CORAL REEFS DIVERSITY IN GILI GENTING ISLAND SUMENEP MADURA

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ABSTRACT

Coral reef ecosystem is the most threatened ecosystem among marine ecosystem in the world due to the combination of anthropogenic and natural disturbances. More research is needed to be monitored and assess coral reef ecosystems, which will be used to find understanding of the ecological integrity and further improvement of the protection strategy in the future. This research was aimed to know the diversity of coral reef diversity at Gili Genting Island, Sumenep Madura and evaluate the condition of coral reef ecosystem based on cover the percentage. Line intercept method was used to understand coral reef diversity and its condition in the desired observation station. The result revealed that 9 families, 22 genera and 45 species of coral have been successfully found, in which Acropora is the most common genus found in in Gili Genting Island. The cover percentage analysis also indicated that the condition of coral reef ecosystem in Gili Genting Island could be classified to very bad category where the total average of cover percentage is 12.55%. These findings provide the preliminary information about the condition of coral reef ecosystem in small island that might be useful for the future integrated management based on ecological perspective.

Keyword: cover percentage, coral reef, diversity.

INTRODUCTION

It was widely known that coral reefs are one of the world's most unique systems with their high biodiversity and primary productivity. Coral reef ecosystem provides various goods and services such as fisheries, tourism, coastal protection, aesthetic and cultural values (Moberg and Folke 1999; Feary et al. 2009). However, coral reefs are recently deteriorating worldwide which have been ascribed to climate change, nutrients, sediment, over-fishing, physical damage by human activities, disease, and herbivore loss, in various mixtures (Baker et al. 2008; Ateweberhan et al. 2013). Some recent findings reveal that many coral reefs may disappear or in dangerous condition within the next few years (Ateweberhan et al. 2013), and therefore protection or conservation is needed to overcome this problem (Muhlis 2011).

In order to prevent coral reefs ecosystem by those factors mentioned above, it is highly recommended to understand how ecosystem change on space and time in establishing effective conservation for future action (Feary et al. 2009). However, our action today is only limited to campaign in protecting coral reef based on one sectorial discipline and not detail in the perspective. Therefore, more research is needed to monitor and assess coral reef ecosystems, which will be used to find understanding of the ecological integrity, further amendment of the protection strategy and improvement of management (Ateweberhan et al. 2013). The final goal of protection strategy is to make coral reefs maintain their high biodiversity and play significant ecological functions in the natural ecosystem.

MATERIALS AND METHODS

Study site

Gili genting Island located at southeast side of Sumenep District. In this study, we conducted field observation in four station as follow: (1) Station I belongs to Bringsang village where small ship harbor located (coordinate: 07°10.565'S - 113°55.134'E); (2) Station II belongs to Gedugan village and almost no people activities in this area (coordinate: 07°13.817'S - 113°57.283'E); (3) Station III belongs to Aenganyar village where the population of people is concentrated. (Coordinate: 07°11.195'S - 113°53.619'E).; (4) Station IV is located in Aenganyar village that is naturally undisturbed by human activities (coordinate: 07°11.751'S - 113°52.944'E). Detail of each station was shown in the map (Fig. 1).

Fig. 1 Map of Gili Genting Island (Photo of map is taken from https://www.google.co.id/maps/).

Sampling method

In order to assess the diversity of coral reef in Gili Genting Island, field samplings using line intercept technique were carried out at four station with different environmental characteristics as described above. We established some 20 m transect lines at 20 m interval along the measuring tape, in which each transect was almost vertical to the shore. We also made several quadrats plot along each transect and then performed underwater observation on coral reef species by using a digital underwater camera and used the photos or images for interpretation of coral communities For coral reef identification, we used book of coral reef identification in Indonesia by Suharsono (2010) and several official website on coral reef identification such as http://coral.aims.gov.au, etc.

For data analysis, we calculated the percentage of live coral and number of occurrences of each life-form using line intercept data (English et al. 1997). The percent cover of a lifeorm category is calculated as percent coral cover (total length of category/length of transect) x 100 after calculating the intercept (length) form transition points recorded along transects. Coral lifeforms assessed in this study including Acropora branching (ACB), Acropora digitate (ACD), Acropora encrusting (ACE), Acropora submassive (ACS), Acropora tabulate (ACT), coral branching (CB), coral foliose (CF), coral massive (CM), coral mushroom (CMR) and coral submassive (CS). We also determined the diversity of coral reef by using Shanon Wiener index (English et al. 1997).

