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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ABSTRACT

Study on 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 substrates in the form of cement, tile and iron (size 12 x 12 cm) was deployed at 5 metre depth at four stations. Station 1, was a sandy area; Station II, a sandy area with poor coral cover; Station III, live coral area with rubble of dead coral and Station IV, dominated by live coral. The results of this study showed six genera from three families namely: *Acropora* and Genus X (Fam. Acroporidae), *Pocillopora, Seriatopora* and *Stylopora* (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 was September with a total of 63 colonies. The highest density of coral colonization was 0.41 colony/m^2/month by *Pocillopora* at September. The highest relative frequency was 64.28 % by *Pocillopora* in August. The distribution pattern of coral colonization was generally clustering and several genera were not counted.

INTRODUCTION

According to the research report of P3O-LIPI , the coral reefs of Indonesia were "mostly damaged". In the west region of Indonesia, 58.14 % of the reefs was highly damaged, 25.58% moderately damaged, 14.73 % good and 1.55 % excellent. For the middle region, 20.93 % was highly damaged, 40.70 % moderately damaged, 29.07 % good and 9.30 excellent. Whereas in the east region 36.73 % highly damaged, 22.04 % damaged, 29.89 % good and 11.34 % excellent. The damage could be caused by natural factors and human activity such as use of explosive material and cyanide to catch fish, exploitation of lime stone reefs and also sewage.

Coral reefs can recover naturally from damage by the colonization process (Veron, 1993; Nybakken, 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, i. e. larva availability and presence of a suitable substrate (Harrison and Wallace, 1990).

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 concomitant 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 select four different stations. Station I, was a sandy area, Stastion II, a sandy area with poor live coral cover, Station III, was live coral with rubble of dead coral and Station IV was dominated by live coral. The distance between stations were approximately 50 metres and all stations were on the east side of Sikuai Island.

Field Processing

This study on coral colonization using artificial substrate in the form of cement, tile and iron with size of 12 x 12 cm. The artificial substrates 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. They were deployed at each station. Three racks were deployed at 5 metres depth with a distance of one metre between each rack. Collecting of substrate was conducted monthly and substrates were changed and water quality measured at the same time (English *et al.* 1994).

RESULTS

Water movement 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 waste and sediment influence is relatively low. But human activity (tourism) on the island causes organics and inorganic wastes on the bottom. Study of water conditions at Pulau Sikuai found that conditions were normal and optimal for coral communities (Table 1).

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

No	Parameter	Month					Average
		July	August	September	October	November	
1	Temperature (°C)	29	29.3	27.5	29.3	29.6	28.94
2	Salinity (°/₀₀)	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	Visibility (m)	6	6	5.8	6.3	6	6.02
6	Weather	Sunny	Sunny	Rainy	Sunny	Sunny	

Table 2. shows frequency and abundance of coral found on the different substrate 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 corals settled in each month are as follows: 12 in July, 17 in August, 63 in September, 7 in October and 9 in November. The corals found consisted of six genera from three families. One genus was not indentified and so was called genus X. They consisted of *Acropora* and Genus X (family: Acroporidae) *Pocillopora*, *Stylopora* and *Seriatopora* (fam. Pocilloporidae). Genus *Pocillopora* and *Stylopora* were found in each sampling month. The diameter of these settled corals were 0.7 mm to 3.1 mm.

The density of coral settlement on artificial substrate in the five month period was between 0.10 – 0.91 colony/m^2, with the highest density found in September and the lowest density in October. The highest relative frequency of corals settlement was 64.28 % during August.

The analysis of coral distribution patterns was done using the Morista Index. Generally the distribution patterns were aggregated at one place and several genera were encountered . All genera were found on the lower surface of the substrate.

DISCUSSION

The data from other similar studies elsewhere in Indonesian region are not available. Similar studies were performed in Gulf of 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 (Moorsel, 1989).

In this study, the total of coral settlement on artificial substrate is much lower compared to those of other studies. This was caused by the time for the study, with only monthly interval substrate deployed. The results of this study seem to support the hypothesis that coral settlement is limited by time of reproduction. (Suharsono, 1984; Sorokin, 1991; Harrison and Wallace, 1990; Moorsel, 1989). There are different type of reproduction seasons namely: daily, monthly, a long time and seasonally. This results to be very important on aquaculture development program, especially on the coral farming project.

Cement plates had the highest coral settlement rate, compared with both tile and iron plates. This substrate could be consistent and it can not be damaged on the water column. Analysis, showed that cement plates had a rough surface and also a good wet ability. Laboratory studies have shown that settlement of coral larvae is usually preceded by testing and searching behavior and intensive exploration at the substartum (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).

Table 2. Distribution pattern of coral settlement on artificial substrate at Sikuai Island, Bungus, Gulf Kabung, Padang, West Sumatera

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

The results of this study have also shown that September is the time for optimal coral settlement. This fact indicated that highest release of coral planulae certainly represented reproductive periods. In high latitude regions, the release of coral larvae happens usually in summer periods (Sorokin, 1991; Yeemin and Sudara, 1991). The change of environmental factors such as temperature, irradition and sediment stress are limiting factors 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 monsoon to the east monsoon called "Pancaroba akhir tahun". This change of climate was approximately occurring at the same time as the iritating maximum release of coral larvae. This data is important such knowing 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, consisting of genera *Pocillopora*, *Stylophora* and *Seriatopora*. The Pocilloporidae has a viviparous hermaphrodite reproduction type with a long breeding season (Harrison and Wallace, 1990; Sorokin, 1991; Yeemin and Sudara, 1992). This group of corals are also most abundant at shallow waters and opportunistic species (Suharsono, 1984; Sorokin, 1991; Harrison and Wallace, 1990).

The pattern of coral settlement distribution was aggregate nearly in one space. This is a strategy of coral settlement to survive in a habitat. The aggregate model of corals settlement could cause fusion between colonies to become a bigger colony, increasing the 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 substrate. The same phenomenon was also found in the Gulf of Thailand and Japan reefs (Yeemin and Sudara, 1991). To settle on the lower surface of artificial substrate is a strategy of the coral larvae to avoid a stressed environment such as from irradiation and sediment (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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