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Kolonisasi karang pada substrat buatan di Pulau Sikuai, Bungus, Teluk Kabung Padang Sumatera Barat: Perencanaan konservasi untuk terumbu karang yang rusak

Coral colonization (scleractinian) on artificial substrate at Pulau Sikuai, Bungus, Teluk Kabung Padang West Sumatera :A conservation planning for damaged coral reef

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Abstrak

Penelitian kolonisasi karang pada waktu dan jenis substrat yang berbeda telah dilakukan dari bulan Juli sampai November 1996 di terumbu karang Pulau Sikuai Bungus Teluk Kabung Padang. Substrat buatan berupa semen, genteng dan besi ukuran 12 x 12 cm diletakan pada kedalaman 5 meter di empat stasiun yang berbeda. Stasiun I merupakan daerah berpasir , Stasiun II daerah berpasir dengan sedikit karang hidup, Stasiun III daerah berkarang hidup dengan patahan karang mati dan Stasiun IV didominasi oleh karang hidup.

Dari hasil penelitian didapatkan 6 genus karang dari 3 famili yaitu: Acropora dan Genus X (Fam. Acroporidae), Pocillopora, Seriotopora dan Stylopora (Fam. Pocilloporidae), Porites (Fam. Poritidae). Total penempelan koloni karang selama 5 bulan adalah 108 koloni dengan jumlah penempelan tertinggi yaitu 59 koloni pada substrat semen, disusul dengan 29 koloni pada substrat genteng dan 20 koloni pada substrat besi. Waktu optimal penempelan adalah bulan September dengan total penempelan 63 koloni. Kepadatan koloni tertinggi yaitu 0,41 koloni/m2/bulan oleh genus Pocillopora pada bulan September. Frekuensi relatif tertinggi adalah 64,28 % oleh genus

Pocillopora pada bulan Agustus. Pola distribusi umumnya mengelompok dan beberapa jenis tidak dapat dihitung.

Abstract

The study about coral colonization on different substrates and temporal variation was conducted from June to November 1996 at Pulau Sikuai Bungus Teluk Kabung Padang West Sumatera. Artificial substrate in the form of cement, tile and iron (size 12 x 12 cm) was deployed at 5 metre deep at four stations. Station I, was a sandy area, Station II, a sandy area with the poor coral cover, Station III, live coral area with the rubble of dead coral and Station IV, dominated live coral.

The results of this study Found six genera from three families there being Acropora and Genus X (Fam. Acroporidae), Pocillopora, Seriotopora and Styloppora (Fam. Pocilloporidae, Porites (Fam. Poritidae). There were a total of 108 colonies on artificial substrate within a five month period that is 59 colonies on cement, 29 colonies on tile and 20 colonies on iron. The period with the highest abundance of coral settlement as September with a total of 63 colonies. The highest density of coral colonization was 0.41 colony/m/month by Pocillopora at September. The highest relative frequency was 64.28 % by Pocillopora at August. The distribution pattern of coral colonization was generally clustering and several genera were not counted.

Introduction

According to the research result of P3O-LIPI Indonesia, it was shown that coral reefs of Indonesia "highly damaged". Of what, the West Region of Indonesia condition was 58,14 % highest damaged, 25,58 % middle damaged, 14.73 % good and 1.55 % exellent. For the middle Region condition was 20.93 % highest damage, 40.70 % middle damage, 29.07 % good and 9.30 exellent. Whereas the East Region condition was 36.73 % highest damage, 22.04 % middle damage, 29.89 % good and 11.34 % exellent. This damage could be caused by natural factors and human activity such as use of explosive material and cyanide to catch fish, exploration of lime stone reefs and also sewage (Kunzmann and Effendi, 1994)

Coral reefs can recover naturally from damage by the colonization process (Veron, 1993 ; Nybaken, 1988 ; Moorsel, 1989 ; Harrison and Wallace, 1990 ; Sorokin, 1991) Colonization or recruitment of coral is important for community structure and development (Harrison and Wallace, 1990 ; Sorokin. 1991 ; Yeemin and Sudara, 1992). Colonization involves two primary factors, there being larva availability and presence a suitable substrate (Harrison and Wallace, 1990 ; Sorokin, 1991)

The presence of larvae release to the reproduction type of species (Suharsono, 1984 ; Harrison and Wallace, 1990 ; Sorokin, 1991 ; Veron, 1993). Release, development, distribution and settlement of larvae influenced by environmental conditions. The change of temperature, salinity, irradiation, sedimentation, water movement, latitude and moon cycles are all limiting factors for the colonization process (Harrison and Wallace, 1990 ; Sorokin, 1991).

