands are mainly dominated by significantly large forest areas with a percentage ranging from 86.15% - 93.72%, followed by rocky beach, development area and sandy area. The highest developed area is on Kapas, which preoccupied about 4.33% of the total island size (Figure 3). The development concentrated in the west coast of the island where several small resorts are located and function as a main area for commercial purposes (Figure 1). Perhentian and Redang account about 3.93% and 3.72% of development areas, respectively (Figure 3). In term of size (ha), developments are concentrated on several parts of Perhentian Besar and Perhentian Kecil (Figure 1). The residential area is located in the southern part of Perhentian Kecil. On Redang, development can be found in the middle of the island occupied with a small airport, hotels, resorts and residential areas. Tourism development are also extensively concentrated in the east coast with hotels, resorts and chalets. Tenggol has the least developed area (0.54%). The area is concentrated around the sandy area of the lagoon in the west coast. As shown in Figure 3, the rocky beach (1.9% - 5.85%) has higher percentage cover than the sandy area of the islands (0.05% - 0.89%).

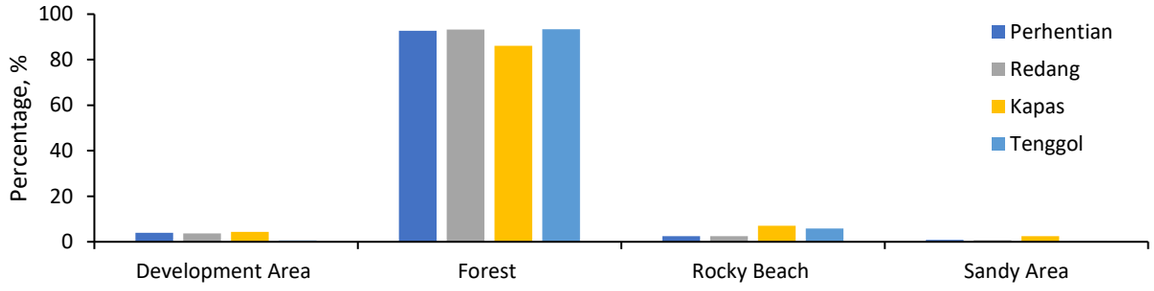

FIGURE 3. Bar graph showing the percentage cover of development area, forest, rocky beach and sandy area in the four main marine parks (a)

NUMBER OF TOURISTS IN TERENGGANU MARINE PARKS

There is increasing number of domestic and international tourists visiting the TMP annually, with a total number of more than 200,000 tourists per year (Figure 4(a)). Relatively, in comparison between the data on 2000 with 2018, the number of tourists increased by 6-fold from 52,634 (2000) to 354, 154 (2018), indicating an intense increment in less than two decades. The trend of tourist arrivals to the TMP is illustrated in Figure 4(b). Relatively, the peak seasons were in April and August. There were no tourists in December to February due to offset and onset of monsoon season where the islands were closed for any tourism activities.

ISLAND DEVELOPMENT AND ITS IMPACT TO CORAL HEALTH STATUS IN TERENGGANU MARINE PARKS

The coral reefs health status in TMP was measured according to the criteria outlined by Chou et al. (1995). Using the percentage of live coral cover as precursor to access the reef conditions, they are divided into five categories namely 'excellent' (≥75%), 'good' (<75% and ≥50%), 'fair' (<50% and ≥25%) and 'poor'. An

