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### Condition of coral reef in Batee Island waters, Peukan Bada Sud-District, Aceh Besar

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#### ABSTRACT

Batee Island is one of the small islands in the Aceh Besar region and is uninhabited and directly faces the Indian Ocean. Batee Island's waters have the potential for marine biota, especially coral reef ecosystems, and other associated biotas. This study aims to determine the percentage and comparison of live coral cover in Batee Island waters and determine the genus' composition in Batee Island waters. This research was conducted in October-November 2016. Collecting coral reef data using the LIT (Line Intercept Transect) method. The results showed that the live coral cover in Batee Island's waters differed between the East and West Batee Islands. The coral reefs' average condition in Batee Island waters at shallow depths (0-5m) is 41.41%, and deep (6-10m) is 36.52%. Overall, the conditions and live coral cover in the waters of Batee Island are classified as moderate. In the waters of Batee Island, there are 31 coral genera. The highest percentage of corals was the genus *Acropora* (50.02%).

#### Introduction

Coral reef ecosystems are the most biologically productive ecosystems and very sensitive to pressure (Bengen, 2004; Ulfah, 2011). Usually, the coral reef ecosystem is in shallow water. According to Muttaqin *et al.* (2014), coral reefs have a significant role as habitat, feeding ground, nursery ground, and spawning ground for various biota that lives in association with coral reefs and also a source of income for humans.

Based on Government Regulation No.37 of 2008, the Aceh waters area is around 74,798.02 km<sup>2</sup> or 7,478,801.59 ha and a long coastline of 2,666.27 km with clusters of large and small islands. Aceh Besar was awarded a coastal area with a 295 km coastline, an area of sea waters reaching 1,355.90 km<sup>2</sup>, and many small islands of 21 and had two large islands. Most of the area is on land, and a small part is in the islands. In the West, Aceh Besar District is directly adjacent to the Indian Ocean (BPS Aceh Besar, 2014).

Batee Island is one of the small, uninhabited islands in the Aceh Besar region and directly faces the Indian Ocean. Batee Island is one of the areas affected by the Marine Conservation Area, located adjacent to Tuan Island in Ujong Pancu. This island became one of the areas affected by the 2004 Aceh tsunami. Batee Island's waters have the potential for marine biota, especially coral reef ecosystems, and other associated biotas. The water condition is still natural, and it is easy to find various types of marine biota that inhabit the substrate. This biota is certainly one of the bio-indicators of the health of coral reef ecosystems in the waters.

This research was conducted at four different observation sites in the Batee Island area. The observation site is determined by circling the island, which is considered to represent the coral reefs' condition in the Batee Island area, namely two sites in the western part of Batee Island and two sites in the eastern part of Batee Island. Each point of observation has different characteristics from both

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the substrate and other influences, such as human activity.

The four observation sites are areas that have the potential for the richness of aquatic biota because there is a stretch of coral reef ecosystems and the potential for underwater ecotourism management. Therefore, it is necessary to recommend a research on the condition of coral reefs. Besides, data on the coral reef ecosystem's condition in the study location is still lacking, so this study is an important information in managing natural resources in that area. So far, the public has not known this location much, so information about coral reef ecosystems' condition will be useful in efforts to manage natural resources.

The condition of coral reefs in Indonesia has experienced severe degradation in recent decades. Human activities such as industrial waste or pollution, waste disposal, tourism activities, and natural factors such as global warming and sedimentation are the causes of this condition (Nontji, 2014; Ulfah et al., 2018; Octavina et al., 2018). Therefore, the author wishes to study coral reefs' condition in Batee Island waters based on the live coral cover.

## Materials and Methods

### Location and time of research

This research is located on Batee Island waters, Peukan Bada Sub-District, Aceh Besar District, which was conducted in October-November 2016 (Figure 1). This research was conducted using a survey method that is directly involved in the field. The sampling site was determined based on the purposive random sampling method, namely the determination with certain considerations by the researcher (Nazir, 2005). In addition to make it easier to reach the Batee Island waters, not all areas can be observed, because the currents are fast and only in certain seasons can dive. Collecting coral reef data using the Line Intercept Transect (LIT) method. This method is used for observing coral reef ecosystems, using transects in the form of meters with the principle of recording the basic substrate, which pertains to transects (Saleh, 2009).

### Coral reef observation methods

a) Roll meter with a scale stretched 150 meters parallel to the coastline. Each transect is 50 meters long with three repetitions, and has an interval of 5 meters.

b) Record the base substrate, which is only pertains to the transect line—Data recording up to centimeter-level.

c) Observation of basic habitat filling biota recorded based on the number of coral reefs (genus) found along the line transect.

d) There are two depths in one observation site, namely shallow (2-5 meters) and deep (6-10 meters) (English et al., 1994).

