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Study on The Condition of Coral Reefs in The Planned Marine Park Area of Kaliage Besar Island, Kepulauan Seribu National Park, DKI Jakarta

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Abstract

Kaliage Besar Island is one of the islands in Seribu Islands National Park, DKI Jakarta. Located in the Management Section of Kelapa Island Region I National Park. The island with the allotment of the use rights of the private island which is used as a public tourist and resort. Kaliage Besar Island still has the potential for highly productive coral reef resources. Currently, the coral reefs of Kaliage Besar Island has suffered damage caused by anthropogenic activities and natural factors. This research used Underwater Photo Transect/UPT method were analyzed using CPCe 4.1. software (Coral Point Count with Excel extension). Data collection was carried out at one research point with a depth of 3 m and a transect length of 20 m with 3 data collection times (10 m intervals between transects). The measurement physico-chemical parameters results was shown that water quality in Kaliage Besar Island was still within tolerance limits for coral life. The percentage of live coral cover was in a bad category with a low value 6,46%. Composition of hard coral genusis consists of 6 family, 7 genus, and 119 individuals. The most dominant genus is *Porites* with submassive and massive growth form. The index value of diversity shows a low category (0,42). The dominance index value showed a high category (0,84). Uniformity and mortality index value showed a low category (0,22 and 0,28).

Keywords : Coral Reef Condition, Ecosystem-Based Marine Park Areal, Kaliage Besar Island Underwater Photo Transect (UPT)

Introduction

Coral is one of the important components of coral reefs and coral reef ecosystems. Coral is a general term used to describe the diversity of biota from the phylum coelenterata, most of which form reefs. Whereas a reef is a limestone skeleton structure formed by corals, algae or other photosynthetic marine organisms. Reef-building corals, called scleractinian corals or true or hard corals, are animals capable of producing calcium carbonate (CaCO3) and are almost entirely associated with zooxanthellae (Spalding et al., 2001; Veron, 2000; Birkeland, 1997).

According to Suharsono (2008), corals are a group of organisms that already have a nervous

system, muscle tissue and simple reproduction, but have developed and are functioning properly. Corals reproduce asexually and sexually (Birkeland, 1997). Asexual reproduction is carried out by forming shoots that will become new individuals in the parent and continuous shoot formation is a mechanism to increase colony size, but not to form new colonies (Nybakken, 1998).

Kaliage Besar Island is one of the islands located in the Thousand Islands National Park. Administratively, Kaliage Besar Island is included in the Kelapa Island Village area, North Seribu Islands District, Seribu Islands Administrative Regency, DKI Jakarta. The island with an area of 6.46 hectares is designated as a private island which is used for public tourism and rest areas. Kaliage Besar Island still has the potential for very productive coral reef resources. Coral reefs provide many benefits for life, including ecological, economic and physical benefits. Ecological benefits, it acts as a habitat for marine flora and fauna, a place to find food (feeding ground), a place for spawning and reproduction (spawning ground), as well as a place of care and rearing (nursery ground). Economic benefits, can provide direct benefits to humans by providing a source of food (marine fishery products) as well as a source of medicine, a provider of the marine tourism industry and as an object of research and education. The physical benefits of coral reefs act as a barrier to waves, currents, and coastal abrasion.

Despite its enormous benefits, the coral reefs of Kaliage Besar Island are still experiencing a lot of threats and damage. Several factors of threat and damage are mostly caused by destructive human activities such as over fishing with destructive fishing gear (muroami fishermen / compressor nets), bad water environment due to sedimentation and chemical waste pollution, plastic waste and eutrophication, coral and sand mining, destructive marine tourism activities, and global climate change also pose significant threats to the coral reef ecosystem on Kaliage Besar Island.