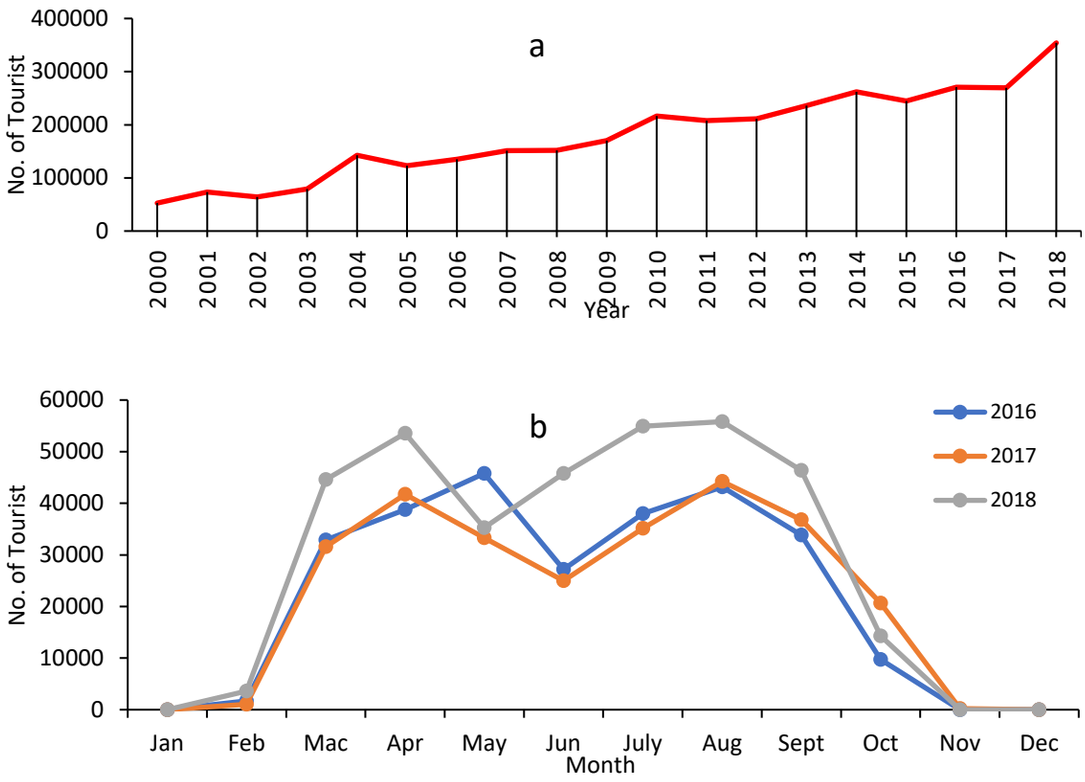

FIGURE 4. Number of tourists visiting the TMP by year (2016 - 2018) and month (January - December)

assessment of coral health status on 63 survey sites in TMP shows that the reefs can be categorized from 'poor' to 'good' condition (Figure 5). Out of the 63 survey sites, majority of the reefs were rated as 'fair' (47.62%), followed by 'good' (33.33%) and 'poor' (19.05%). None of the reefs was rated as in 'excellent' condition. Apart from Tenggol (Figure 5(d)), 'poor' reef areas were found in other marine parks. On Perhentian, most of the areas were classified as 'poor' reef conditions are located nearby the islands' development areas (Figure 4(a)). Similarly, only one site located near to the concentrated tourism area on Kapas was rated as 'poor' (Figure 5(c)). 'Poor' reef sites on Redang were found at the northern and southern part of the island (Figure 5(b)).

DISCUSSION

ISSUES IN TERENGGANU MARINE PARKS

Marine parks in Peninsular Malaysia are significant to study in order to comprehend the complexity of their governance. The complex nature of these marine parks demands the management to be done in a three-tiered system, involving the federal government, state government and local authorities (Cheryl 2010). At the national level, the federal government is responsible in formulating national policies related to the marine parks. However, the state government also has rights to exercise powers on the terrestrial parts of the marine parks. Meanwhile, the local government is responsible to implement the laws while providing as well as managing infrastructures and facilities on the islands. In TMP, development on the islands is mainly concentrated at the sandy beaches where major tourism activities take place. Even though less than 5% of the islands are occupied by the development to accommodate tourists' influx, this will inadvertently lead to dense development on certain part of the islands. As the management of the TMP is directly linked to federal and state government, a comprehensive understanding of the structures of the existing governmental system is important to elucidating the sustainable development of the TMP (Olsen et al. 2014). Existing unintegrated development plans to

