Biodiversity of Associated Megabenthic Invertebrate of Corall Reef Ecosystem of Petong Island Batam Indonesia

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Abstracts. Global warming and climate changes were of the main environmental concern of marine scientist in the last three decade. As a biodiversity hotspot, marine coastal ecosystem faced an environmental threat because of increasing sea surface temperature (SST) and land base effluent, which in turn had an impact on the biodiversity of megabenthic faunal on coral reef community. The present paper studied the current condition of reef ecosystem as well as biodiversity of megabenthic community in Petong Island, a core zone of Batam Marine Management Area (BMMA), Riau Archipelago Province. Gradual changes of physical and chemical properties of seawater originated from coastal activities presumably has caused an effect on benthic faunal community structure. It revealed that benthic lifeform coral cover account for 30.53%, categorized into fairly good, whereas abiotic sand cover of 16.53%. The lifeform consists of Acropora (AC) 1.73% and non-Acropora 28.80%. Death coral with algae (DCA) account for 40.40% and death corall (DC) 2.80%, Soft Corall (SC) 1.20%, fleshy seaweed (FS) 0.07%, other fauna (OT) 1.47%, and rubble (R) 7.00%. Apparently, only 4 of target species megabenthic fauna from eight, were encountered including; seaurchin (Diadema sp.), topshell (Drupella sp.), giant clam (Tridacna sp.), trochus (Trochus sp.), with density of each megabenthic fauna calculated 5929, 1857, 71 and 71 ind/ha, respectively. It appeared that sea urchin were the highest density and followed by topshell (Drupella sp). Sea urchin were noted as a bioindicator of reef ecosystem health. High density of sea urchin may indicate that reef in unhealthy state. The presence of Diadema Sitosum indicate that dead coral were present and it feed on algae growing in dead coral. High density of sea urchin may indicate that reef in unhealthy state

1. Introduction
Published reports suggested that coastal reef ecosystem face inter-related issues affecting the ocean sustainability, including climate change, unsustainable fishing, ocean acidification, pollution and waste, and loss of habitat. The global warming and climate changes had an impact on reef ecosystem in some region [1]. As a fragile ecosystem, physical and chemical properties of seawater modulate the ekokinetic of pollutant and sustainability of reef community.
As a biodiversity hotspot, corall reef ecosystem was threatened frequently by land based of industrial effluent which affect benthic faunal biodiversity. Based on line intercept transect-LIT and rapid reef check, the condition of reef ecosystem in Batam Marine Management Area (BMMA) especially in Petong Island categorized good in that encountered 163 species of stony corall include into 17 ordo CRTIC–LIPI (2014). It was reported that endangered mollusc including giant clam \((Tridacna sp)\), \(Trochus sp\) (CITES) exist in the area. Degradation of reef ecosystem BMAA in the last 7 year were presumably related to anthropogenic activities including (i) explosive fishing, (ii) sand and tin mining, (iii) coastal reclamation (iv) ocean pollution; (v) development in coastal and inland.

The present work dealt with the evaluation of the reef ecosystem consisting of lifeform cover and community structure, and biodiversity of macrobenthic faunal of Petong Island which has been established as a core zone of Batam Marine Protected Area (BMPA), Riau Archipelago.

2. Materials and Methods

Field observation of lifeform of coral reef ecosystem were conducting by line intercept transect (LIT) of 50 m length. Three stations with three replicates LIT were conducted in the core zone of Batam Marine Management Area-BMMA (Figure 1).

![Figure 1. Map of Core Reef Zone Batam Marine Management Area](image)

The LIT with three replicates located on the reef slope around 100 m from the coastline. Three sampling sites were established in Petong waters. In each sampling point a 50 m roll meter were set up as a transect, Timed underwater visual census [1] was conducted to survey the macrobenthic invertebrate and mega-fauna communities in the depth of euphotic (4–7 m).

To observe and record megabenthic communities an Underwater Photo Transect (UPT) were employed [5], [6], [7] fauna picture were taken along the transect with use of 44 x 58 cm frame (Fig 2). This method is ideal for the assessment of large fauna, which are difficult to sample using conventional visual census method that cover only small areas, because these animals have large territories and exhibit behaviors that limit their sightings (Richards et al., 2011).
Figure 2. Illustration of sampling with Transect Methods UPT [9]

Megabenthic Sampling
Mega-benthic density were assessed by Benthos Belt Transect (BBT) which develop from Belt Transect Method. Benthic fauna were recorded along the transect with a 44 x 58 cm frame (Fig 3).