According to Supriharyono (2000), in the Thousand Islands, 85% of the corals have been damaged. The condition of coral reefs in the Seribu Islands is generally categorized as being in a damaged to moderate condition. Based on information from the DKI Jakarta Provincial Environmental Management Agency (BPLHD) (2013), 50% of the area's coral reefs consist of rubble, dead coral and sand. Research conducted by TERANGI (2009) showed that coral conditions in the Seribu Islands were in moderate condition and long-term research reports found that hard coral cover fluctuated from 31.45% in 2005, down to 28.86% in 2007, then increased to 34.27% in 2009 (Setyawan et al., 2011).

From the above background, it is necessary to take comprehensive steps by making the concept of restoring coral reef ecosystems that have been damaged through the creation of a Marine Park Area on Kaliage Besar Island, Thousand Islands, DKI Jakarta. It is hoped that this step can provide solutions in restoring coral reef ecosystems that have been damaged (remediation) and will be managed into conservation areas whose ecological functions are maintained, become educational areas, natural marine research laboratories, development of marine product cultivation and sustainable marine ecotourism areas. In realizing this goal, it is necessary to carry out stages of research activities on the condition of coral reefs in the waters of Kaliage Besar Island as initial data and a feasibility study on the location of coral reef ecosystem restoration activities through planting coral transplants and creating an ecosystem-based marine park area.

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Method

The research activity was carried out at the location of the planned marine park area, which is to the west of the main jetty of Kaliage Besar Island, Kepulauan Seribu Marine National Park, DKI Jakarta (Figure 1 and Table 1). This location is chosen based on unique ecological criteria, has a specificity in the use of resources (ship / dock activities), adjusted to the cardinal directions which are influenced by the season and the accessibility that affects it.

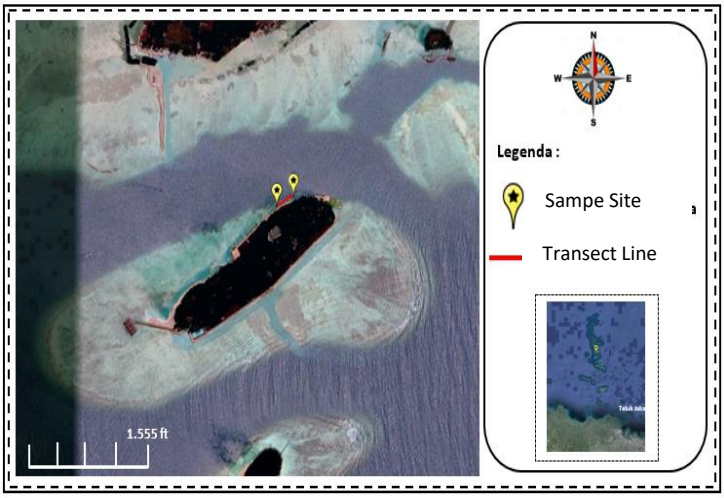

Figure 1. Map of Research Location

Tabel 1. Titik Koordinat Lokasi

Point 0	S	5^0 39’ 37.565”
	E	106^0 34’ 08.631”
Point 1	S	5^0 39’ 38.5451”
	E	106^0 34’ 06.782”

This study used the Underwater Photo Transect (UPT) method applied to assess the condition of coral reefs (Giyanto et al, 2010). There is 1 station at a depth of 2 m with a transect length of 20 m and there are 3 times collecting data with 10 m intervals between transects. A 58 x 44 cm frame is placed on the transect line starting from the 1 m point and on each subsequent meter (Giyanto et al, 2010).

The frame is placed in a zigzag manner, that is, the first point is placed on the part that is closer to the land then at the next point the frame is placed on the part that is farther from the mainland (Figure 2). Taking photos of the mounted frame is done perpendicularly with a distance of ± 60 cm from the frame and the base of the substrate.

