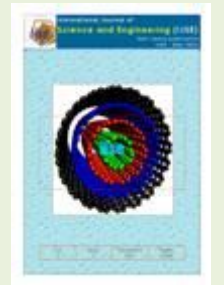




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Codition of Coral Reef at Teluk Pandan Sub-District East Kutai District

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Abstract - Coral reef of TelukPandan Sub-district East Kutai District still low in both monitoring and management, thus also poorly in coral reef database. This research purpose was to obtain the data of coral reef condition and distribution description in this sub-district. Research was held on October 2013 at six observation stations using lifeform line intercept transect survey method. The coral condition estimation was based on live coral cover (LC) and hard coral mortality index (HCM). Coral reef distribution and wide were estimated by satellite image Landsat 7 ETM+ processing and direct field tracking using GPS. There estimated ± 618.63 ha of coral reef area consist of fringing and patch reef formation type. Live coral cover vary 2.1-67.8% or categorized "poor" to "good" reef condition and in average LC = 38.1% ("fair/moderate" condition). Hard coral mortality (HCM) index ranged 0.14 - 0.8 and in average 0.31.

Keywords - Coral; Condition; Distribution; Mortality Index; Teluk Pandan; East Kutai

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I. INTRODUCTION

Coral reef are very diverse, complex marine ecosystems which commonly occur in shallow tropical water (U.S. Coral Reef task Force Working Group on Ecosystem Science and Conservation, 2000) and has important function and role for marine environment and biota life and also for human life. Coral reefs are often characterized as an underwater tropical rain forest with high biodiversity and primary productivity (Hubbell, 1997; Gladfelter, 1985 in Jaap, 2000). These ecosystems are also valuable assets that provide food, jobs, and beautiful seascape that attracts tourists, protection of vulnerable shorelines from storms and wave action, and provide huge revenue to local communities and national economies (Lobel, 2011).

However, coral reefs are fragile and susceptible harm from many sources that differ in effects (U.S. Coral Reef task Force Working Group on Ecosystem Science and Conservation, 2000) and it is becoming increasingly acknowledged that coral reefs are globally threatened, even along related ecosystem is rapidly deteriorating world-wide (Abelson et al., 1999). According to Wilkinson (2008) the world has effectively lost 19% of the original area of coral reefs.

East Kutai District is include to a region of EastKalimantanProvince with the coastal area southern bordered to BontangCity until northern border of Berau District. TelukPandan is one among seven sub-districts in East Kutai District that covering coastal and sea area as part of the administrative region, also as the southernmost sub-district.

Studies of Juliani (2013) and Juliani and Suyatna (2014) indicate that TelukPandanSub-district had the highest demersal fish stock compared to the other six coastal sub-districts. Unfortunately the data of coral reef existence and condition as the buffer of this fish potency is poorly available. Refer to study of Yasser MF (2010) on coral reef of Bontang City, the direct southern border region to the sub-district, indicate that coral reef in Bontang City has suffer degradation as impact of both nature and anthropogenic disturbance. Thus, reef of TelukPandan possibly experience the same impact and degradation since the area still low in coral reef monitoring and management.

Our research on coral reef of TelukPandanSub-district was conducted in order to obtain the description of the condition and distribution. Along the environment change due to the region development both land and water, the database further expect to support the following

researches and the efforts of policy determination and management for the coral reef of TelukPandan Sub-district.

II. RESEARCH METHOD

Data was collected in waters of Teluk Pandan Sub-district, East Kutai District, East Kalimantan Province, on October 2013. There 6 (six) observation stations surveyed using lifeform line intercept transect method as described in English et al. (1994) in order to obtain the data of coral condition. Fifty meters long measuring tape was placed parallel to the reef edge profile. Each coral colony or benthic organism that crossover by the line were measured by it length of each lifeform category.

Coordinate of observation stations (Figure 1):

1. N 0o 12' 23.9" E 117o 33' 11.0"
2. N 0o 13' 13.7" E 117o 32' 36.0"
3. N 0o 14' 30.2" E 117o 32' 48.4"
4. N 0o 15' 06.9" E 117o 32' 15.6"
5. N 0o 16' 58.4" E 117o 32' 21.9"
6. N 0o 18' 09.5" E 117o 32' 44.0"

Coral percent cover was calculated using formula (Gomez and Yap, 1988; English et al., 1994; Gomez et al., 1994):

Percent cover of hard coral (HC) is total of both coverage of lifeform Acropora and Non-Acropora. Live

coral coverage (LC) is total of hard coral and soft coral coverage (LC = HC + SC).

$$Percent\ Cover\ \alpha = \frac{total\ length\ of\ lifeform\ \alpha}{length\ of\ transect} \times 100$$

α = a category of lifeform

The percentage of LC <25% was categorized as "poor/bad" coral coverage condition, LC 25% - <50% categorized as "fair/moderate" condition, LC 50% - <75% categorized as "good" condition, and LC ≥75% categorized as "excellent" condition (Jompa and Pet-Soede, 2002; Hill and Wilkinson, 2004).

