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CORAL COMMUNITY STRUCTURE IN PAYAR ISLAND MARINE PARK, MALAYSIA

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Abstract: Conservation efforts such as reef survey and monitoring programs are crucial to ensure the sustainable management of coral reef resources. The present study aims to investigate the diversity and abundance of corals at seven fringing reef sites in Payar Island Marine Park by applying a Coral Video Transect method. A total of 38 genera from 14 families of corals were identified. Massive *Porites* and massive-platy *Physogyra* were dominant in the coral assemblages cover almost 49% of the total live coral coverage. These corals have higher tolerance compared to other corals to withstand strong currents and high suspended sediment conditions. Reef sites in Payar Island were categorized as having 'poor' to 'fair' coral conditions with the percentages of live corals cover from 8.1% to 43.3%. The 'poor' average coral condition (15.7% ± 4.9) is most likely influenced by the impacts of sedimentation and uncontrolled tourism related activities. Current findings provide useful information on the current status of corals for a better reef management plan in Payar Island Marine Park.

KEYWORDS: Scleractinian corals, Peninsular Malaysia, reef condition, sedimentation

Introduction

Malaysia's coral reefs cover approximately 1,687 km^2 seabed areas and the majority of reefs are located at the north and east coasts of Sabah along the Sulu Sea (Cros *et al.,* 2014). The east coast of Sabah has been delineated in the Coral Triangle (CT) area which is recognized as the global center of marine biodiversity (Veron *et al.,* 2011). Recent compilation of data for hard coral species in the South China Sea region (including Malaysia) suggested the inclusion of 398 species for the east coast of Peninsular Malaysia and 248 species for the west coast of Sabah within the boundary of CT area (Huang *et al.,* 2015; 2016).

Within the Peninsular Malaysia, the hard coral diversity in the west coast area is relatively low with only 56 species recorded (Affendi & Rosman, 2012). High sedimentation and water turbidity lead towards a low diversity and percentage cover of live corals in this area (Toda *et al.,* 2007; Praveena *et al.,* 2012; Safuan *et al.,* 2016). A recent study by Safuan *et al.* (2018) indicated that the coral reefs around the west coast of Peninsular Malaysia were in a 'poor' condition due to the sedimentation impact. Additionally, the associated human induced disturbances such as land clearance for coastal development (Phang, 1995), and shipping activities (Qu & Meng, 2000) along the Straits of Malacca are among the major problems affecting coral reefs in this area.

Payar Island is one of the popular tourism destinations located in the north-west coast of Peninsular Malaysia. The recreational and cultural values provided by the coral reefs have become major attraction for local and international tourists to visit this island. Based on the annual visitor numbers from year 2000 to 2010, approximately 100,000 tourists have visited this island per year (Hasnan *et al.,* 2012). However, the growing influx of tourists with extensive tourism activities have resulted in reef damage and other related problems such as pollution from increased disposal of sewage to the reef environment (Lim, 1998; Jonsson, 2003; MCRCP, 2005).

Several studies on hard coral diversity in Payar Island have been published (De Silva & Ridzwan, 1982; Jonsson, 2003; Toda *et al.,*

2007). The earlier hard coral survey (De Silva & Ridzwan, 1982) recorded 35 genera in Payar and Segantang Islands. In subsequent studies, the numbers decreased with only 14 genera recorded (Jonsson, 2003) and 11 genera by Toda *et al.* (2007) at the Marine Park Centre House Reef. Nevertheless, previous works were not enough to represent the diversity status of hard corals in Payar Island due to the limited number of sampling stations. Additionally, it is important to perform a continuous evaluation of coral reefs for, at least, every five years to know the current status of the live coral coverage and reef condition (Waheed *et al.,* 2012).

Therefore, the present study attempts to fill the gap to determine the generic diversity and abundance patterns as well as the reef condition at seven fringing reef sites around Payar Island Marine Park. The finding of this study is important in assisting the Department of Marine Park (DMPM), Ministry of Natural Resources and Environment (MNRE) and other relevant agencies to update their coral inventories and providing them with reliable data and information to ensure the conservation and sustainable management of coral reef ecosystems.

