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Coastal Biodiversity of Tidung Island: Mangrove Forest and Coral Reef Conservation Program

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Abstract

Kepulauan Seribu has different characteristics in the ecosystem from other areas of DKI Jakarta. This area is a group of islands formed by coral reefs and their associations. The different characteristics ecosystem make Kepulauan Seribu increase in tourism and fishery activities. Thus, there is a need for efforts to restore damaged habitats as a result of tourism activities. Restoration of mangroves and coral reefs needs to be carried out to maintain existing natural resources. Based on this background, the research aims to determine the composition and value diversity and evenness of mangrove and coral reefs in Tidung Island. The research was conducted in three locations (Tidung Besar, Tidung Kecil, and Cinta Island) held along in August 2020 & August 2021. The method for vegetation mangrove based by purposive sampling as the representation of the area, with a total of 12 locations spread over the islands, meanwhile in Coral based by LIT (*Line Intercept Transect*) with a predetermined transect length of 10 meters over the coral reefs. The results of diversity index value successively in Mangrove Forest are 3,429; 1,289, and 3,240. The value of this diversity index is classified as high and medium, increasing more than in 2020. The evenness indexes successively in Mangrove Forest are 0.890; 0.502; and 0.919. The composition of coral genera is 7 genera from 5 Famili. The coral diversity index value is 1.426, which indicates the medium category. The evenness index value of the coral area of Tidung Island is 0.733,which is a high category.

Keywords: coastal biodiversity, conservation, coral reef, mangrove

INTRODUCTION

Kepulauan Seribu is an administrative area of DKI Jakarta which is separated from the mainland of Java. Its strategic geographical location makes various potentials in this archipelago can be utilized both in the field of fisheries, and the development of tourist destinations. Tourists who come to the Kepulauan Seribu also contribute economically to the development of the area (Apriyanti, 2014).

The position of the Kepulauan Seribu is located between 5010'00"–5 057'30" South Latitude and 106019'30"–106044'50" East Longitude (Statistics Indonesia, 2016). Kepulauan Seribu has different characteristics in the ecosystem from other areas of DKI Jakarta. This area is a group of islands formed by coral reefs and their associations. The different characteristics of this ecosystem make the Kepulauan Seribu able to continuously improve in tourism activities, income in fishing communities through

increasing marine cultivation, and utilization of fishery resources by conserving coral reef and mangrove ecosystems (Bahri et al., 2017).

Tidung Island is located in the South of Kepulauan Seribu. The island area consists of 50.13 ha of Tidung Besar Island and 14.45 ha of Tidung Kecil Island with a total area of 64.58 ha (Statistics Indonesia, 2021). Tidung Besar Island functioning as a settlement and Tidung Kecil Island is more focused on conservation areas. Between the two islands connected by a bridge called "The Cinta (Love) Bridge" where this area is widely used as a destination by tourists. On this Island, local people generally made a living as fishermen and ecotourism.