Hard coral mortality (HCM) index calculated as ratio of standing dead coral to total cover of both live hard coral and dead coral, HCM = dead coral/(hard coral + dead coral) (Gomez et al., 1994; Fox et al., 2001). Coral mortality index values near zero indicates no significant changes for live coral, while the value of 1 shows that there is a change of live to dead coral, and if MI >0.33, the mortality index is considered to be high and the reef is classified as sick (Sadhukhan and Raghunathan, 2011).

Coral reef distribution and wide were estimated based on satellite image Landsat 7 ETM+ 2008 and further processed using software of ER Mapper 5.5. Direct field tracking using global positioning system (GPS) was performed to identify coral and non-coral areas (ER Mapper, 1997; F-G UGM – Bakosurtanal, 2000).

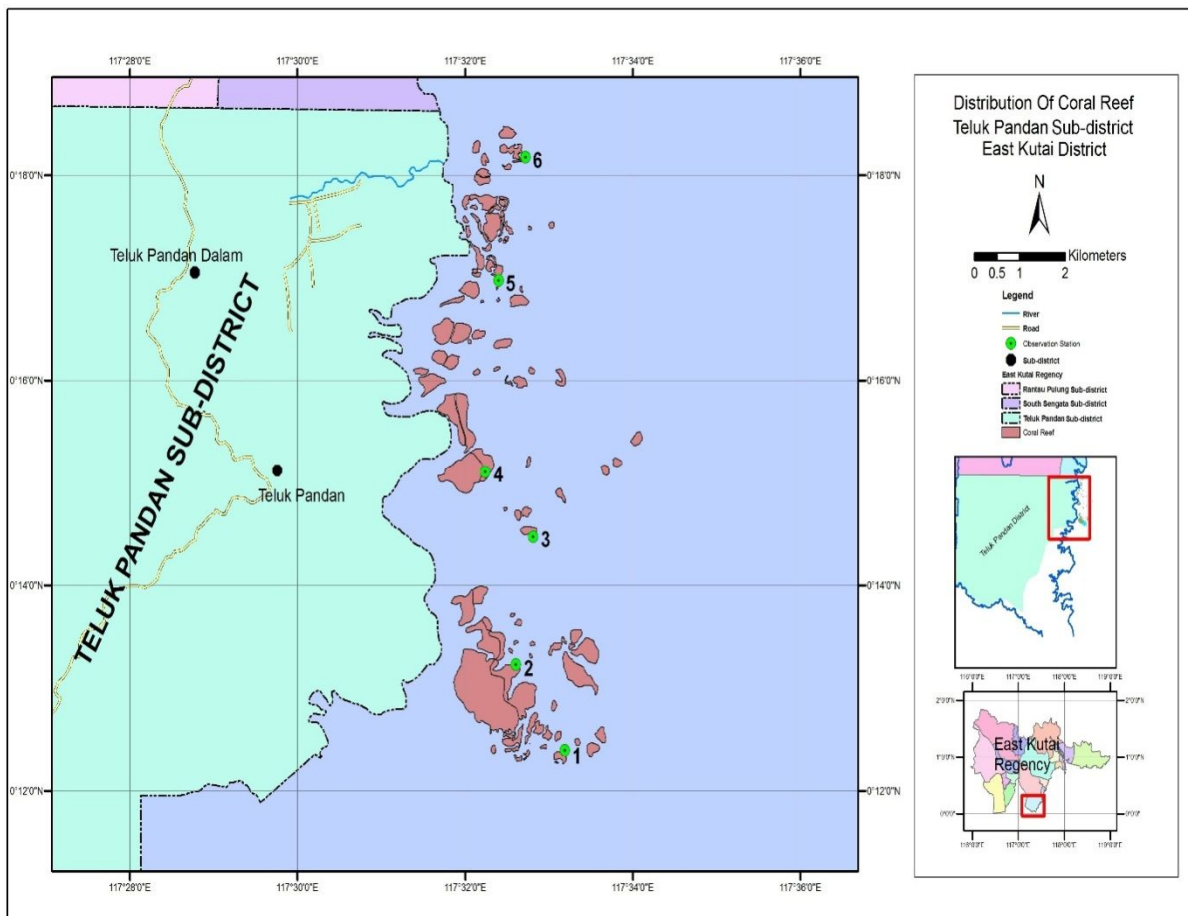


Figure 1. Distribution of Coral Reef, TelukPandan Sub-district, East Kutai District