Materials and Methods

Study Area

Fieldwork was carried out from 2 to 7 February 2014 at Payar Island Marine Park, located approximately 19 nautical miles from Langkawi Island in the state of Kedah. Payar Island Marine Park was selected as to evaluate the current status of coral reefs since they are likely to be influenced from the impacts of tourism activities and sedimentation problem along the Straits of Malacca. This Marine Park consists of four main groups of islands namely Payar, Kaca, Lembu and Segantang Islands. A total of seven fringing reef sites were selected namely as Banana Reef (PP1), Coral Garden (PP2), Kaca Island (PP3), Lembu Island (PP4), Segantang Bay (PS1), Anemone Garden (PS2) and Tyre Reef (PS3) with depths ranging from 3 to 18 m (Figure 1). All reef sites are situated at the southern exit of the Andaman Sea and exposed to frequent high load of suspended sediments, especially during rainfall season of the northeast monsoon (Chua & Ross, 2002). Bottom morphology is dominated by coarse sand, sandstone rock and patches of boulder substrates lined the reef slopes. The corals at all reef sites were distributed in patches.

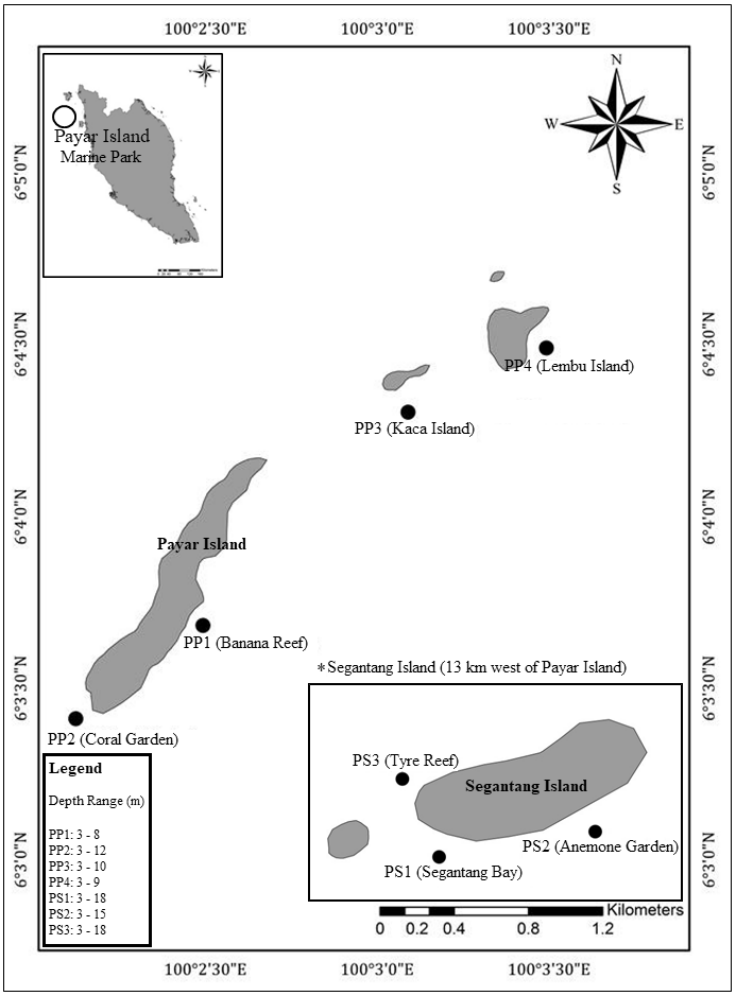

Figure 1: Location of 7 reef sites in Payar Island Marine Park: PP1 (Banana Reef: N 06°03'41.0", E 100°02'29.6"), PP2 (Coral Garden: N 06° 03' 24.7", E 100° 02' 07.4"), PP3 (Kaca Island: N 06° 04' 18.1", E 100° 03' 05.4"), PP4 (Lembu Island: N 06° 04 '18.2", E 100° 03' 26.4"), PS1 (Segantang Bay: N 06° 02' 35.8", E 099° 55' 27.5"), PS2 (Anemone Garden: N 06° 02 '38.0", E 099° 55' 26.8"), PS3 (Tyre Reef: N 06° 02' 39.7", E 099° 55' 31.6").

