TYPES AND DISTRIBUTION OF CORAL REEF ON THE KARIMATA COAST, WEST KALIMANTAN

By:

Noor Cahyo D. Aryanto and Yani Permanawati [1)]

(Manuscript received November 24, 2008)

ABSTRACT

The identification of quality and condition of the coral reef in the study areas will support the biological diversity and it frequently contains a valuable assortment of natural resources, conservation of marine biota.

The environmental problem particularly on the coastal area needs a more comprehensive management due to the complexity of the rapidly growth.

Karimata Archipelago geographically is located between 108^{o}40' - 109^{o}10' E and 1^{o}25' - 1^{o}50' S and administratively belongs to the Ketapang Regency (approximate 100 km west side of Ketapang). In the study area, the growth of coral reef is dominated by non-Acropora type arised between the depths 3-15m. The condition is somewhat good to good.

Karimata Archipelago consist of two big islands they are Karimata Island (Studied area) and Serutu Island and also some other isles, with the topography from low land to high land having the height of about 1030 meters from sea level.

Keywords: Coral reef, Karimata coast, West Kalimantan.

SARI

Identifikasi kualitas dan kondisi terumbu karang di daerah penelitian dapat menopang keanekaragaman biologi yang pada akhirnya dapat berperan sebagai kawasan konservasi biota laut.

Masalah kepekaan lingkungan khususnya di wilayah pantai dan pesisir memerlukan penanganan yang lebih komperhensif, karena kawasan ini relatif lebih kompleks selain perkembangannya yang demikian pesat.

Gugusan kepulauan Karimata secara geografi menempati posisi 108^{o}40' - 109^{o}10' BT and 1^{o}25' - 1^{o}50' LS dan secara administrasi masuk dalam Kabupaten Ketapang (lebih-kurang berjarak 100 km ke arah barat dari Ketapang). Di lokasi telitian, keberadaan terumbu karangnya didominasi oleh jenis non-Acropora yang tumbuh baik pada kedalaman antara 3 hingga 15 m. Terumbu karang yang dijumpai dengan kondisi agak baik hingga baik.

1. Marine Geological Institut (PPPGL)
Jl. Dr. Junjunan No.236, Bandung-40174, Email: noor_aryanto@yahoo.com

Kepulauan Karimata terdiri dari 2 pulau besar, P. Karimata di mana lokasi studi terletak dan P.Serutu dan beberapa pulau-pulau kecil dengan topografi dari dataran rendah hingga dataran tinggi (1030 m) di atas permukaan laut.

Kata kunci: Terumbu karang, Pantai Karimata, Kalimantan Barat.

INTRODUCTION

The investigated area is geographically situated between 108°40′00″ – 109°10′00″ E and 1°25′00″ – 1°50′00″ S which administratively belongs to Ketapang Regency (approximate 100 km west side of Ketapang), West Kalimantan Province. Karimata Archipelago consist of two big islands, they are Karimata Island (studied area), Serutu Island and some other isles.

This paper is the result of the join research programe with Bappeda West Kalimantan Province when acquisition data had been done last year. The primary objective of this paper is to identify the types and distribution of the coral reef along the coast that are controlled by water quality.

The coral reef is an organism living in the tropical shallow water. The coral reef consists of Anthozoa type from Scleractinia class *(hermatypic coral)* or reef type that is capable to make the reef framework bearing carbonate calcium.

Morphologically, the coral reef ecosystem is divided into 3 types: (1) fringing reef or marginal reef; (2) barrier reef and (3) atoll. Fringing reef or marginal reef, as its name, lives along the marginal beach, while barrier reef is separated from main land by lagoon and atoll is reef in ring form or ovale around the lagoon.

Geology

The old rock units in this area are Metamorphic Pinoh (early Perm to early Jura) and Sukadana's granite (upper Cretaceous). Both units is underlain as nonconformity the Serutu sandstone (Oligocene) where exposed in Serutu island and then, all these units are covered by alluvium and swamp deposits (Fig. 1). Pinoh metamorphic's rock such as chertstone and quartzitose sandstone contains plagioclase, chlorite epidote, garnet, tourmaline and malachite. Quartzite, dark grey, consists of anorthite, dominantly by tourmaline, gneiss, garnet and epidote. At the Sanggau sheet, this rock is correlated by low degree metamorphic rock that has late Trias ages *(de Keyser & Rustandi, 1993).* Meanwhile, at the Ketapang sheet, this unit is intruded and metamorphosed by Sukadana's granite. Sukadana's granite consists of biotite granite, diorite, quartz diorite and granodiorite. Biotite granite, grey, coarse grain and consists of tourmaline where wide exposed in Karimata Island and Lintang Island that could be equalized of Sukadana's granite (Upper Cretaceous) at the Ketapang's sheet *(de Keyser & Rustandi, 1989)* and at Nangataman's and Pontianak's sheet *(Pieters & Sanyoto, 1993).* Serutu sandstone consits of sandstone, fine grain, white and browny, coal intercalation in milimeter's thick.