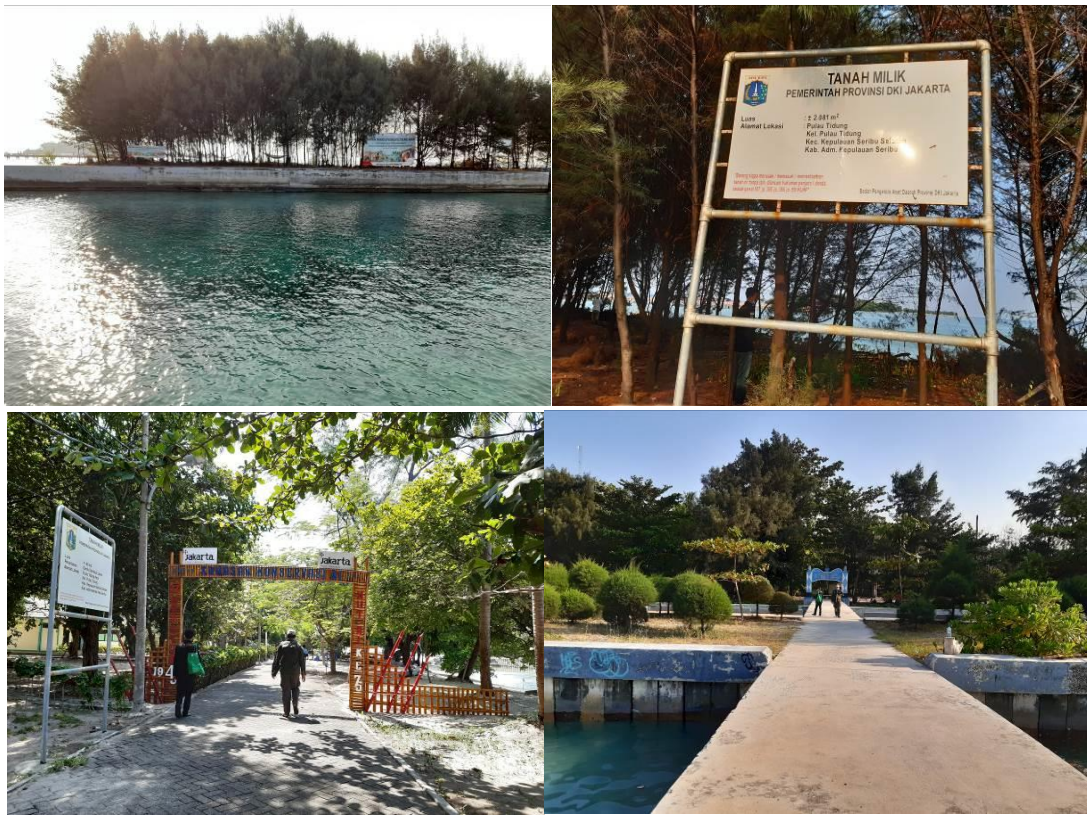

Figure 1. View of Tidung Island

Unfortunately, behind the opportunities which wide open to the people of Tidung Besar Island, they still depend economically on utilizing marine resources for various purposes. Meanwhile, some of the people are not aware and ignore its sustainability. Although there is always socialization about coastal ecosystems from Government, Private Companies, Non-Governmental Organizations, and Universities, it is still an effort to provide knowledge in communities around to maintain and preserve coastal ecosystems conservation (Ekel, et al., 2021).

Thus, there is a need for efforts to restore damaged habitats as a result of tourism activities. Restoration of mangroves and coral reefs needs to be carried out to maintain existing natural resources. Based on this background, the research aims to determine the

composition and value diversity and evenness of mangrove and coral reefs in Tidung Island.

METHOD

Location

The research was conducted in three locations (Tidung Besar Island, Tidung Kecil Island, and Cinta Island) held along in August 2020 & August 2021 (Figure 1).