Identification of coral reefs is carried out down to the genus level, referring to the Coral Finder guidebook (Kelley, 2009) and (Suharsono, 2008) based on genus categories for coral reefs that have not been identified in the field. As supporting data, Physic-chemical parameters were recorded, including temperature, salinity, brightness, and pH.

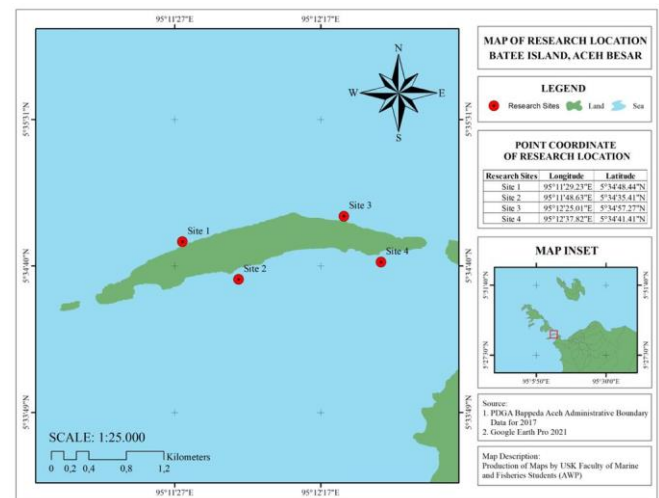


Figure 1. The Batee Island which is the research location.

## Data analysis

### Percentage of live coral cover

Calculation of the percentage cover for each category of live coral growth by comparing the total length of each category with the total transect length using the following formula (English et al., 1997):

$$Li = \frac{ni}{L} \times 100\%$$

Information:

Li = Percentage of live coral cover (%);

ni = total length of live coral cover (cm);

L = length of transect (cm).

To determine the percentage category of coral cover or coral reef condition based on the Decree of the Minister for the Environment No. 04/MENLH/02/2001 concerning Standard Criteria for Damage to Coral Reefs and Category of Coral Reef Condition, as follows:

Table 1. The percentage category of coral cover or coral reef condition based on the Decree of the Minister for the Environment No. 04/MENLH/02/2001.

Coverage (%)	Category
0-24,9	Poor
25-49,9	Moderate
50-74,9	Good
75-100	Very Good

#### Composition of the genus

The analysis of genus composition data describes descriptively based on observations after data collection in the field. The results of the analysis are displayed in the percentage of occurrences.

## Results

### Condition and percentage of live coral cover

Overall, the value of live coral cover in Batee Island waters is around 16.59-63.73% as poor to good category (Figure 2). Batee Island in the eastern area (Site 1 and Site 2) has a good coral cover at shallow depths with live coral cover values of 54.87% and 63.73%. Meanwhile, at the same site, at deep depths, the value of live coral cover was 39.83% and 37.86%, categorized as moderate coral cover.

#### Percentage of base substrate cover

The research results on the East Batee Island waters Site 1 at deep depth, the dominant substrate was dead coral and sand. Systematically, the percentage is 12.27% dead coral and 20.02% sand. In shallow depths, it is 18.56% rock and 10.55% sand. It is different from Site 2 in deep depth, dominated by a coral fracture of 19.56% and 18.77% sand. Meanwhile, in the shallow depths, it consists of 10.28% broken coral and 16.47% rock (Figure 3).