RESULTS

Coral reef composition and diversity in Gili Genting Island

We recorded a total of 9 families, 22 genera and 45 coral species on Gili Genting Island, Sumenep District of which 10 families, 18 genera and 40 species occurred in the whole sampling quadrats (Table 1). Among all the corals, *Acropora* was the most dominant genus found in Gili Genting Island. There were 10 species from genus *Acropora* and this species composition is higher than genus *Goniastrea* (4 species), *Anacropora* and *Montipora* (2 species).

This finding also revealed the diversity index of coral reef species in Gili Genting Island can be categorized as medium class (1.61 ± 0.14). It means that the stability of coral reef community in Gili Genting Island is in stable condition. Diversity index analysis also revealed that station IV have higher diversity index values (1.86) than three other stations, station I (1.49), station II (1.63) and station III (1.54) (Fig. 2).
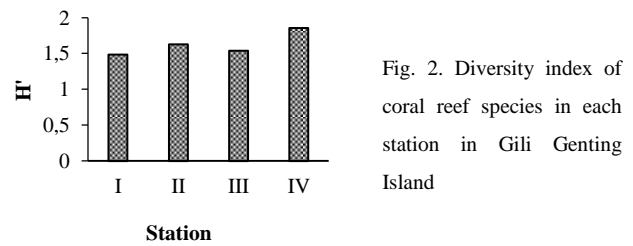

Fig. 2. Diversity index of coral reef species in each station in Gili Genting Island

Table 1. Coral reef species in Gili Genting Island

Family	Genus	Species
Acroporidae	Acropora	*A. caroliniana, A. humilis, A. hyacinthus, A. inermis, A. monticulosa, A. palifera, A. polystoma, A. pulchra, A. rosaria, A. samoensis*
	Anacropora	*A. forbesi, A. reticulata*
	Montipora	*M. danae, M. stellataasdmnb*
Agariciidae	Coeloeseris	*C. mayeri*
	Pavona	*P. frondifera*
Faviidae	Favites	*F. paraflexuosa*
	Goniastrea	*G. aspera, G. edwarsi, G. minuta, G. pectinata, G. ramosa, G. retiformis*
Faviidae	Leptastrea	*L. purpurea*
	Leptoria	*L. phrygia*
	Montastrea	*M. annuligera, M. magnistellata*
	Oulastrea	*O. crispata*
	Pleseastrea	*P. versipora*
Fungiidae	Ctenactis	*C. echinata*
	Cycloseris	*C. hexagonalis, C. vaugani*
	Fungia	*F. fungites, F. horrida*
Mussidae	Loboyphyllia	*L. flabelliformis, L. hemprichi*
	Symphyllia	*S. radians, S. recta, S. valenciennessi*
Pectiniidae	Pectinia	*P. teres*
Pocilloporidae	Pocillopora	*P. damicornis*
	Stylophora	*S. pistillata*
Poritidae	Goniopora	*G. minor, G. tenuidens*
Helioporidae	Heliopora	*H. coerulea*

Cover percentage of coral reefs and environmental parameters

We observed cover percentage of coral reef in four station as described in method section. The result revealed that station I have highest cover percentage than the other stations (Fig. 3), in which the values are 18.4%, 13.54%, 11.78% and 14.32% in station I, II, III and IV, respectively. In general, we can summarized that coral cover percentage in Gili Genting Island could be classified as poor condition. Another result also revealed that the environment parameter also less varies in each station where some parameters such as pH, salinity and dissolved oxygen are not different with standard criteria
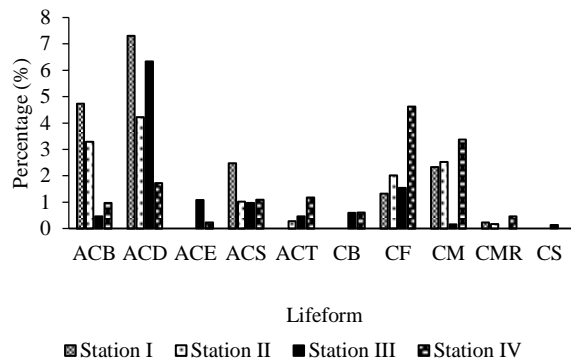
of health coral.