Coral Survey Method

Coral survey was carried out using the Coral Video Transect (CVT) method adopted by Liew *et al.* (2012) and optimized by Safuan *et al.* (2015) with some modifications. At each of the reef sites, four lines of 30 × 0.5 m transects with a 3 m interval between each transect were placed at the depth following the reef contour. A total of 28 transect lines were surveyed in this study, covering of 420 m^2 reef areas. The images of benthic communities along the transect tape were recorded using an underwater camera (Olympus TG-3 in a ratio of 16:4 and 1980 × 1080 high definition (HD) resolutions) protected with a 40 m waterproof case (Olympus PT-053). The height of the camera from the substrates was maintained at approximately 50 cm using a reference bar and held at a perpendicular angle to the bottom substrate. Video recording along the transect tape was run at a speed of 6 minutes per transect to record clear and sharp images for laboratory analysis. The additional photographs of living corals surrounding reef sites were taken

at both actual size and micro shots, enabling later verification of coral genera identification.

Image Processing and Data Analysis

The extracted images of video (300 picture frames per reef site) were analyzed using the Coral Point Count with Microsoft Excel extension (CPCe) software version 4.1 developed by Kohler and Gill (2006) with 10 random points per image. Analysis was done using high number of frames for a better taxonomic resolution of reefs with low coral cover (Pante & Dunstan, 2012). Corals were identified at generic level using the Indo Pacific Coral Finder Toolkit (Kelley, 2009) supported by the Corals of the World (Veron, 2000). Benthic community data obtained from the CPCe software were summarized into percentage cover of five categories: live corals (scleractinian corals, non-scleractinian corals and soft corals), dead corals (coral rubble and dead coral with algae), algae (several species of algae and macro algae), other invertebrates and abiotic elements consisted of sand, silt and rock substrates. The reef condition was indicated by the total percentage cover of live corals: excellent (> 75%), good (51% - 75%), fair (26% - 50%) and poor (< 25%) following the Coral Reef Health Criteria developed by Chou *et al.* (1994). The abundance of each coral genus at every reef site was determined based on the total colony number counted in the extracted images. It was categorized on a rating scale of one to five cross (+), where + = 1 – 25 colonies, ++ = 26 – 50 colonies, +++ = 51 – 75 colonies, ++++ = 76 – 100 colonies, +++++ = > 100 colonies. Univariate analysis was done using the Shannon-Wiener index, H' (Shannon & Weaver, 1949) to determine the generic diversity and relative abundance of different coral genera at every reef site while the Pielou's evenness index, J' (Pielou, 1966) was used to determine the equitability of individuals' distribution among coral genera. It was performed using PAST (Paleontological Statistic software version 3) (Hammer *et al.,* 2001). The statistical comparison of One-Way analysis of variance (ANOVA) was used to compare the mean of diversity and evenness indices of coral genera between sites. Post hoc Tukey HSD test was utilized to determine the significance differences ($p < 0.05$) among reef sites using Minitab 17 software.

Results and Discussion

Coral Community Structure

Overall, a total of 766 coral colonies belonging to 38 genera from 14 families were recorded in the study area. Out of these, 36 genera were hard corals and two genera were soft corals (Table 1). Poritidae was the dominant coral family with a cover of 32.5% of the live coral coverage followed by Euphylliidae, Dendrophyllidae and Faviidae with 19.7%, 15.0% and 12.6%, respectively. Genus *Porites* had the highest live coral coverage with 29.3% (221 colonies) followed by *Physogyra* 19.3% (154 colonies), *Tubastrea* 13.8% (104 colonies) and *Pocillopora* 7.3% (67 colonies). The rest of genera had < 5% of the total live coral coverage. Genera *Porites, Goniopora, Pocillopora* and *Physogyra* were commonly found at most of the reef sites (≥ 6 reef sites). Among these genera, *Porites* and *Physogyra* were found at all reef sites. Genera *Astreopora, Leptastrea, Leptoria, Stylophora, Acanthstrea, Gardinoreseris, Coeloseris, Polyphyllia, Herpolitha, Fungia, Merulina, Coscinarea* and *Dendronepthya* (soft coral) were the least abundant (≤ 1 reef site).