Damaged coral reef areas are dominated by sand and coral rubble. Establishing artificial substrate may help to enhance these environments and increase coral biomass. The additional spaces provided by these are important in the concomaitant settlement, early survival and post recruitment of the coral (Yeemin and Sudara, 1992).

This paper recorded spatio-temporal variation structure of coral colonization on artificial substrate in Sikuai Island Padang West Sumatera. This can provide basic data for coral reef management.

Material and Methods

Site Selection

Site selection was based on different habitat. Visual methods were used while snorkelling to sketc four different station. Station I, was a sandy area, Station II, a sandy area with poor live coral cover, Station III, was live coral with rubble of dead coral and Station IV live coral dominated. The distance of beetwen each station was approximately 50 metres and all stations were on the east side of Sikuai Island.

Field Processing

This study on coral colonization using artificial substrata in the form of cement, tile and iron with size 12 x 12 cm. The artificial substrata were attached on the racks using metal wire. On each rack was attached four of the same substrate with a distance of about 20 cm between each. At each were deployed at each station, three racks were deployed at 5 metres depth with a distance of 1 metre between each rack. Collecting of substrate was conducted monthly and substrata were changed and water quality measured.at the same time (English *et. al.*, 1994).

Result

Waters Condition

Water mevement at the eastern side of Pulau Sikuai was relatively quiet with little water movement and waves. Current is maximal in the time between low tide and high tide, in a small channel between Pulau Sikuai and another island. The Pulau Sikuai waters are far from the mainland so the waste and sediment influence is relatively low. But human activity (tourim) on the island causes organics and inorganic wastes on the bottom. Study of waters conditions at Pulau Sikuai found that conditions were normaly and optimal for coral communities (Table 1)

Table 1. Water quality of Pulau Sikuai Waters Bungus Teluk Kabung Padang West Sumatera

No	Parameter	July	August	Septem ber	Octo ber	Novem ber	Average
1	Temperature(⁰C)	29	29.3	27.5	29.3	29.6	28.94
2	Salinity (//oo)	33	33	32.9	32.6	32.8	32.88
3	D.O (mg/l)	8.3	8.9	9.8	8.8	8.9	8.94
4	Current (cm/scd)	11	10	13	10	12.5	11.3
5	Visibilty (m)	6	6	5.8	6.3	6	6.02
6	Weather	Sunny	Sunny	Rainy	Sunny	Sunny	

(Sumber : Abrar, 1996)

Structure and Compotitions of Coral Settlement

Table 2. Shows frequency and abundance of coral found on the different subtrata in the monthly periods at Pulau Sikuai. A total of 108 coral settled (59 on cement plate, 29 on tile plate and 20 on irons) over a five month period. Number of coral settled in each month is follow this value, 12 at July, 17 at August, 63 at September, 7 at October and 9 at November. The species of corals found consisted of six genus from three families. One genus was not identified and so called genus X. They consisted of, Acropora and Genus X (family. Acroporidae) Pocillopora, Stylopora and Seriotopora (family Pocilloporidae). Genus Pocillopora and Stylopora were found in each month period. The diameter of these settled corals were 0.7 mm to 3.1 mm.

Table 2. Density (colony/m2/month) and Frequency Relative (%) of coral settlement on artificial substrata in the each month periods at Sikuai Island Bungus Gulf Kabung Padang West Sumatera.

No	Taxa	Month									
		July		August		September		October		November	
		D	FR	D	FR	D	FR	D	FR	D	FR
I	Acroporidae										
1	Acropora	0.01	11.1	0.03	14.3					0.03	11.1
2	Genus X							0.01	16.5		
II	Pocilloporidae										
1	Pocillopora	0.07	22.2	0.17	64.3	0.41	42.5	0.03	33.3	0.04	33.3
2	Seriotopora	0.01	11.1			0.07	7.5	0.01	16.6		
3	Stylophora	0.07	55.5	0.04	14.3	0.26	35	0.04	33.3	0.07	55.5
III											
1	Porites			0.01	7.1	0.17	15				
Number		0.16	99.9	0.25	99.9	0.91	100	0.09	99.7	0.12	99.9

Keterangan : D = Density, FR = Frequency Relative

The Density of coral settlement on artificial substrata in the five month period was between 0,10 - 0.91 colony/m2, with the highest density found in September and lowest density in October.

