CHANGES IN CORAL COVERAGE IN THE EASTERN INDONESIA DURING COREMAP2

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Introduction

Indonesia has 51,020 km^2 of coral reefs or 17.95% of the world`s coral reefs (Spalding et al. 2001). Coral reefs and their associated marine life have an economic value for Indonesia. Unfortunately, they are vulnerable to human-induced stress. To protect, rehabilitate, and achieve sustainable use of the Indonesian coral reefs and their associated ecosystems which, in turn, enhance the welfare of the coastal communities, Government of Indonesia initiated COREMAP (Coral Reef Rehabilitation and Management Program). COREMAP is a long-term program, consisted of three phases. COREMAP Phase 1 launched in 2000 and finished in 2003/2004. COREMAP Phase 2 (COREMAP2) starts in 2006 and finished in 2011. COREMAP is financed by the Government of Indonesia with support from several donors: World Bank (WB) for eastern Indonesia, Asia Development Bank (ADB) for western Indonesia, and Australia Agency for International Development (AusAID). AusAID was involved only during COREMAP Phase 1. The aim of this study is to evaluate the impact of COREMAP2 (2006-2011)based on the condition of coral reef in the eastern region of Indonesia.

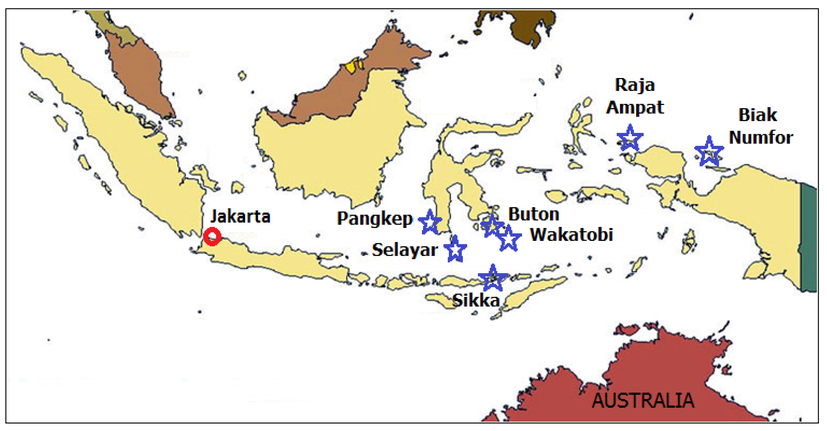

Fig. 1: Maps of Indonesia and location of COREMAP2 in the eastern Indonesia.

Material and Methods

Observation of reef health condition were conducted at 7 districts (Fig. 1) of COREMAP2 location in the eastern Indonesia: Pangkep, Selayar, Buton, Wakatobi, Sikka, Biak Numfor and Raja Ampat .

For each district, some stations were selected as sampling site and they were set up as permanent transects location for next monitoring during COREMAP2. The length of line transect is 30 m (but it was divided into three-10m line transect) (Fig 2), parallel to the coast at the deep where coral growth is still commonly found (around 3-5 m depth). To investigate whether there was a change in coral coverage in the eastern Indonesia, test of statistic using two-way ANOVA was applied to analyze data of live coral cover (in %) at each district. Before doing test, data were transformed into arcsin square root or p'=arcsin √p (Sokal & Rohlf 1995, Zar 1996).

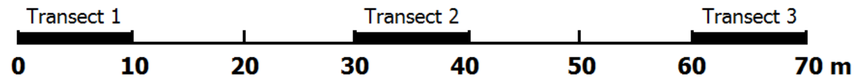

Fig. 2: Line transect applied at each station in each district.

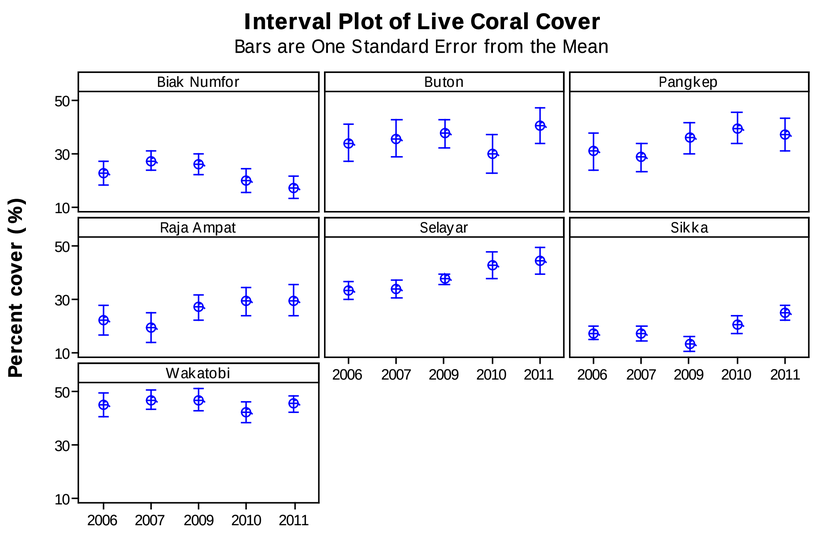

Fig. 3: Live coral cover (%) in each district over the year of observation

Table 1: Result of two-way Anova based on the arcsin square root of live coral cover.