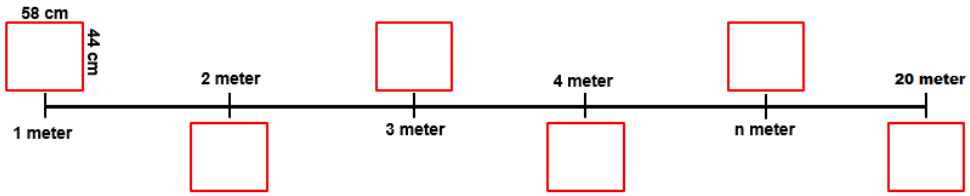

Figure 2. Position of Placing the Frame on the Transect Line

As many as 50 photos were collected on each transect so that there are 100 photos on the two transects. Taking photos using underwater cameras as documentation of habitat conditions to obtain images of the bottom of the waters that are included in the frame (Giyanto, 2012).

Data in the form of digital photos were analyzed using CPCe 4.1 software (Coral Point Count with Excel extension) developed by the National Coral Reef Institute (NCRI) (Kohler and Gill 2006). The data from the analysis consisted of the presence frequency and the percentage cover of the base substrate. The basic substrate category used in this CPCe has been modified from the initial default to the category corresponding to the LIT category based on (English et al, 1997).

Result And Discussion

Water Quality

The quality of the waters on Kaliage Besar Island is still within tolerance limits for coral life with values from the measurement results of the physical and chemical parameters of the waters, namely temperature 29ºC, pH 7.5, salinity 36 psu, and brightness 7 meters (Table 2).

Tabel 2. Nilai rata-rata parameter fisika dan kimia perairan Pulau Kaliage Besar

Temperature (ºC)	pH	Brightness (m)	Salinity (psu)
29	7.5	7	36

The temperature value that can affect the optimal growth of coral reefs is in the temperature range 25 - 30 ° C (Sukirno, 1994). According to Nybakken (1992), the temperature that coral reefs can tolerate is up to a minimum temperature of 20ºC and a maximum temperature in the range of 36 - 40ºC. The pH value of sea water that can support marine life is in the range of 7 - 8.5 (KepMen LH Number 51 of 2004). Meanwhile, a good salinity level for coral reef life ranges from 25 - 40 psu (Sukirno, 1994). According to the Minister of Environment Decree (Decree of the Minister of Environment Number 51 of 2004), the brightness value in the waters is good if it is more than 5 meters.

Living Coral Cover Condition

From the results of data analysis, it shows that the percentage of live coral cover in the study location is in the bad category with a percentage value of 6.46% (Figure 3). The damage to coral

reefs in the research location is mostly caused by human physical activity, this is reinforced by the very high value of the abiotic composition with many discoveries of rubble that have long died (Figure 3).

The poor percentage of live corals is due to the impact of the construction of the pier embankment and the research location is an active port on Kaliage Besar Island as the location of the mooring area which moves when entering and exiting the jetty will cause physical damage and high sedimentation in the water column which eventually covers and will affect live coral growth at that location. In addition, the factor of coral damage at the study site was caused by destructive fishing activities and plastic waste contamination, the discovery of large size trash sacks covering live coral colonies.

The dominant substrate composition was abiotic with a percentage value of 88.52%. The most common abiotics found are sand and rubble. High fractures are caused by natural factors such as strong waves and currents (influenced by west monsoons and east monsoons with high waves and currents) as well as by physical factors caused by human activities (anthropogenic).

Macro Algae were also found at the study site with a percentage value of 2%. The most common type of macro algae is *Padina* sp.. Macro algae is a bioindicator of water quality and as a coral competitor in coral reef aquatic ecosystems. The high algae cover is due to the increase in water fertility which can be triggered by the entry of nutrients from the 13 rivers into the Jakarta Bay, which is carried to the waters of the Thousand Islands. Another factor that can also contribute to the increase in algae is a decrease in the number of algae predators, such as herbivorous fish and sea urchins.

Jompa and McCook (2003) state that all species in the macro algae group are coral competitors that can threaten the existence of live corals if the growth of these algae groups is not controlled. Concern about algae growth is something that needs special attention. In Caribbean waters, Veirmeij et al. (2010) found that turf algae changed the substrate from coral cover to algae cover due to increased nutrition. Predatory herbivores are not even able to control the turf algae population. As a result, turf algae are now the main benthic organisms in Caribbean waters.