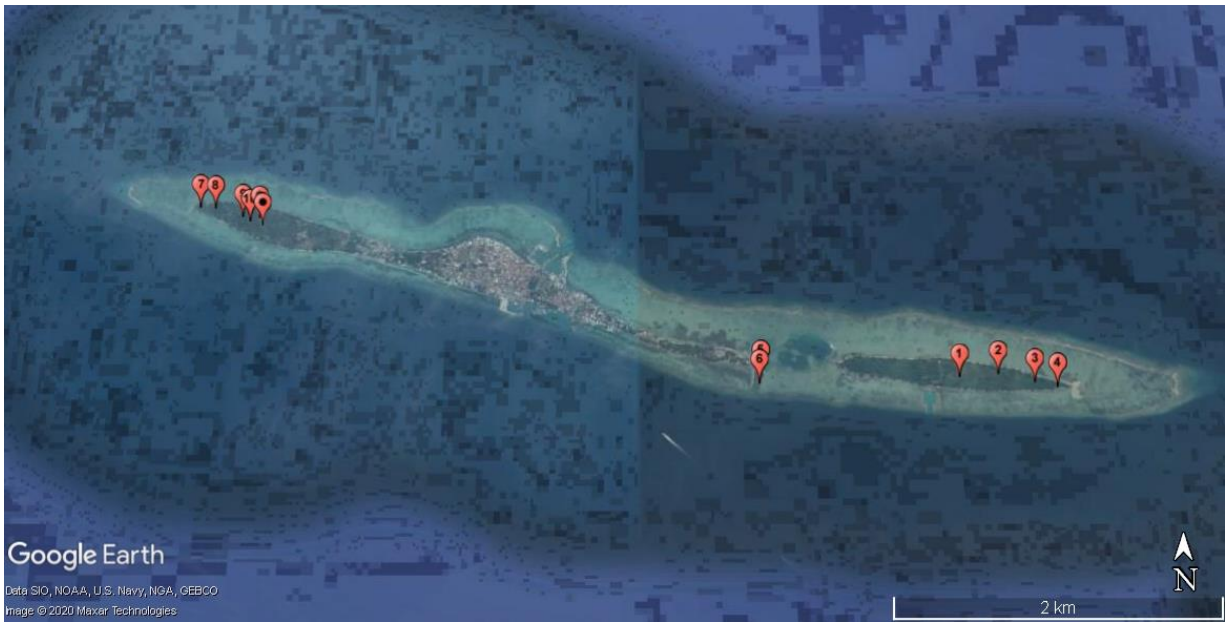

Figure 2. Map of Area Research in Tidung Besar, Tidung Kecil, and Cinta Island

Materials

The materials used in the observations included digital cameras, binocular, digital clock, 100 meters long rope, tagging tape, roll meters, newtop paper, snorkeling equipment, GPS (Global Positioning System), stationery, data tabulation, and identification guide books. The books are Introduction to Mangroves in Indonesia, "Birds in Sumatra, Kalimantan, Java, and Bali (Mackinnon et al, 2010), and The Identification of "Coral Finder Toolkit Indo Pacific 2.0" (Kelley, 2009).

Data Collection

a. Mangrove

The method for mangrovesis based on purposive sampling as the representation of the area. Data collection and collection activities include sampling vegetation data using the transect method. A total of 12 transects were made with a size of 20m x 20m or each transect made at locations with different gradations of environmental changes such as habitat, ecosystem, or physiognomy conditions. Each transect was divided into 5 sub transects/plots, each measuring 20m x 20m for level data collection for trees > 10 cm in diameter at breast level; then a 10m x 10m plot was made to collect data on trees at the pole

level with a diameter of 5 cm - 9.9 cm; plots of 5m x 5m for saplings measuring 1cm - 4.9 cm in diameter; Meanwhile, for seedlings, 2m x 2m plots were made for saplings <1 cm in diameter. Tree data collection includes stem diameter measured at breast height, total height, and branch-free height.

b. Coral Reef

The coral reef data retrieval method used is LIT (Line Intercept Transect) with a predetermined transect length of 10 meters, observations are made by spreading the measuring tape over coral reefs and then identifying to the famili level (English et al, 1997).

Data Analysis

a. Species Composition

Species composition is a measurement of the species in an area, to determine the underlying composition whether there is a relationship between the number of species commonly found in two community areas and the total species (Rusmendro, 2004).

b. Diversity

Species diversity is calculated using the Shannon-Wiener diversity index (H') with the following formula (Magurran, 1988):

$$H' = -\sum Pi \, . \ln Pi$$

Where :

H' = diversity index by Shannon-Wiener

pi = proportional abundance of each species

According Magurran (2004), states that the range of diversity index values is :

H' ≤ 1 = diversity Low

1 < H' < 3 = diversity Medium

H' > 3 = diversity High

c. Evenness

The species evenness index (Evenness) serves to determine the evenness of each species in each community. Species evenness can be calculated using the formula (Fachrul, 2012), namely:

$$E = \frac{H'}{Ln\ (S)} \ x\ 100\%$$

where :