Present findings indicated that the coral community structure in Payar Island was dominated by massive *Porites* and massive-platy *Physogyra* which encompassed almost 49% of the total live coral coverage. Previous studies conducted in Payar Island also reported a dominant coverage of massive *Porites* in the coral assemblages (Jonsson, 2003; Toda *et al.,* 2007). However, none of them showed the dominance of massive-platy *Physogyra* in their datasets. This might due to the limited number of reef sites surveyed, of which two reef sites (House Reef and Japanese Garden) were by Toda *et al.* (2007) and one reef site (House Reef) was by Jonsson (2003). Besides, *Physogyra* can be misidentified with *Plerogyra* since

both of them have similar fleshy polyp tissue. They differ in corallites morphology of which *Physogyra* colony has meandroid corallites while Physogyra colony has flabello-meandroid corallites (Veron, 2000; Akmal *et al.,* 2017).

The extensive cover of massive *Porites* can be associated with its ability to tolerate harsh environmental conditions. It has been documented that the massive *Porites* has higher growth rate and is able to survive in the high sedimentation areas compared to branching *Acropora* and foliose or encrusting *Montipora* corals (Toda *et al.,* 2007; Hennige *et al.,* 2013). Besides, its massive colony growth form provides greater tolerance to strong wave and current conditions (Ammar & Mahmoud, 2006; Hennige *et al.,* 2013). Moreover, the dominant massive *Porites* in Payar Island might be due to its survivability towards the natural bleaching event recorded in 1998 (Jonsson, 2003). It has been reported that the massive *Porites* is more resistant to bleaching event and has high recovery process after bleaching (McClanahan *et al.,* 2007).

Genus *Physogyra* was the second dominant corals found in the surveyed sites. *Physogyra* colonies form massive and thick plates covered with a mass of bubble-like vesicle on their colony surface (Veron, 2000). Massive-platy *Physogyra* is commonly found in turbid water reef environment due to its ability to withstand in the low light level condition caused by heavy sedimentation (McClanahan *et al.,* 2007; Saad & Khodzori, 2017). These adaptations are the possible causes for high percentage cover of massive-platy *Physogyra* in Payar Island. Among the genera recorded in Payar Island, the azooxanthellate, or non-photosynthetic corals of *Tubastrea* cover almost 14% of the total live coral coverage. High percentage cover of the *Tubastrea* corals has also been reported at several islands in the west coast of Peninsular Malaysia (Safuan *et al.,* 2016). This might be related to its ability to survive in low light conditions due to elevated suspended sediments since the *Tubastrea* corals do not have mutualistic relationship with zooxanthellae algae (genus *Symbiodinium*) and only depends on planktonic organisms as their food particles (Sheppard *et al.,* 2009).

Apart from that, this study also revealed 14 genera of new scleractinian corals for the west coast of Peninsular Malaysia which were not listed in the previous study by Affendi and Rosman (2012). The new scleractinian corals recorded are *Montastrea, Leptoria, Stylophora, Acanthastrea, Gardineroseris, Coeloseris, Leptoseris, Litthophyllon, Polyphyllia, Herpolitha, Physogyra, Euphyllia, Coscinarea* and *Stylocoenilla* (Table 1).

Table 1: Coverage (%), total colony number, diversity and abundance patterns of coral genera in Payar Island Marine Park