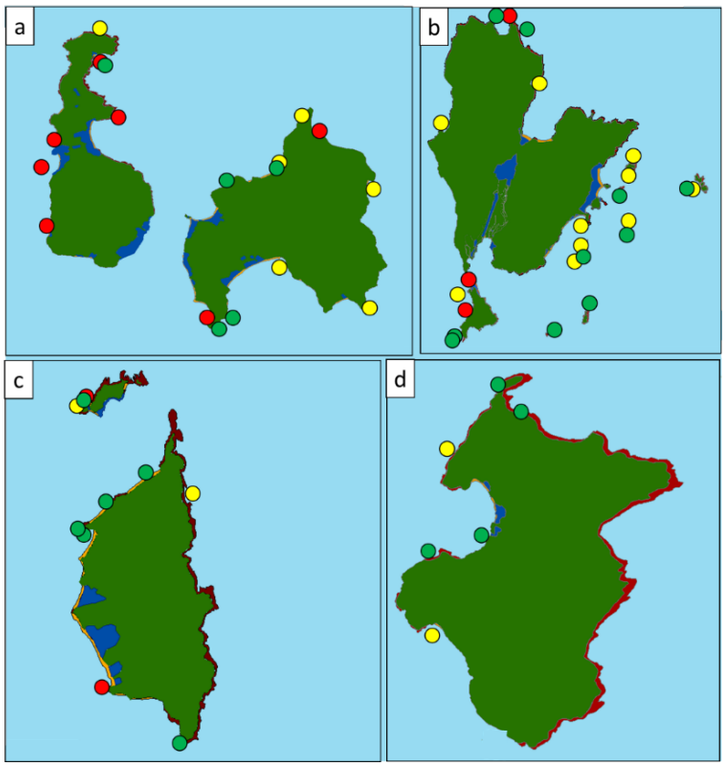

FIGURE 5. Coral health status in marine parks of Terengganu as indicated by colored dots (red = poor, yellow = fair and green = good). Maps shows the distribution of different type of geographical condition on (a) Perhentian (b), Redang (c), Kapas and (d) Tenggol. Colored maps are light blue = ocean, green = forest, dark blue = develop area, brown = rocky beach and orange = sandy area

stimulate the socioeconomic growth in the TMP are conflicting, to some extent, with the needs to conserve and preserve the marine ecosystems.

From the ecological perspective, coral reef is a fragile ecosystem and largely affected by multiple disturbances from natural and anthropogenic stresses leading to marine ecosystem degradation (Bruno & Selig 2007; De'ath et al. 2012). The TMP are harbored with rich coral reefs ecosystem but being impacted by local disturbances that affecting the health of the reefs (Akmal et al. 2019; Safuan et al. 2021). In TMP, a study showed that less developed island and non-MPA island such as Pulau Bidong has better reef conditions than Perhentian, where macroalgae dominated the reefs (Safuan et al. 2021). Similar trend is also observed between Tenggol with other MPA with intense island development. It is suggested that the nutrient influx from improper drainage system may have driven the domination of macroalgae that competed with corals for space, hence compromising the health of the coral reefs ecosystem (Heery et al. 2018; Lach et al. 2019). One major issue is that some of the developments on the islands have mostly been constructed in total disregard of the buffer zone concept. They have been built around 10-20 meters from the sea without proper drainage and waste disposal facilities (Praveena et al. 2010). As noted earlier in Aziz et al. (2019), this uncontrolled mainland style of development on Perhentian and Redang are affecting the fragile ecosystems, which will further deteriorate in the long run.

Globally, mainland coastal zone has undergone drastic urbanization growth, which adversely impacted the marine environment through increase in the sedimentation delivery, nutrient and pollution which threatening the nearby coral reefs ecosystem (Heery et al. 2018). Sedimentation from nearby mainland is

transported to the ocean via rivers (Fabricius 2005). Based on the location of the TMP islands in Table 1, Kapas, which has the closest proximity to the mainland, is most likely to be impacted from sedimentation transported by terrestrial run-off from Sungai Marang. Coral reefs on Kapas was found to be occupied by abiotic components such as dead coral and sedimentation deposition (Safuan et al. 2021). Closer proximity from the mainland has direct impact on the coral cover, resulting in drastic decline of live coral cover and increase of dead coral and algae cover (Baum et al. 2015; Tkachenko et al. 2016). On Perhentian and Redang, intense development near to the sandy beaches may also contribute to sedimentation. A study on the Maldivian reefs found that, apart from contributing to nutrient influx, the reefs were also impacted by the presence of hotels and residential areas where loose sediment cover was higher in the area closer to the development (Cowburn et al. 2018).

Noting that marine parks are the main tourist attractions in Terengganu, the tourists' influx contribute to degradation of the coral reefs and not just to the nutrient influx (Lach et al. 2019). While diving and snorkeling are among the popular tourism products of the islands (Jaafar & Maideen 2012), poorly-supervised diving and snorkeling activities in the marine park areas are damaging the coral reefs and natural habitats of the marine animals. Unlike Perhentian and Redang, Kapas is uninhabited and the development only involve small scale resorts and chalets. While tourism activities in other marine park islands are scattered in many island parts, distributing the number of tourists, the activities on Kapas are mainly concentrated in one part of the islands contributing to its the 'poor' reef status. This correlation is further corroborated by a study in Akumal Bay in Mexico, which showed that higher dead coral was found on the reef with intense tourism activities, suggesting that snorkeling activities contributed to reefs degradation (Gil et al. 2015). Degradation of coral cover significantly correlate with the snorkelers' presence at the reefs (Renfro & Chadwick 2017) due to the physical damage caused by improper diving and snorkeling activities, either by trampling or standing on the reefs (Hawkins & Roberts 1993). Despite its contribution to the state's economy, this activity must be suitably managed and controlled to reduce long-term environmental degradation.