The highest relative frequency of corals settlement as 64.28% by Pocillopora during August.

Distributions Pattern of Coral Settlement

The analysis of coral distribution patterns was done using the Morista Indexs. Generally distribution patterns of corals were aggregated at one place and several genera were uncounted. The all genera were found on the lower surface of the substrata

Dicussion

The data from other similar studies are not available for elsewhere in Indonesia region. Similar studies were performed in, i.e Gulf Thailand reefs, Japan reefs (Okinawa, Amakusa and Kushimoto reef) (Yeemin and Sudara, 1992) Great Barrier Reef, Red Sea reefs, Atlantic reefs (Sorokin, 1991) and Caribbian reefs (Van Moorsel, 1989).

In this study, the total of coral settlement on arificial substrata is much lower compared to other studies. This was caused by the time used for this study, with only monthly

interval subtrata deployed. The results of this study seem to support the hypothesis that coral settlement is limited by time of reproduction.

Cement plates had the highest coral settlement rate, compared with both tile and iron plates. The this substrata could be consistant and its can=t damaged on the water volume. Analysis, showed that cement plates had a rough surface and also a good wettability. Laboratory studies have shown that settlement of coral larvae is usually preceded by testing and searching behavior and intensive exploration at the substratum (Babcock and Ryland, 1990 ; Moorsel, 1989). Usually in natural habitats, the planula of coral settle in the holes from sea urchin houses on the reef-rock surface (Sorokin, 1991). Studies of settlement behavior have shown that scleractinian planulae are discriminate in their choice of settlement site, and generally prefer cryptic microhabitats (Harrison and Wallace, 1990 ; Sorokin, 1991).

The results of this study have also shown that during September is the time for optimal coral settlement. This fact indicated that highest release coral planulae certainly have reproductive periods. In hight latitude regions, the release of coral larvae happened , usually summer periods (Sorokin, 1991 ; Yeemin and Sudara, 1991). The change of environmental factors such as temperature,

Table 3. Distribution pattern of coral settlement on artificial substrata at Sikuai Island Bungus Gulf Kabung Padang West Sumatera

No	Taxa	Kind of Substrata		
		Cement	Tile	Iron
I	Acroporidae			
1	Acropora	39.5		-
2	Genus X		-	-
II	Pocilloporidae			
1	Pocillopora	5.7	11.7	21.1
2	Seriotopora		31.8	-
3	Stylopora	8.6	19.75	10.7
III	Poritidae			
1	Porites	37.3	7.9	

iirradition and sediment stress are all limiting factors to the breeding season of corals, but in tropical regions these factors are relatively constant. During September the weather conditions in Indonesia change from the West Moonson to the East Moonson called APancaroba akhir tahun@. This change of climate was approximately of the same time as the iritating maximum release of coral larvae. This data is important as to know the time and limiting factors of coral settlement help us to rehabilitate and manage coral reef.

The taxa of corals settlement was dominated by Pocilloporidae, cosist of genera Pocillopora, Stylophora and Seriotopora. The Pocilloporidae has a viviparous hermaphrodite reproduction type with a long breeding season (Harrison and Wallace, 1990 ; Sorokin, 1991; Yeemin and Sudara, 1992). This gruop of corals also most abundant at shallow waters and oportunistic species (Sharsono, 1984 ; Sorokin, 1991 ; Harrison and Wallace, 1990). Identify are unknow it is difficult to identifity juvenile corals to genera level. (English *et. al.*, 1994).

The pattern of corals settlement distribution was aggregate with the distance nearly inter-species in one space. This is a srategy of coral settlement to survive in the a habitat. The aggregate model of corals settlement could cause fusion between colonies to become a bigger colony and chances of survival (Harrison and Wallace, 1990 ; Sorokin, 1991). The results of this study also showed that all colonies settled on the lower surface of artificial substrata. The same phenomenon was found in Yeemin and Sudara studies at Thailand Gulf and Japan reefs (1991). The coral larvae to settle on the lower surface of artificial substrata is a strategy to avoid a stressed environment i.e irradiation and sediment stress (Van Moorsel, 1989 ; Harrison and Wallace, 1990 ; Veron, 1993). This strategy is also used to avoid predators, grazers and boring species activity (Sorokin, 1991)

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