No	Corals	Reef Site														Total Colony Number/ Coverage (%)	
		Banana Reef		Coral Garden		Kaca Island		Lembu Island		Segantang Bay		Anemone Garden		Tyre Reef			
		PP1		PP2		PP3		PP4		PS1		PS2		PS3			
	HARD CORALS	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**		
	Acroporidae																**2.7**
1	*Acropora*	0	-	1	+	2	+	6	+	1	+	0	-	0	-	10	1.3
2	*Montipora*	7	+	0	-	0	-	0	-	0	-	2	+	0	-	9	1.2
3	*Astreopora*	0	-	0	-	0	-	1	+	0	-	0	-	0	-	1	0.1
	Faviidae																**12.6**
4	*Favia*	4	+	6	+	4	+	4	+	0	-	0	-	0	-	18	2.4
5	*Favites*	7	+	12	+	11	+	4	+	2	+	0	-	0	-	36	4.8
6	*Platygyra*	3	+	0	-	6	+	1	+	0	-	0	-	0	-	10	1.3
7	*Diploastrea*	1	+	1	+	0	-	0	-	2	+	0	-	0	-	4	0.5
8	*Montastrea**	2	+	4	+	3	+	2	+	0	-	0	-	0	-	11	1.5
9	*Cyphastrea*	4	+	6	+	3	+	0	-	1	+	0	-	0	-	14	1.9
10	*Leptastrea*	1	+	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
11	*Leptoria**	0	-	0	-	1	+	0	-	0	-	0	-	0	-	1	0.1

No	Corals	Reef Site														Total Colony Number/ Coverage (%)	
		Banana Reef		Coral Garden		Kaca Island		Lembu Island		Segantang Bay		Anemone Garden		Tyre Reef			
		PP1		PP2		PP3		PP4		PS1		PS2		PS3			
	HARD CORALS	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**	**NC**	**AC**		
	Poritidae																**32.5**
12	*Porites*	76	++++	15	+	51	+++	24	+	13	+	28	++	14	+	221	29.3
13	*Goniopora*	1	+	1	+	4	+	0	-	4	+	1	+	6	+	17	3.2
	Pocilloporiidae																**7.4**
14	*Pocillopora*	17	+	17	+	3	+	6	+	20	+	0	-	4	+	67	7.3
15	*Stylophora**	1	+	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
	Mussidae																**1.2**
16	*Symphyllia**	2	+	1	+	0	-	0	-	1	+	1	+	0	-	5	0.7
17	*Blastomussa**	3	+	0	-	0	-	0	-	0	-	0	-	0	-	3	0.4
18	*Acanthastrea**	0	-	0	-	1	+	0	-	0	-	0	-	0	-	1	0.1
	Agariciidae																**3.2**
19	*Pavona*	8	+	7	+	1	+	0	-	1	+	0	-	1	+	18	2.4
20	*Gardineroseris**	1	+	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
21	*Coeloseris**	1	+	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
22	*Leptoseris**	0	-	0	-	1	+	1	+	0	-	0	-	0	-	2	0.3
23	*Pachyseris*	0	-	0	-	1	+	0	-	1	+	0	-	0	-	2	0.3
	Fungiidae																**1.7**
24	*Lithophyllon**	6	+	0	-	1	+	0	-	1	+	1	+	1	+	10	1.3
25	*Polyphyllia**	0	-	1	+	0	-	0	-	0	-	0	-	0	-	1	0.1
26	*Herpolitha**	0	-	0	-	0	-	0	-	1	+	0	-	0	-	1	0.1
27	*Fungia*	0	-	0	-	0	-	0	-	0	-	0	-	1	+	1	0.1
	Dendrophyllidae																**15.0**
28	*Tubastrea*	3	+	4	+	0	-	0	-	75	+++	20	+	2	+	104	13.8
29	*Turbinaria*	0	-	4	+	2	+	0	-	2	+	1	+	0	-	9	1.2
	Merulinidae																**0.9**
30	*Merulina*	2	+	0	-	0	-	0	-	0	-	0	-	0	-	2	0.3
31	*Hydnophora*	1	+	0	-	2	+	1	+	0	-	1	+	0	-	5	0.7
	Euphylliidae																**19.7**
32	*Physogyra**	55	+++	34	++	10	+	18	+	7	+	15	+	15	+	154	19.3
33	*Euphyllia**	1	+	2	+	0	-	0	-	0	-	0	-	0	-	3	0.4
	Siderastreidae																**1.2**
34	*Psammocora*	3	+	0	-	1	+	4	+	0	-	0	-	0	-	8	1.1
35	*Coscinarea**	1	+	0	-	0	-	0	-	0	-	0	-	0	-	1	0.1
	Astrocoeniidae																**0.9**
36	*Stylocoenilla**	1	+	5	+	1	+	0	-	0	-	0	-	0	-	7	0.9
	SOFT CORALS																
	Xeniidae																**0.4**
37	*Xenia*	0	-	2	+	1	+	0	-	0	-	0	-	0	-	3	0.4
	Nephteidae																**0.4**
38	*Dendronephthya*	0	-	0	-	0	-	0	-	3	+	0	-	0	-	3	0.4
															TOTAL	**766**	**100**