Source	DF	SS	MS	F	p
District	6	1068.85	178.142	26.65	0.000
Year	4	38.92	9.731	1.46	0.247
Error	24	160.45	6.685		
Total	34	1268.22			

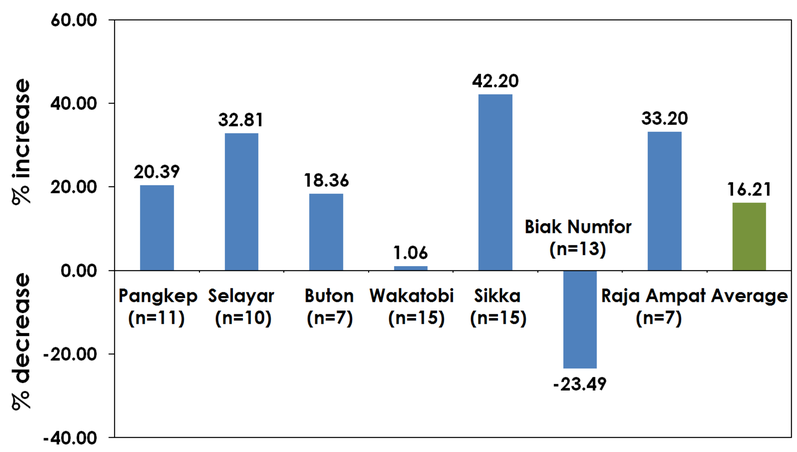

Fig. 4: Change of live coral cover from 2006 to 2011 (n=number of stations).

Conclusion

The live coral cover in the eastern Indonesia during COREMAP2 trended to increase. COREMAP activities which manage coral reefs and their associated ecosystem in an integrated manner certainly play an important role on the result obtained.

Results & Discussion

Average and standard error of live coral cover at each district during COREMAP2 is shown in Fig. 3. There was no evidence the difference of live coral cover over the year during COREMAP2 (p=0.247) (Table 1). However, the live coral cover trended to increase in most of district. Fig. 4 indicated six out of seven districts (86%) had improvement in live coral cover from 2006 to 2011. During that period, live coral covers increased by 16%, or an average annual rate of 3.2%. Improvement of live coral cover in one district (Wakatobi) was very small. In Biak, live coral cover was decline since 2009. Wakatobi is an area where the coral reef conservation has been developed before COREMAP. Some NGO are also involved in coral reef management in Wakatobi area. Live coral in this area most probably are in optimum condition, so the live coral cover tends to stable, not increase anymore. Declining live coral cover in Biak due primarily to storm damage (Fig. 5) with additional destruction by bombs and some limited bleaching (Fig. 6).

The use of destructive fishing was reduce as result of massive conservation campaign conducted by COREMAP. Public Awareness campaigns offered directed messages to promote behavior change such as prevention of destructive fishing, habitat protection, sustainable fisheries, community programs and regulations. Based on COREMAP2's socio-economic survey was conducted in 2010, the result showed that over 75% of resident in the project area were aware of the importance of coral reefs to their livelihood.

We believe that activities of COREMAP to protect, rehabilitate, and achieve sustainable use of the Indonesian coral reefs and their associated ecosystem has been in the right way. For comparison study, we use data at Kepulauan Seribu (Thousand Island) in Jakarta Bay, Jakarta. That is located in the north of Jakarta city, capital of Indonesia, near the mainland of Java. It is an extreme example to describe the most severe impact of human activity to coral reef. Umbgrove (1928), which in 1920 encountered the condition of coral reefs in the Thousand Islands was generally in good condition. In a study conducted in 1985 (Moll & Suharsono 1987), the results showed that coral cover declined in Jakarta Bay with coverage about 15%. While De Vantier et al. (1998) on research conducted in 1995 found that the percentage of live coral cover in Zone 1 of Thousand Island (nearest area to mainland of Java) was only below 5%. Similar results were also obtained by Giyanto et al. (2006) in studies conducted in the same location in 2005.

Fig. 5: Coral reef in Owi island, Biak in 2006 (left) and in 2010 (right).

Fig. 6: Destruction of coral reef in Biak due to bomb (left) and bleaching (right).