Figure 3. Megabenthic sampling with use of Benthos Belt Transect (BBT) [2]

Data Analysis
Amount of 30 photos from random points of each sampling site were analysed with software CPCe versi 4.1 (Coral Point Count with Excel extension [8]).

Abundance Megabenthic Fauna
Density of megabenthic were calculated with formula: (Harvey, 2008).

\[ X = \frac{\text{number of individu (x)}}{\text{area of belt transect (140 m}^2)} \]

Abundance (X) = (individu/m²) Area of belt transect = (140 m²)
Number of ind (x) = (individual)  

Coral reef condition were interpreted from percentage lifeform cover taking by underwater photograph in quadrat transect (Figure 4). Underwater photograph was taken for each category of lifeform and code of corall lifeform.

Lifeform cover were calculated and analysed by computer application of Coral Point Count with Excel Extension-CPCE [8]. The program automatically performs point-count analysis randomly on the photographs and analyse statistically for each lifeform in Microsoft Excel. Lifeform identification were done by putting random points on the picture a labelling based on the number as indicated in Figure 5.
3. Result and Discussion
Field observation showed a reef slope of 35° were found in Petong Island with sand substrate and rubble dominant. Death coral were frequently encountered which covered with algae (DCA). Species of corall found including *Porites* sp., *Montipora* sp., *Fungia* sp. and *Platygyra* sp. Lifeform found consisted of Coral foliose (CF), Coral massive (CM), Coral encrusting (CE), Coral mushroom (CMR), Acropora encrusting (ACE) dan Coral submassive (CS).

It revealed that benthic lifeform cover account for 30,53% consisting of Acropora (AC) 1.73% and non Acropora 28,80%, whereas abiotic sand cover of 16,53%. Death coral with algae (DCA) account for 40,40% and death corall (DC) 2,80%, Soft Corall (SC) 1,20%, fleshy seaweed (FS) 0,07%, other fauna (OT) 1,47%, and rubble (R) 7,00%. (Fig 4). While megabenthic encountered were shown in Figure 5
Based on quadrant transect performed along the study area, it was encountered four species megabenthic fauna associated with reef ecosystem which are seaurchin (*Diadema sp.*), topshell (*Drupella* sp.), giant clam (*Tridacna* sp.), trochus (*Trochus* sp.) (Fig 5). While other target species such as holoturian, lobster, *Linckia laevigata*, and *Acanthaster planci* were unfound. Density of benthic thase fauna revealed 5929, 1857, 71, and 71 ind/ha, respectively. The calculated density of benthic fauna in reef ecosystem of Pulau Petong waters were presented in Table 1. Sea urchin (*Diadema sp.*) appeared the most abundance.
Table 1. Density of benthic fauna found in reef ecosystem of Pulau Peton Island, Batam

| No. | Benthic fauna     | Amount (ind) | Density |
|-----|-------------------|--------------|---------|
| 1   | Diadema sp        | 83           | 0.5929  | 5929    |
| 2   | Diadema sp        | 26           | 0.1857  | 1857    |
| 3   | Tridacna sp       | 1            | 0.0071  | 71      |
| 4   | Trochus sp        | 1            | 0.0071  | 71      |

The benthic fauna density found were in accordance with the study done [10] [11]. The high density of sea urchin (Diadema sp.) in this study may indicate the bad health status of coral reef since it feed on epifauna algae (algae feeder). Species of megabenthos dominant of Pulau Petong reef ecosystem were seaurchin (Diadema sp.) account for 75%, followed by drupella (Drupella sp.) 23%, clam (Tridacna sp.) and lola (Trochus sp.) 1%.(Fig 7)

4. Conclusion

Condition of coral reef ecosystem in Petong Islands appeared fairly good with hard coral cover (HC) of 30.53%. Death coral with Algae (DCA) revealed 40.40%. Hard coral (HC) were dominated by Coral foliose (CF) which account for 13.80%. It evealed that megabenthic fauna dominant consisted of sea urchin (Diadem sp) with density of 5929 individu/ha. High density of sea urchin may indicate that reef in unhealthy state gastropod (Drupella sp.), bivalvia (Tridacna sp.) and trochus (Trochus sp.) were found in low density.

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