The structure that can be observed in the study area is north-southward and northeast-southwestward lineation (Fig. 1). This lineament existences on the igneous rock is interpreted as fault, or fracture, while when it is found on the metamorphic rock, it is interpreted as a fold axis or fault (Sanyoto and Margono, 1996). Pursuant to regional analysis, the main stress direction in this area of northwest-southeast resulting all pre-

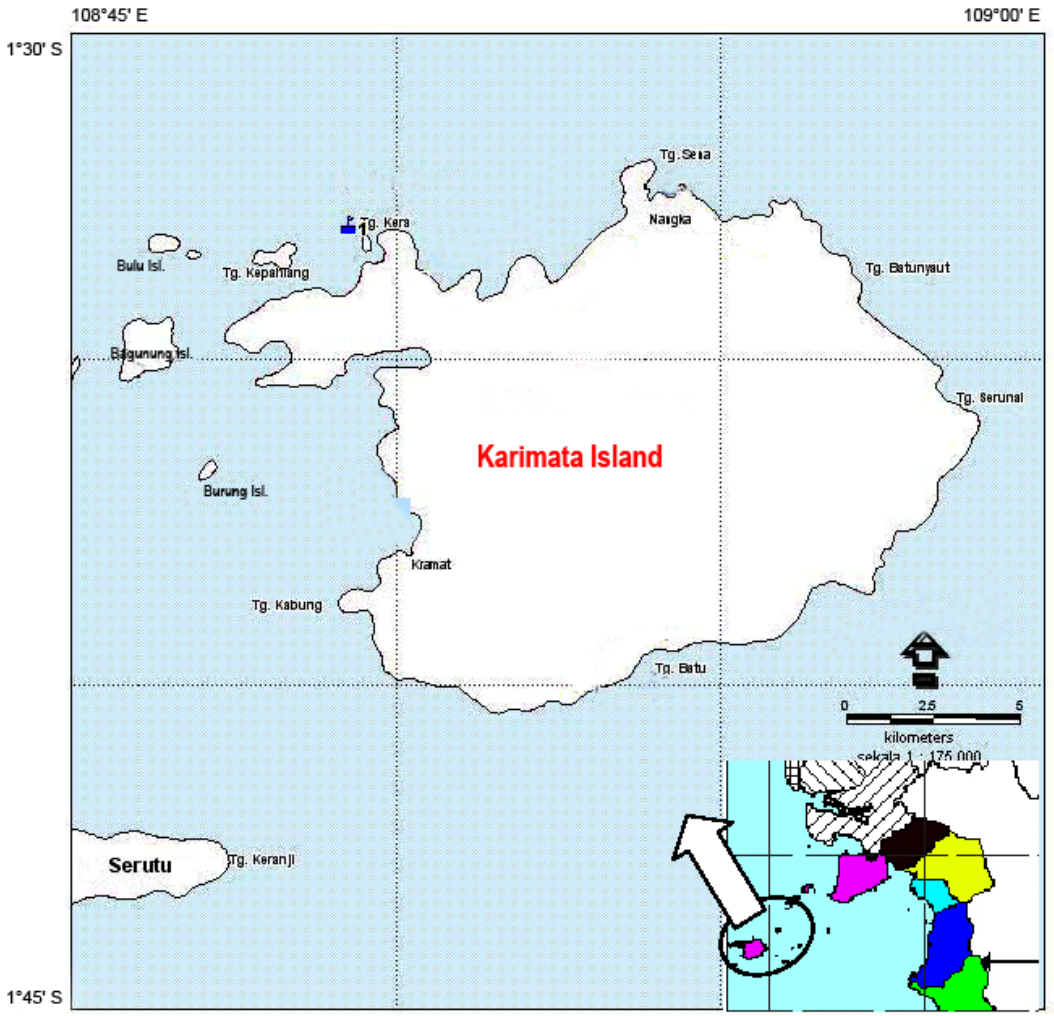

Figure 1. Study area map (Aryanto, 2004)

Tertiary and Tertiary rock be folded and faulted at Miocene. (Moechtar, 2002).

METHODS

Lifeform or transect method is used to identify the coral reef condition. This method is more emphasized to the growth form based on the observation to growing of coral reef besides biota having association with reef like algae, and sponge.

Transect line as long as 50 meters put down is parallel to the coastline at 3 and 8 meters depth. The transect line position at those depths conclude that the reef (and its diversity) are grown better at these depths.

Coral reef Identification

The reef distribution does not only limited horizontally but limited also vertically with deepness factor and also elementary substrate structure. The growth, rate and covering growth of reef is decrease by exponential with deepness.

Primary factors influencing the vertically distribution are light intensity, oxygen content, temperature, and brightness of water. The existence of reef distribution alongside the coast of West Kalimantan, is generally influenced by the existence of high sedimentation which is supplied by the river stream located in many places.