BEST PRACTICES: FOLLOWING AUSTRALIA'S PATHWAY IN GOVERNING THE MARINE PARKS

Understanding the specific nature of the reefs and the sources of the stressor on the ecosystem is important to be included in the regional and local planning processes, which can be carried out through the application of ecosystem-based MSP. MSP ensure existing and emerging uses can be maintained, use conflicts reduced, and ecosystem health and services protected and sustained for future generations (Foley et al. 2010). The GBRMP, which is the pioneer mechanism toward implementation of the MSP was designed for achieving the ecologically sustainable use and management objective (Day 2002; Hassan & Alam 2019). There are several approaches that can be adopted in implementing MSP through benchmarking on the GBRMP, particularly in governing the TMP as stated herewith.

GREAT BARRIER REEF INTERGOVERNMENTAL AGREEMENT

Similar to Malaysia, the Australian Constitution divides the powers in governing its ocean between the Commonwealth and the states. The GBR Intergovernmental Agreement, signed by the Australian Premier and the Governor of the Queensland, Queensland State Government has been observed for about 35 years to provide a framework for the cooperation to protect the GBR. In 2015, the agreement was renewed to reflect the shared vision outlined in the Reef 2050 Plan.

GREAT BARRIER REEF MARINE PARK ACT 1975

By giving the legal status to the MSP, the management framework becomes clear to be enforced (Ehler & Douvere 2009), which indirectly renders towards an efficient enforcement. Under the GBRMP Regulations 1975, a framework for planning and management of the marine park, including zoning plans, management plans and permits were established based on the concept of multiple-use management. There are several governing strategies adopted by the Australian government for managing the GBR which can be applied for TMP to systematize its management.

GBRMP AUTHORITY

The GBRMP Authority under Section 5 of the Act has been empowered to advise and act on behalf of the Australian Government. This is consistent with the principles of ecologically uses, including precautionary principle. The Australian Commonwealth and the Authority are bound to work closely with the Queensland Government agencies, marine park

users and the local communities towards an effective implementation of MSP. As a federal agency, the GBRMP authority reports directly to the commonwealth minister for the Environment and Heritage.

LOCAL MARINE ADVISORY COMMITTEES (LMAC)

The GBRMP Authority established 11 Local Marine Advisory Committees (LMAC) between 1999 and 2005. The LMAC, among others, works as a mechanism to involve the local communities and stakeholders in the management of the marine park (Australian Government 2006). As a voluntary community-based committees, LMAC provide various forums in engaging the local communities and is responsible to deliberate on the different segments of the communities. For example, the LMAC raises the local's concerns; develops objectives proposes solutions and actions; and provides feedback to the authority and other agencies on governance and management, decision-making and action plans.

MSP ZONING AS A TOOL FOR STRATEGIC REEF MANAGEMENT

In brief, the GBRMP implements eight different zoning for strategic management in protecting the large and sensitive marine ecosystem (Great Barrier Reef Marine Park Zoning Plan 2003). However, the management plan cannot be directly adapted in other countries due to the differences in social, economic and the marine ecosystem. At early stage, we recommend implementation of zoning based on the coral health criteria and interrelate the zones with the established GBRMP zoning plans as shown in Table 2. Coral health status outlined by Chou et al. (1995) was used as ecological criteria for this zoning as it is commonly applied for determining the coral reefs' health status in Malaysia (Akmal et al. 2019; Safuan et al. 2020; Toda et al. 2007). Using percentage live coral cover as a precursor can be part of ecological principles for implementing MSP (Foley et al. 2010) because hard coral is the main reef-builder, which acts as a key framework-building species due to their ability to form three-dimensional reef structure and services provided by the ecosystem (Darling et al. 2019). Variation in percentage coral cover has been evaluated for a large-scale regional spatial prioritization plan, which can help to improve the MPA system that can meet specific conservation objective (Vercammen et al. 2019) and understanding the differences between MPA and non-MPA area (Cortés-Useche et al. 2019). Moreover, a recent study by Shokri and Mohammadi (2021) demonstrated that the distribution of live coral cover can provide information for appropriate zoning plan to counter to rising number of tourist and tourism activities on Kish Island, Iran. Hard coral is a fragile organism and sensitive to environmental changes especially related to natural and anthropogenic disturbances. Hence, our approach of using the percentage cover of live coral as coral health indicator for spatial zoning is due to the functionality of the organism, 'best available' data and commonly used as coral health status in Malaysia.