III. RESULTS AND DISCUSSIONS

Coral reef in Teluk Pandan Sub-district coastal East Kutai District is a section of continuous reef groups that distributed along the East Kalimantan Province coastal at Marangkayu Sub-district KutaiKartanegara District, Bontang City and southern region of East Kutai District at South Sangatta Sub-district (Marine and Fisheries Office, 2011; Marine and Fisheries Office, 2012). Reef formation type in this coastal mainly was fringing reef that found at near coastline, while small spots of patch reef type observed at farther seaward. Community of seagrass was intensely observed associate overlapping in almost all reef flats both fringing and patch reef, while mangrove community only associate with the back reef near the coastline.

Coral reef in TelukPandanSub-district estimate ± 618.63 ha. Group of reef that closer the coastline tend to form wider groups rather than small scattered groups at farther seaward. The widest group was found at southern part, estimated ± 216 ha (figure 1).

The coral reef tends to develop in scattered colonies at the reef flat commonly dominate by massive lifeform, while dense developing reef found at the reef edge. Coral

found well developed at deep of seawater surface level (or zero meter) until reef upper slope ± 5-7m deep.

The life coral cover (LC) vary from 2.1-67.8% or categorized “poor” to “good” reef condition, while in average LC = 38.1% categorized into “fair/moderate” condition which is contribute by coverage of hard coral (HC) 21.0% and soft coral (SC) 17.1%. Highest LC found at station 3 and the lowest at station 1. However, Figure 2 and Table 1 show that high live coral coverage at station 3 as well at station 5 mostly contribute by abundance of SC by 64.0% and 26.7% while HC contribute only poorly 3.8% and 8.9%. If refer to Done (1997) condition of the principal scleractinian and hydrozoan corals is a critical determiner for the long-term integrity of the reef ecosystems, thus station 2 and 4 possibly considered as reefs with better condition rather than the other stations. Reefs at those two stations respectively has HC of 59.0% and 39.6%, and ‘if the reef condition category estimate by hard coral alone, respectively it categorized to “good” and “fair/moderate” condition, while the other four stations including the average of whole stations has HC < 25% or categorized into “poor” condition.

Table 1. Percent Cover of Lifeform at Each Observed Station and in Average of Teluk Pandan District, East Kutai Regency

Station	Categories/Lifeform	1	2	3	4	5	6	Av.
DEAD CORAL	DC	-	0.2	-	-	1.1	1.3	0.43
	DCA	4.5	9.1	9.3	6.2	14.0	10.7	8.97
ACROPORA	ACB	-	41.7	2.6	6.5	-	1.3	8.68
	ACT	-	-	-	4.3	-	-	0.72
	ACE	-	0.8	-	0.2	-	-	0.17
	ACS	-	2.2	-	1.5	0.4	0.2	0.72
	ACD	-	-	-	1.3	-	-	0.22
NON ACROPORA	CB	-	2.6	-	4.2	-	-	1.13
	CE	0.4	-	-	8.1	-	-	1.42
	CF	-	2.9	-	2.5	-	-	0.90
	CM	0.1	2.0	1.2	5.7	6.6	8.9	4.08
	CS	0.1	1.7	-	3.4	1.6	0.3	1.18
	CMR	-	1.5	-	1.3	0.3	1.0	0.68
	CME	-	3.6	-	0.6	-	2.5	1.12
CHL	-	-	-	-	-	-	-	
OTHER FAUNA	SC	1.5	2.3	64.0	5.9	26.7	2.2	17.10
	SP	2.5	0.9	-	-	0.3	-	0.62
	AA	-	1.0	-	2.3	2.0	2.8	1.35
	CA	-	4.2	-	0.4	-	-	0.77
	HA	-	2.4	0.6	11.5	4.7	3.1	3.72
	MA	-	0.3	-	-	-	1.1	0.23
	TA	-	0.4	-	-	-	-	0.07
	ZO	-	-	-	-	-	-	-
OT	0.1	0.3	-	0.5	1.7	1.0	0.60	
ABIOTIC	S	1.5	4.5	7.2	6.9	11.5	1.1	5.45
	R	85.0	15.0	10.7	25.4	29.1	62.5	37.95
	RCK	4.3	-	-	0.6	-	-	0.82
	SI	-	0.4	4.4	0.7	-	-	0.92
	WA	-	-	-	-	-	-	-