Fig. 3 Cover percentage of coral reef lifeform in station I, II, III and IV.

Table 2. Environmental water parameter of Gili Genting Island

Water	Station			
parameter	I	II	III	IV
Temp. (°C)	28 ± 0.8	29.3 ± 0.5	30	30 ± 0.8
Salin. (‰)	38 ± 0.8	35.3 ± 0.4	32.2 ± 1.2	35.7 ± 0.5
pH	7.4 ± 0.1	7.3 ± 0.1	7.4 ± 0.2	7.3 ± 0.2
DO	7.3 ± 0.1	7.0 ± 0.1	7.7 ± 0.1	7.8
Trans. (cm)	85.7 ± 0.9	89.3 ± 0.5	87 ± 0.8	88.3 ± 1.2

DISCUSSION

In this study, we observed the diversity of coral reefs and assessed the cover percentage of coral reef in Gili Genting Island. Line intercept method had been used to measure the cover percentage of coral reef life form. The result revealed that there were 45 species of coral reef obtained from this study, where genus *Acropora* is the most dominant genus found than the other genera. This result also corresponds to some previous results on coral reef investigation in other Indonesian small island where genus *Acropora* is one of the most dominant genus found in those islands (Muhlis 2011; Minarputri et al. 2012). Diversity analysis using Shannon wiener index also revealed that the diversity of coral reef in Gili Genting Island could be classified as in stable condition.

The quality of coral reef condition could be assessed by the live coral coverage in the seashore expressed as percentage. Regarding the standard criteria for coral reef health (Zamani and Madduppa 2011), the coral condition could be classified as excellent (total coverage = 75 – 100%), good (50 – 74.9%), fair (25 – 49.9%) and poor category (0 – 24.9%). In this study, the average of live coral coverage is 14.51± 2.43 %, that means that the live coral condition in Gili Genting Island belongs to poor category.

In contrast, some environmental parameters for the criteria of health coral obtained from this study indicated

the excellent category as previously stated by (Zamani and Madduppa 2011) on live coral standard criteria based on environmental parameter. The value of pH, which is obtained from this study, reaches 7.3 – 7.4 or similar with the standard that ranges from 7.0 to 8.5. The value of dissolved oxygen, an important criteria for health coral, also indicated the similar value with standard (> 5). While another criteria, salinity value in each station also indicated the similar value of the standard. These values correspond to previous finding on water parameter investigation of coral reef ecosystem reported by (Muhlis 2011) where the value of pH reached 7.5 – 7.7, salinity 31 – 33 and dissolved oxygen > 5.

REFERENCES

Ateweberhan M, Feary D., Keshavmurthy S. Chen, A., M.H. Schleyer, Charles R.C. Sheppard S. 2013. Climate Change Impacts On Coral Reefs: Synergies With Local Effects, Possibilities for Acclimation, and Management Implications. Mar Pollut Bull 74:526–539.

Baker AC, Glynn PW, Riegl B. 2008. Climate Change and Coral Reef Bleaching: An Ecological Assessment of Long-Term Impacts, Recovery Trends and Future Outlook. Estuar Coast Shelf Sci 80:435–471.

English, S., Wilkinson, C., & Baker, V. 1994. Survey Manual for Tropical Marine Resources 2nd. Townville: Australia Institut of Marine Science.

Feary D. A., McCormick MI, Jones GP. 2009. Growth of Reef Fishes in Response To Live Coral Cover. J Exp Mar Bio Ecol 373:45–49.

Minarputri N, Moehammadi N, Irawan B. 2012. The Profile of Bama Beach Based on The Substrate, The Presence of Seagrass, Coral Lifeform, and Echinodermata. Berk Penelit Hayati J Biol Res 17:205–210.

Moberg F, Folke C. 1999. Ecological Goods and Services of Coral Reef Ecosystems. Ecol Econ 29:215–233.

Muhlis. 2011. Ekosistem Terumbu Karang dan Kondisi Oseanografi Perairan Kawasan Wisata Bahari Lombok. Berk Penelit Hayati J Biol Res 16:111–118.

Suharsono. 2010. Jenis-jenis karang di Indonesia. Jakarta: Puslitbang Oseanologi – LIPI.

Zamani NP, Madduppa HH. 2011. A Standard Criteria for Assesing the Health of Coral Reefs : Implication for Management and Conservation. J Indones Coral Reefs 1:137–146.