The percentage value of cover for other biota at the research location is 1%. Another type of biota that is commonly found is the type of sea urchin *Diadema cytosum*. According to Nystrom et al., (2000), sea urchins are one of the keystone species for coral reef communities. This is because sea urchins are one of the controllers of microalgae populations in coral reef ecosystems. Sea urchins are abundant in nutrient-rich bottom conditions. Nutrient enrichment can lead to an abundance of algae, both planktonic and benthic. Location The number of sea urchins found shows that the waters of Kaliage Besar Island are influenced by the Jakarta mainland and the Kelapa Island mainland, which, among other things, carry a number of nutrients.

In addition, other biota of protected and vulnerable species of molluscs were also found, namely the type of hole clam (*Tridacna crocea*) and the round milk type (*Trochus niloticus*). This type of biota is protected by Government Regulation Number 7 of 1999 concerning Preservation of Plant and Animal Species and Minister of Forestry Decree No 12 / Kpts / II / 1987. This type of biota is included in the red list of the International Union for Conservation of Nature and Natural Resources (IUCN, 2004) and is included in appendix 2 of the Convention on International Trade of Endangered Species (CITES, 2007).

Composition of Coral Growth Forms

This form of growth is one way of adapting corals to their environment. Forms of coral growth found at the research location were sub-massive (CS) with a percentage value of 65.57%, followed by the form of brain coral growth (massive / CM) with a percentage value of 26.23%, coral branching. CB) was 4.10%, coral foliose (CF) was 3.28% and the least found was a form of coral mushroom (CMR) growth with a percentage value of 0.82% (Figure 3).

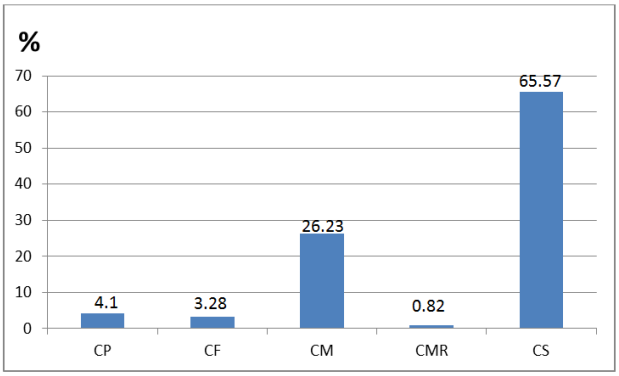

Figure 3. Composition of Coral Growth Forms

According to English et. al (1994), The dominant coral type in a habitat depends on the environment or the conditions in which the coral lives. In a habitat, the types of coral that live can be dominated by a certain type of coral. In the reef flat area, it is usually dominated by small corals which are generally massive and submassive. In the area of the reef slopes are usually overgrown by branching corals.

Massive and submassive corals mostly grow on the outer reefs with current currents. Living corals in leeward zones have a slender and elongated branching shape, in contrast to areas with windward zones that tend to grow corals in the form of short, strong, creeping or submassive branches.

Composition of the Genus of Hard Coral

The results of the analysis and identification of hard corals in the study area consisted of 6 families, 7 genera, and 119 individuals. The Porites clan is the most dominant clan, each contributing 94.12%, followed by the Millepora clan at 2.52% and Stylophora and Pavona which both contribute 1.68%. Other clans that contribute less than 1% are the Fungia, Montipora, and Pachyseris clans (Table 3).

Table 3. Composition of the Genus Hard Coral

Family	Genus	Individual
Poritidae	Porites	112
Pocilloporidae	Stylophora	2
Fungiidae	Fungia	1
Acroporidae	Montipora	1
Agariciidae	Pavona	2
	Pachyseris	1
Millepoeidae	Millepora	3

Total Individual	**119**

Besides that, it is also able to quickly clean itself from the deposits that cover it because it produces a lot of mucus (mucus). The Porites clan is highly competitive, with a long life expectancy, has limited dispersibility and a slow growth rate. The genus of the Porites species in coral reef waters is also a bio-indicator of the quality of waters experiencing high pollution and sedimentation. The Porites clan can live and grow in coral reef waters that have experienced pollution and sedimentation.