S = total number of species (species richness)

E = evenness index
H' = diversity index

According to Krebs (1999), the evenness index value (E) is classified into 3, namely: $0 < E \leq 0.4$, so the population uniformity is small; $0.4 < E < 0.6$, then the population uniformity is moderate; $E \geq 0.6$, then the population uniformity is high.

d. Percentage of Coral Reef Cover

To find out the percentage of coral cover can be calculated by the following formula:

$$L = (\frac{Li}{N}) \text{ x } 100\%$$

Where :
L = Percent of coral reef cover (%)
Li = length categories
N = length of transect

According to the Decree of the Minister of the Environment No. 4 of 2001, the criteria used are based on the range of live coral percentage levels, which are listed in Table 1.

Table 1. The Range of Percentage Coral Reef Cover

Percentage Cover	Criteria
0-24,9 %	Low
25-49,9%	Good Enough
50-74,9%	Good
75-100%	Excellent

RESULT

Mangrove Forest in Tidung Island

a. Biodiversity

Structure communities can be seen from species diversity, it can also be used to measure community in a form of Stabil (Soegianto, 1994). The overall results obtained in the Tidung Island showed in diversity index (H') that varies from 2020 to 2021 (Figure 3).

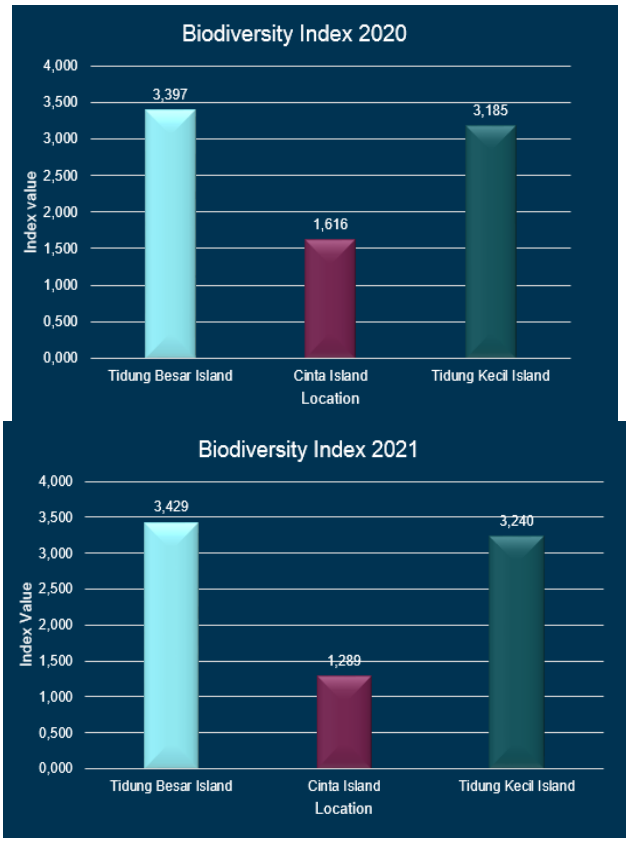

Figure 3. Diagram of Biodiversity Index in Mangrove Forest

By the tree stands, diversity index value on Tidung Besar Island is 3, 397, Cinta Island showed a diversity index (H') of 1.162, and on Tidung Kecil Island of 3.189 in 2020. Then, the diversity index value increased in 2021 to 3,429 on Tidung Besar Island; 1,289 on Cinta Island; and 3,240 on Tidung Kecil Island. Based on the criteria of the Shannon-Wiener Index (1987) and Magurran (2004), Tidung Besar and Tidung Kecil Islands have high diversity category, while Cinta Island has a medium.

The results indicate that the diversity of plants found on Tidung Island as a whole is overgrown by many types of plants and only a few dominate, thus indicating a balance of species that live on Tidung Island. In communities that have a higher diversity value, the relationship between components in the community will be more complex, according to Indriyanto (2012), this affects the stability of the community if there are disturbances to its constituent components (Indriyanto, 2012).