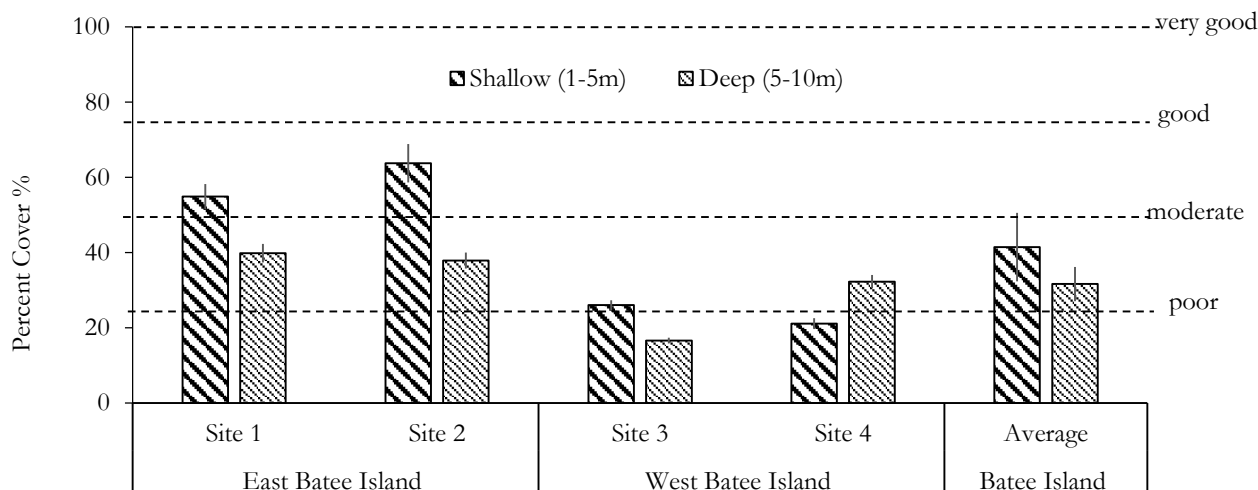


Figure 2. Graph of percentage of coral cover in batee island waters.

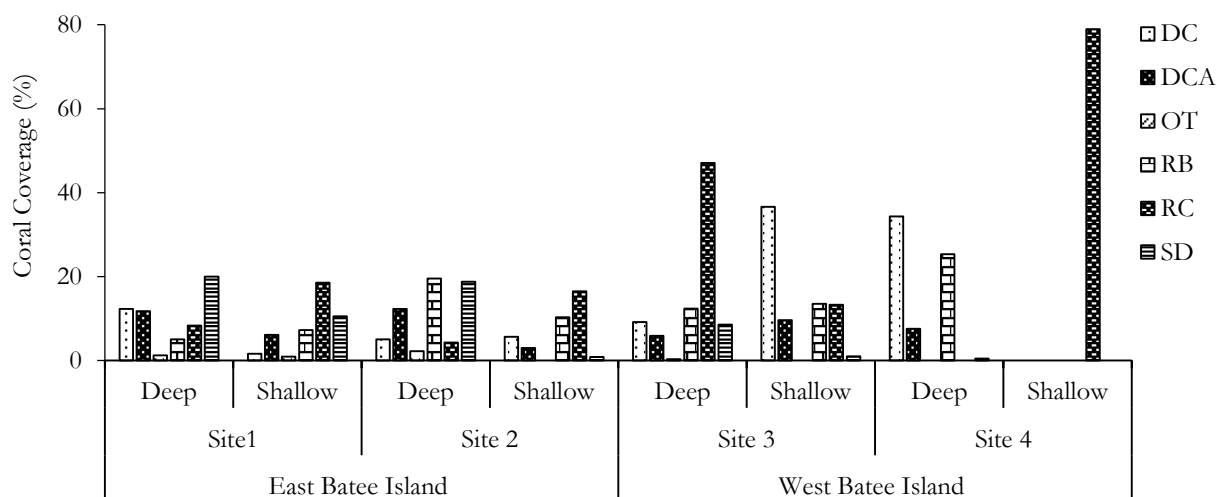


Figure 3. Percentage graph of base substrate cover.

Remarks: DC: Dead Coral; RB: Rubble; DCA: Dead Coral with Algae; RC: Rock; SD: Sand; OT: Other

Table 2. Percentage of coral genus &gt;1% in Batee Island waters.

Famili	Genus	East Batee Island (%)				West Batee Island (%)			
		Site 1		Site 2		Site 3		Site 4	
		D	S	D	S	D	S	D	S
Acroporitidae	<i>Acropora</i>	23.01	31.87	20.87	50.02	3.60	5.47	14.03	1.60
Pocilloporidae	<i>Pocillopora</i>	8.57	10.33	5.90	6.58	6.95	11.93	10.87	13.80
Poritidae	<i>Porites</i>	1.33	3.57	1.27	2.03	1.90	1.07	1.47	-
Favidae	<i>Platygyra</i>	-	-	-	-	-	1.20	-	3.13

Remarks: D: Deep, S: Shallow.

### Composition of the coral genus

The results showed that the composition of the coral genus was as much as 31 coral genera. The 31 coral genera can be divided into two major groups, namely the genus' composition with a percentage of >1% and <1%. The composition of coral genera with a percentage of >1% in East Batee Island waters was 3 coral genera (Table 2), and <1% were 28 genera of coral. Not much different from West Batee Island, the genus' composition with a percentage of >1% is four genera, and <1% is 27 genera.

### Discussion

East Batee Island (Site 3 and Site 4) at shallow depths is classified as medium live coral cover with live coral cover of 26.00% and 21.07%. Whereas at deep depth, the live coral cover were 16.59% and 32.27%, respectively, in the poor and moderate categories. The percentage of live coral cover in Batee Island waters is shown in Figure 2.