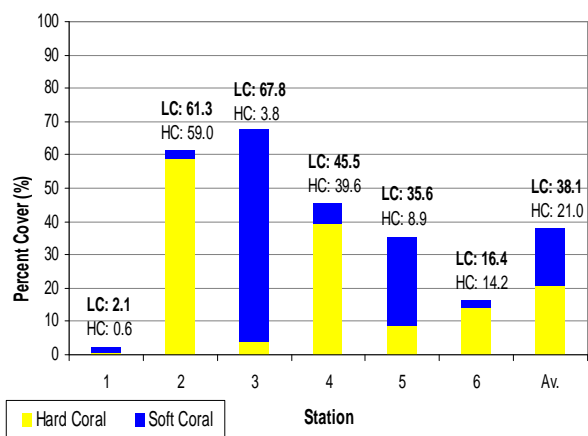


Figure2. Percent Cover of Live Coral (LC) and the Proportion of Hard Coral and Soft Coral of Each Observation Station and in Average, TelukPandan Sub-district, East Kutai District

In general, despite soft coral coverage is dominant in live coral but the overall vastest coverage was contribute by abiotic category of rubble (R) about 38% as shown in Table 1. This rubble form very common observed at the reef flat part at almost entire studied area, except station 2 and 3. Reef at station 2 dominated by hard coral cover particularly at reef crest by acropora branching (ACB) and station 3 dominated by soft coral (SC) cover. Reef crest often space monopolized by fast-growing scleractinians of branching coral (Tomascik *et al.*, 1997).

Domination of soft coral toward poorly cover of hard coral occur at station 3 and 5, while dead coral with algae and rubble are non-live coral that in other hand also commonly cover this reefs area. The domination of soft coral on indicated 'long dead' coral in this reefs estimate related to characteristic of octocorals recruit and grow at a relatively rapid rate thus faster recover to pre-disturbance population, while stony coral recruit and grow in very slow rate even under optimal conditions and their recovery may require several decades to a century (Jaap, 2000).

Northern part reefs relatively suffer higher damage than reefs at southern part, and outer reefs in form of small patch reefs tend suffer higher damage than reef at near shore. Hard coral mortality index vary from 0.14 – 0.88, the average HCM of 0.31 indicate healthy reef without significant change of live coral. Low mortality value of station 2 and 4 with similar HCM of 0.14 indicate healthy reefs, while high mortality at station 1, 3, 5 and 6 with HCM respectively 0.88, 0.71, 0.63 and 0.46 classified as sick reef condition (HCM > 0.33).

The worst reef condition of TelukPandanSub-district was found at station 1, as representing the most outer patch reef. Figure 3 show that the highest HCM value (0.88) was obtained from this station with vast rubble cover (R= 85%) observed all along the scuba dive. There obviously visualized during the observation that the severe damage on this coral reef station mostly caused by destructive fishing practice of blast fishing. Unfortunately, this kind of destruction been observed as well at the whole reefs area in TelukPandan Sub-district particularly toward the small.

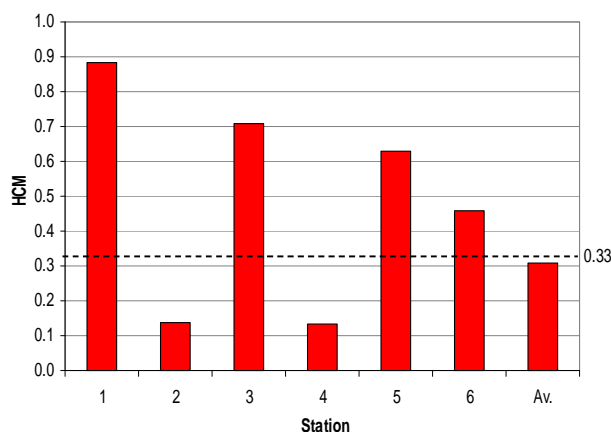


Figure3. Hard Coral Mortality Index (HCM) Each Observation Station and in Average, TelukPandan Sub-district, East Kutai District

CONCLUSIONS

Coral reef of TelukPandan Sub-district estimate ± 618.63 ha consist of fringing and patch reef formation type. Live coral cover vary 2.1-67.8% or categorized "poor" to "good" reef condition and in average LC = 38.1% ("fair/moderate" condition). Hard coral mortality (HCM) index ranged 0.14 – 0.8 and in average 0.31.

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