Mangrove cultivation is also carried out by PT. Pertamina Persero TBBM Jakarta Group as a contribution in maintaining the conservation around the coastal area of Pulau Tidung collaborating with local communities to prevent erosion on the island. It is always carried out both extensively and intensively.

Figure 4. Mangrove Seedlings and Cultivation in Tidung Island

b. Evenness

The evenness index aims to the number of individuals in a community, this value indicates the evenness of species. Based on the results of the study, the evenness index value of mangrove species (Figure 5) found on Tidung Island was varied. In a row, Tidung Besar Island has an Evenness Index of 0.890; Cinta Island has an Evenness Index of 0.502; Tidung Kecil Island has an Evenness Index of 0.919. This is an increase compared to the data in 2020, showing that the community of plant species on the island is more evenly distributed based on the number from last year.

Figure 5. Diagram of Evenness Index in Mangrove Forest

The evenness value is close to 1 on Tidung Besar and Tidung Kecil Islands, which indicates that evenness is high. Meanwhile, the value of the Species Evenness Index in Cinta Island is still low, which is less than 0.60. According to Odum (1993), the evenness index value can be categories as high if > 0.60. The evenness of species on Tidung Island has a high value because the number of individuals of each species does not dominate or have the highest number in one community. The value of the species evenness index will be evenly distributed if all the plant species found at the observation location are spread out in the same number of individuals.

Therefore, it is necessary to planting tree seeds, especially mangroves around the coast of Tidung Island as an effort to prevent coastal abrasion, provide new habitats for existing fauna, and increase environmental conservation around the Kepulauan Seribu area in particular.

Coral Reef Conservation Program in Tidung Island

a. Composition and Percentage of Coral Reef Cover

Based on observations made at the research site, it was found that there were 31 individuals consisting of 7 genera from 5 famili (Table 2). Based on the other research In Tidung Island in 2021 there are 16 genera from 7 famili (Ekel, et al., 2021). The genus Acropora was the most common genus in the study area, followed by the genus Pocilllopora. This based on Acropora has a high survival rate and relatively fast growth(Harriot dan Fisk, 1988).

Table 2. Composition in famili, genus, and individu on Coral Reef Conservation

No.	Famili	Genus	Individu
1	*Acroporidae*	*Acropora*	18
2		*Montipora*	2
3	*Agariciidae*	*Pachyseris*	2
4	*Mussidae*	*Symphyllia*	2
5	*Pocilloporidae*	*Pocillopora*	3
6		*Stylophora*	2
7	*Poritiidae*	*Porites*	2
			31

The observation results from the percentage of live coral cover of 51.3%, which is included in the good category based on the criteria of the Minister of Environment in 2001. This shows that there are no factors that can damage the ecosystem and coral reefs because a tourist destination is focused in the Cinta bridge area, there are rarely snorkeling activities, more tourists just spend time walking on the bridge. Thus, only a view activities that held in tourist boat anchor and snorkeling which can potentially damage coral cover. In addition, this area is not a fishing area for fishermen where destructive fishing is rampant, such as the many ways of fishing called *muro ami*, the use of cyanide and fish bombs.

b. Biodiversity and Evenness

The coral diversity index value on Tidung Island is 1,426 (Figure 6), this value is included in the medium category. The value of the diversity index can indicate an ecosystem is it in needs of an organism contained on. Thus, there are various types and no competition between families that dominate the ecosystem. This diversity index can determine the abundance of a community seen from the number of genera which found in the ecosystem. The more number of the famili found, the more diverse the community will be.