This is confirmed by the statement of De Meesters et al. (2002) stated that the Porites clan was able to adapt to a turbid aquatic environment by carrying out a more active metabolism. so that in turbid waters and low salinity, it is likely that the dominant coral genus is Porites. According to Cappell (1980), high sedimentation rates, the colony forms in sequence tend to be massive (solid), branching (branched) and foliose (sheet).

Hard Coral Community Structure

In looking at the ecological conditions of coral reefs, it is necessary to carry out an integrated analysis which is not only based on the size of the coral biota cover, so it is necessary to use another analysis which as a whole can explain the condition of the relationship between groups of coral biota which will directly determine the type of ecosystem stability.

Diversity Index (H')

Diversity index is used to measure the abundance of a community based on the number of clans in a location. The greater the number of clans, the more diverse the community. This index also indicates that the more clans there are, the greater the role of the clan in the community.

The diversity index value at the research location shows a low category with a diversity index value of 0.42. Natural factors from waves, high sedimentation and anthropogenic activity from humans greatly affect the number of coral genera found. In addition, the type of substrate in the form of high sand and rubble forms the base of an unstable substrate for young coral and will affect the low number of genera found.

Dominance Index (D)

The dominance index value at the research location shows a high category with a dominance index value of 0.84. This indicates that there are coral genera that dominate. The dominant hard coral genus is from the Porites clan. The high level of clan dominance is because the porites clan is able to adapt to bad environmental conditions and has massive and submassive growth forms that are stronger against wave disturbances. The high level of dominance of a species in water indicates the location is under pressure. If the dominance index value is greater, the diversity index value will decrease, indicating the dominance of one species over other species. The amount of domination will direct the condition of the community to become unstable or depressed.

Uniformity Index (E)

The uniformity index value at the research location shows a low category with a uniformity index value of 0.22. This shows that the distribution of the number of individuals for each clan is not the same, so there is a tendency for one clan to dominate. The low uniformity value is due to the

dominant clan, namely the Porites clan. With water quality conditions that have decreased due to high pollution and sedimentation and high pressure damage caused by human activities, the Porites clan is able to survive and be able to adapt to these conditions compared to other clan types so that this clan type tends to dominate.

Mortality Index (Mi)

The mortality index value at the study location shows a low category with a coral mortality index value of 0.28. Although the number of genera and individual corals found was small, most of the corals that were found were still alive and in the form of colonies in small numbers that were just developing. If the water conditions are getting better and supporting coral growth, the coral colonies will get bigger. This is what causes the low coral mortality index value in the study location.

The results of the analysis showed that the percentage of live coral cover was in the bad / low category with a value of 6.46%. The composition of hard coral genera consists of 6 families, 7 genera and 119 individuals. The most common coral genera found is the Porites clan with massive and submassive growth forms. The index value of coral genus diversity is in the low category, namely 0.42. The dominance index value of 0.84 is included in the high category. The value of the uniformity index and mortality index were included in the low category, namely 0.22 and 0.28, respectively.

Conclusion

Coral reefs in Kaliage Besar Island have a percentage value of live coral cover of 6.46% which is in the bad category. The composition of coral genera found were 6 families, 7 genera and 119 individuals which were dominated by the Porites with submassive and massive growth forms.

Diversity of coral genera is in low condition with a diversity index value of 0.42. The dominance index value is in the high category, amounting to 0.84 and the value of the uniformity index and mortality index is in the low category of 0.28.

The research location is highly recommended for a coral reef ecosystem restoration program (remediation) by planting coral transplants with several artificial transplant media which will be formed into an ecosystem-based marine park area and a coral reef education center**.**

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