Note. + = 1-25 ++ = 26-50 +++ = 51- 75 ++++ = 76-100 +++++ = >100
*New coral records for the west coast of Peninsular Malaysia
NC: Number of Colony
AC: Abundance of Colony

Reef Condition

Table 2 shows the percentage cover of corals and other benthic communities at all reef sites. Banana Reef and Tyre Reef recorded the highest and the lowest coverage of live corals with 43.3% and 8.1%, respectively. Kaca Island, Coral Garden and Lembu Island recorded higher coverage of algae with 34.5%, 33.9% and 31.6%, respectively. Meanwhile, Anemone Garden, Segantang Bay and Tyre Reef recorded higher coverage of other invertebrates with 50.6%, 38.0% and 30.6% respectively. Most of the reef sites in Payar Island were categorized as 'poor' condition except for Banana Reef ('Fair' condition). Based on the total number of coral genera in Payar Island, Banana Reef, Kaca Island and Coral Garden showed a higher number of coral genera with 27, 21 and 18 genera, respectively. Meanwhile, Anemone Garden and Tyre Reef showed comparatively fewer numbers of coral genera with 9 and 8 genera, respectively. Coral Garden, Banana Reef and Kaca Island also showed higher index value of coral genera diversity with 2.42, 2.17 and 2.10, respectively. Among reef sites, Coral Garden had the highest value (H': 2.42, J': 0.84) ($p < 0.05$) while Anemone Garden had the lowest value (H': 1.46, J': 0.58) ($p < 0.05$) of Shannon diversity and Pielou's evenness indices of coral genera.

Overall, reef sites in Payar Island were in 'poor' condition with low live corals cover (8.1% – 43.3%). A previous study conducted by Coral Cay Conservation Ltd at six reef sites in Payar Island also recorded the low coverage of live corals ranged between 8.1% – 48.2% (MCRCP, 2005). Low number of generic diversity of corals also have been documented in Payar Island with 11 and 9 genera recorded at House Reef and Japanese Garden, respectively (Toda *et al.,* 2007). In this study, higher number of corals range at between 8 to 27 genera was recorded at 7 reef sites in Payar Island. This updated generic list of corals (including hard and soft corals) could provide useful information to marine protected areas (MPAs) management agencies on the current status of corals in Payar Island.

The 'poor' reef condition and low percentage cover of live corals in Payar Island are likely to be influenced by massive impacts of natural and anthropogenic disturbances. Previous studies indicated that certain reef sites in Payar Island were affected by the bleaching event in March, 1995 during the El Niño (Lim, 1998). The associated high nutrient runoff caused by improper solid waste disposal have resulted in the absence of branching *Acropora* and reduction other fast-growing corals such as *Montipora* and *Echinopora* at the Marine Park Centre House Reef and Langkawi Coral Poontoon House Reef (Jonsson, 2003). It has been documented that the impacts of bleaching events highly contributed towards loss of susceptible species and subsequently decreased the live coral coverage due to the mortality effect and spread of disease (Baker *et al.,* 2004; McClanahan *et al.,* 2007).

Moreover, constant exposure to high sedimentation and turbidity are among the most serious threats affecting coral reefs in the west coast of Peninsular Malaysia including Payar Island archipelago (Chua & Ross, 2002). Higher accumulation rate of suspended sediments was recorded along the west coast (49.8 mg/cm^2/day) compared to the east coast (3.5 mg/cm^2/day) of Peninsular Malaysia (Lee & Mohamed 2011). Other study showed that the distribution of total suspended solids (TSS) on surface water of Payar Island was more than 200 mg/L indicated high levels of TSS concentration (Abdullah *et al.,* 2016). The suspended sediments and other particulate matters are mainly transported from major rivers of the east coast of Sumatra and the west coast of Peninsular Malaysia (Soegiarto, 2000). The problem is further intensified by the land clearance for coastal development activities along the Straits of Malacca leading to a major outflow of sediments into the water (Nickerson-Tietze, 2000). High turbidity from suspended sediments could directly give negative impact on coral growth due to a reduction of sunlight penetration required for photosynthesis process (Erftemeijer *et al.,* 2012).