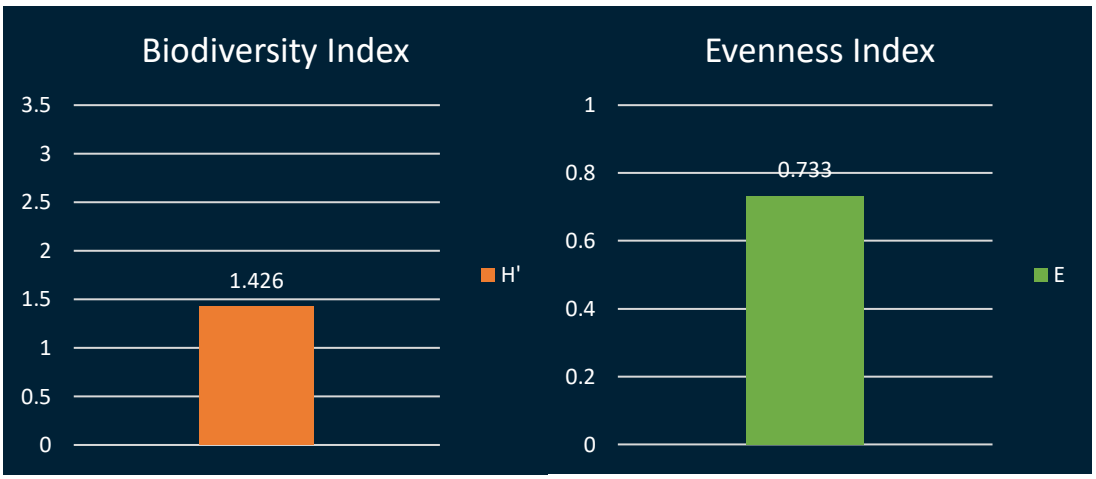

Figure 6. Diagram of Diversity and Evenness Index based on Genera of Corals

This condition can be suspected to be influenced by several factors, such as the location factor in the protected area, which is in the small strait between Tidung Besar Island and Tidung Kecil Island, which has low waves. In addition, there is public awareness in restoring coral reef ecosystems by means of coral transplantation (Figure 7). According to Haruddin (2011), human activities that impacting damage to coral reef ecosystems are coral mining, fishing using explosives, nets, overexploitation, anchoring fishing boats and tourist boats, also waste pollution.

Figure 7. Coral Transplantation around Cinta Bridge, Tidung Island

The evenness index value in the study area is 0.733 (Figure 6). This value is included in the category of high, this indicates that there is no dominant in genus. According to Krebs (1972), high evenness indicates that the coral reef ecosystem is relatively in a good condition. According to Odum (1993), the evenness index value to be high if > 0.60. The evenness of coral genera on Tidung Island has a high value because the number of individuals from each famili does not dominate in one community. The evenness index value will be evenly distributed if all the coral genera found at the observation location are spread out in the same number of individuals (Novarino, 2010).

DISCUSSION

Conservation efforts and provision of mangrove seedlings and coral reefs need to be carried out and integrated with the development of ecotourism areas in the future. In order to create independence with the development of tourism activities, but not to damage the environment and conservation activities. Because the concept of ecotourism is restrictions on tourism activities, such as the number of visitors, and others. It is necessary to provide local plant seeds and mangroves on a regular basis so that the seeds that have not had time to grow but have been eroded by ocean currents can be maintained and develop sustainably. It is necessary to expand the conservation of coral reefs around the Cinta Bridge together with intensive management and maintenance of coral reefs.

CONCLUSION

The biodiversity index value is 3,429 on Tidung Besar Island, Cinta Island shows a diversity index (H') is 1,289, and Tidung Kecil Island is 3,240. The value of this diversity index is classified as high and medium, increasing more than in 2020. The evenness index in Tidung Besar Island is 0.890; Cinta Island has an Evenness Index of 0.502; and Tidung Kecil Island has an Evenness Index of 0.919. This is relatively high, close to the value of One.The composition of coral genera found in the transplant area of Tidung Island is 7 genera from 5 Famili. The coral diversity index value is 1.426, which indicates that the diversity belongs to the medium category. The evenness index value of coral in the transplant area of Tidung Island is 0.733,which is a high value.

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