Based on the Decree of the Minister of Environment No. 04/MENLH/02/2001 concerning Standard Criteria for Damage to Coral Reefs and Category of Coral Reef Condition, the average condition of coral cover in Batee Island waters as a whole is classified as moderate, where the percentage of cover is 36.52%. The difference in the percentage of coral cover has a negative impact on the abundance and diversity of biota associated with coral reefs. Because if coral reefs are damaged, it will harm humans and the biota that associated with coral reefs. Excessive exploitation has resulted in ecosystem damage and population decline, and even species destruction (Baransano and Mangimbulude, 2011).

Marine Protected Areas (MPAs) can play an increasingly important role in the conservation and management of coral reefs (Westmacott, 2000). A well-protected area can slowly promote coral reef growth. An area with a suitable environmental activity and supported by good management will improve the coral reef ecosystem's health and productivity in that environment. Because it is not

direct, coral reefs will be protected from environmental threats, such as waste, bombing, and fish toxins that will affect coral reefs.

The substrate cover of the coral reef found at the research location was different for each site. Overall, the substrate cover in the Batee Island waters is dominated by hard corals, broken coral, sand, rocks, dead corals, and dead corals covered with algae.

The waters of West Batee Island are dominated by broken coral and rocks at both Site 3 and 4, at both depths. Systematically, the substrate proportion at Site 3 is 47.07% rock and 12.35% broken coral, while shallow 36.63% dead coral and 13.50% broken coral. At Site 4, the proportion of basic substrate cover was 34.37% dead coral and 25.37% broken coral in the deep. In the shallow depths, there are only 79.93% stones. Coral reefs will rapidly grow and develop at a depth of less than 10 m. Nybakken (1993) states that coral reef ecosystems develop well in waters with less than 25 m.

The percentage of base substrate cover in Batee Island's waters varies from the East and the West. The average percentage at sites 1 and 2 is dominated by 11.90% stone and 12.55% sand. This site is also a route for boats to carry out fishing activities such as fishing and catching fish so that some fishermen throw anchors in the coral reef area. In contrast, Site 3 and Site 4 dominated by rocks as much as 34.82% and dead corals as much as 20.05%. Area management is the right step to help maintain coral growth (Simarangkir, 2015).

The substrate cover at Site 1 and Site 2 is dominated by rock and sand, and in this location, the waters are relatively calm. Meanwhile, Sites 3 and 4 of the base substrates are dominated by dead rocks and corals, and this location has high current and wave intensity. According to Bahri et al. (2011), in the east and west monsoons, Ujong Pancu is always windy, causing high waves, with the current waters' physical conditions. This is supported by two seasons, namely the east and west monsoons, causing this area to be dominated by hard coral species.



Most of the coral reef cover conditions at the research location were damaged, especially the West Batee Island site. The dominant damage factor at the research location was due to being hit by waves. It can be seen from the unstable substrate structure. There were coral fractures as much as 12.80% and dead coral 20.05%. At low tide, the coral reefs were open at a shallow depth. The condition of Batee Island's waters, which is flowing and choppy, is influenced by two seasons, namely the east and west monsoons and the gaps in the two islands. Physical factors can affect coral growth, where wind and currents significantly affect coral reef growth conditions.

Overall, the most significant percentage of corals based on genus in all research sites were *Acropora* and *Pocillopora*. According to Rudi (2008), the Acroporidae and Pocilloporidae families are superior in terms of colonizing a new substrate, but Acroporidae will only be able to metamorphose if there is Crustose Coralline Algae on a substrate. Its branching nature in shallow waters and does not die quickly causes the spread, this type is often found in coastal waters with choppy waters.

Coral species from the genus *Acropora* and *Pocillopora* have tiny polyps, and it is not easy to clean themselves from adhering particles, so this species requires strong currents and waves. This genus was found in all research sites with a more dominant number than other genera. The high coral colony cover of the genus *Acropora* is (50.02%) and *Pocillopora* (13.80%), because the two coral genera were genera of coral that lived relatively fast and choppy areas. The dominant coral types in a habitat, depending on the environment or the coral's condition, is alive. Branched coral is a coral type that lives in shallow waters with clear water quality and is often found on beaches with choppy waters. Rudi (2013) stated that the coral types that live in current conditions are usually *Acropora* and *Pocillopora*. Branched corals grow and develop at a depth of 5–15 meters below sea level.

## Conclusion

The live coral cover in Batee Island's waters is different between the East and West Batee Islands. The coral reefs' average condition in Batee Island waters at shallow depths (0-5m) is 41.41%, and deep (6-10m) is 36.52%. Overall, the conditions and live coral cover in the waters of Batee Island are classified as moderate. There are 31 coral genera in Batee Island's waters with the highest coral cover percentage, namely *Acropora* genus (50.02%).

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