Furthermore, the lack of policy and enforcement in terms of carrying capacity of visited tourists may significantly affect the reef ecosystem's health and condition in Payar Island. Payar Island has been receiving a large number of tourists since the year of 1988 (Lim, 1998). The total number of visited tourists to this island increased from 1,373 visitors in 1988 to 90,307 in 1996 with approximately 98% increase over the past 8 years (Nickerson Tietze, 2000). In fact, the overcrowding of tourists with uncontrolled diving, snorkeling and boating activities have been the main culprit of various accumulated negative impacts on coral reefs. It has been reported by many researchers that snorkeling and SCUBA diving activities are the main causes of reef damage by direct fin contact of snorkelers and divers (Zakai & Chadwick-Furman, 2002; Weilgus *et al.,* 2004; Paveena *et al.,* 2012; Shahbudin *et al.,* 2017). Moreover, the large number of tourists is directly contributing to an excess of nutrients due to sewage and waste water discharged into the reef areas (Risk & Erdmann, 2000). As a consequence, it may reduce the water and substratum quality and certainly affects the reproduction and recruitment of coral species (Risk & Erdmann, 2000; Downs *et al.,* 2006). Therefore, consistent good management and enforcements are needed to mitigate these problems. Regulation such as limiting the carrying capacity of visiting tourists to the Marine Park and even restricting any tourism activities at biologically sensitive reef areas should be implemented to sustainably manage and conserve coral reef resources.

Reef Site	Live Corals (%)	Dead Corals (%)	Algae (%)	Other Invertebrates (%)	Abiotic Elements (%)	Reef Condition	Total Genera	H' (Mean ± SD)	J' (Mean ± SD)
Banana Reef (PP1)	43.3	9.7	21.8	10.3	14.9	Fair	27	2.17 ± 1.3	0.66 ± 0.3
Coral Garden (PP2)	20.8	12.8	33.9	22.8	9.7	Poor	18	2.42 ± 1.4*	0.84 ± 0.4*
Kaca Island (PP3)	10.7	27.4	34.5	10.8	16.6	Poor	21	2.10 ± 1.2	0.69 ± 0.3
Lembu Island (PP4)	8.8	18.6	31.6	1.5	39.5	Poor	12	1.95 ± 1.1	0.79 ± 0.3
Segantang Bay (PS1)	8.3	9.4	31.3	38.0	12.9	Poor	16	1.62 ± 0.9	0.66 ± 0.3
Anemone Garden (PS2)	9.7	13.7	20.5	50.6	5.5	Poor	9	1.46 ± 0.8*	0.58 ± 0.3*
Tyre Reef (PS3)	8.1	23.8	29.7	30.6	7.8	Poor	8	1.69 ± 1.0	0.80 ± 0.3
Total Average of Payar Island (Mean ± SE)	15.7 ± 4.9	16.5 ± 2.6	29.0 ± 2.1	23.5 ± 6.6	15.3 ± 4.3	Poor	15.9 ± 2.6	1.9 ± 0.1	0.7 ± 0.0

*Significant at 0.05 levels

Conclusion

This study concluded that the reefs around Payar Island Marine Park had low average coverage of live corals. The 'poor' reef condition recorded at most of the reef sites is likely to be influenced by human induced disturbances such as sedimentation impact. Video transect surveyed a total of 766 coral colonies belonging to 38 genera and 4 families in the study area. Massive *Porites* and massive-platy *Physogyra* were recorded in high percentage of live coral coverage. The dominant of these species might be due to their tolerance to adapt in the area of high suspended sediments. Research finding also revealed 14 new records of scleractinian coral genera for the west coast of Peninsular Malaysia. The information generated by this study provides useful data to the Department of Marine Park Malaysia and other institutions about the current status of coral diversity and abundance in Payar Island Marine Park for conservation plans

towards sustainable management of coral reef ecosystems.

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