The islands in TMP have been pressured to cater for the demands of tourism sector such as accommodation, infrastructures and marine recreational activities. Hence, the issue of the increasing trend of multiple-conflicts of different demands in the TMP should be addressed. Conflicts among the multiple-users of a marine zone leading to coastal and marine ecosystem degradation are quite well documented (Douvere et al. 2007; Noble et al. 2019). Compatibility and conflicts of development and ecosystems in the TMP can be identified by establishing a matrix conflict approach (Freeman, Whiting & Kelly 2016; Stefano et al. 2018). Classifying the types of conflict and analyzing the effects to habitats and ecosystems will help the authority to implement better management to avoid conflicts in the future (Tuda, Stevens & Rodwell 2014).

The assessment of the coral reef health highlights the multiple conflicts faced by the TMP. Conservation can be undertaken by re-prioritizing and re-mapping to enhance ecological, social and economic objectives in the affected areas with poor coral cover. New regulations should be imposed in these areas as recovery zones until the marine biodiversity has been rehabilitated. Unfortunately, the natural recovery process of coral reefs communities can take from few years to more than a decade, depending on types of disturbances (Gouezo et al. 2019; Graham, Nash & Kool 2011). Perhaps, coral restoration can be a good alternative to minimize acceleration of coral reefs degradation, improving the reef resilience (Hein et al. 2019) and act as an early response to address degradation of coral reefs (Hein et al. 2020).

TABLE 2. Proposed zoning based on coral health criteria for adoption in Terengganu Marine Park

Zoning	Criteria (Coral Health Status)	Zoning specification	Interrelation with GBRMP Zoning Plan 2003
Recovery Zone	Fair to Poor	- Area represented by unhealthy and disturbed reefs with low coral cover and have a potential to decline from 'fair' to 'poor' condition - Degraded reefs classified as 'poor' (< 25%) or 'fair' condition with a percentage cover of live coral near to the borderline of 'poor' condition (< 30%) - Requires immediate action to minimize the acceleration of coral degradation (closing the area and/or coral reefs restoration) - Seasonally opened (Mar to June, following the the trend in Figure 4(b)) for low impact activities, including low impact recreational activities paticularly in the area nearby the tourism development sites - As the reef recover, the zone can be converted into open access zone	Preservation Zone
Protected Zone	Good to Excellent	- Area represented by healthy and undisturbed reefs with high coral cover and have a potential to remain healthy if remain undisturbed by anthropogenic activities - Healthy reefs classified as 'good' or 'excellent' condition with a percentage cover of live coral 50% and above - Less accessible either due to its location (far from tourism development area) or have potential hazard (environmental condition such as strong current) - Acts as control or reference site for scientific studies and environmental impact assessment - Zone remains unchanged	Habitat protection zone, Scientific research zone
Open access Zone	Fair	- Area represented by healthy reefs with high coral cover and have potential to recover or remain unchanged if disturbed by low impact activities - Healthy reefs classified as 'fair' condition with a percentage cover of live coral between 49% and 30% - Open (Mar to October, Figure 4(b)) for low impact activities, including low impact recreational activities - The zone can be converted into recovery zone when there is potential reef degradation and percentage cover of live coral decline to below 30%	General use zone, Conservation park zone

Conclusion

This study investigates the governance practice for TMP and identified several issues in relation to unintegrated manner of governance and management, as well as ecological status in the marine park. There is a need to harmonize the sectoral governance framework involved through the designation of MSP in Terengganu's water. Zoning is part of the MSP process that can be adopted for the TMP by interrelating the ecological parameter such as coral health status. In the future, other ecological indicator such as macroalgae and dead coral cover can be included in the criteria or perhaps a specific health index that can fit with the current status of the coral reefs in Malaysia. In relation to this, sedimentation, improper wastewater discharge and tourism activities are known as the major problem in touristic island that required further attention. Information regarding these matters such as water quality and tourist capacity are crucial to provide a management framework to deal with these issues. In the meantime, efforts to propose the implementation of MSP require cooperation from various stakeholders and interested parties to minimize the multiple conflicts between user and the ecosystem. Strategic governance and management plan consisting of sustainable development guidelines should be in place with the decision-making made on the basis of the scientific knowledge.

Acknowledgements

We would like to acknowledge the Ministry of Higher Education (Malaysia) for the Long-Term Research Grant Scheme under the HICoE programme (Vot 66928) and Malaysia Marine Spatial Planning Project jointly conducted with Fujian Institute for Sustainable Ocean, Xiamen University. This study also benefited from the project coordinated by PlanMalaysia Terengganu, entitled 'Development Plan of the Resort Islands and Marine Parks in the State of Terengganu, 2018'.

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