The reef growth is generally located at the isle separated from the main land, farther from the main land progressively goodness growth of its reef.

Based on the coral reef's component along the transect line above, they are grouped in Acropora type and non-Acropora. The condition of coral reef is also observed (life, before death or death) such as the following biota that is noted into form like in Table 1.

Water Quality

Salinity, temperature, pH and total dissolve solid (TDS) are measured as *insitu* using Lutron Yk-01, while the lightness of sea water is measured using sechi desk and also measurement of Heavy Metal by Atomic Absorption Spectrometry (AAS) method.

The Measurement of Brightness

The measurement of brightness have been done on the fields with using the tool called "*Sechi desk*".

The Measurement of Oxygen Dissolved (DO) as Iodiometri

Oxygen will oxidize Mn^{2+} then it forms MnO_2. With an increase of the iodide alkali in the acid condition, it will free the iodium. The quantity of iodium which were free is equivalent with the quantity of oxygen dissolved. The Measurements of Oxygen Dissolved must be analyzed as soon as possible, because oxygen dissolved into water is much influenced by temperature and air pressure.

The Measurement of Requisites Oxygen (COD)

Organic matter in the water is the oxidation of $KMnO_4$ become CO_2 and H_2O, the remainder $KMnO_4$ is the reduction by oxalate acid as more.

Determining the heavy metal using AAS

Metal ion will absorb an energy become free atomic, this free atomic will be detected by energy radiation from cathode lamp become re-ionization.

RESULT

Coral reef that surveyed at 3 locations is in the north, south and west part of Karimata Island. In the northern part precisely at Kapayang Island (northwest of Karimata), it shows that the types of the coral reef belongs to non-acropora (acropora type does not exist). Based on the transect measurement between 2.5 to 3 meter depth (Table 1) and at 3 meter depth (Table 2), it shows us about types and distribution of coral reefs, the condition of coral reefs is somewhat good to good (dead or damage condition only < 25% coverage, and at 3 meters depth, dead coral algae is none); (Fig. 2 and 3).

Figure 2. Coral reef condition on Kapayang Island (northwest of Karimata)

Figure 3. The view of under water on Karimata Island which is dominated by Acropora spp and Montipora spp *(western of Karimata)*

The growth of coral reefs on this Karimata Islands is dominated by *non-Acropora spp,* arised between the depths 3 – 15 m. The percentage of reef's closure is still sufficiently high ranging between 49-91%, but some part of the coasts have lower closures ranging between 20-30%. On the depth of 15 m, the growth of reefs is as small *patches* which were not widely distributed.

The onsite field measurement shows us that the condition of sea water on Karimata Island has the salinity content between 33.0-34.0 ppt. The brightness of sea water is good. The content of the suspended sediment (*turbidity*) of sea water is small, less than 1 mg/l. The temperature of sea water on the observation has the range between 28ºC-29ºC. The difference of the temperature of the sea water between surface and 5 m depth is more or less 0.5ºC in the morning or at night, the water temperature is decreasing with the water depth (Fig. 4).

According to the result of laboratory analysis the heavy metal content of sea water samples can be summarized as followed (Table 3):

1. Toxic heavy metal for living depend on metal type, quantity and target organism. Types of metals which have a more toxic are *Lead metal (Pb), Cadmium (Cd),* and *Mercuri (Hg).*
2. The disposal of the mining exhaust containing of *Mercuri (Hg)* in huge quantity could become a pollutan which is dangerous for human healthy. It is called "*bioaccumulation*" into organism.
3. The metal disolved into water were controlled by pH water, rise a pH drop a metal disolved into water, because the rising of pH changes a stability from carbonate shape become hidroxide formed within water the body composition (*river, etc*), so that it will be deposited in mud sediment.

Tabel 1. The coral reef types in the northern Karimata (2.5-3 meter depth)

Category	Code	Occurences	Coverage area (%)	Total (%)
Acropora				
Acropora Branching	ACB	-	0.0	
				0.00
Non-Acropora				
Coral Branching	CB	4	2.43	
Coral Encrusting	CE	1	0.17	
Coral Massive	CM	20	23.47	
Coral Submassive	CS	1	1.05	
Coral Heliopora	CHL	7	14.2	
				49.10
Dead Scleractinia				
Dead Coral Algae	DCA	28	21.93	
				21.93
Other Fauna				
Sponge	SP	10	2.37	
Others	OT	3	1.17	
				3.53
Algae				
Coraline Algae	CA	6	2.00	
Macro Algae	MA	6	4.13	
				6.13
Abiotik				
Silt	Si	9	17.27	17.27
Unrecord/missing data	DDD	0	0.00	0.57
T o t a l		0	0	100

(source: Aryanto, N.C.D., 2004)

Tabel 2. The coral reef types in the southern Karimata (3 meter depth)

Category	Code	Occurences	Coverage area (%)	Total (%)
Acropora				
				0.00
Non-Acropora				
Coral Branching	CB	8	90.77	
Coral Foliose	CF	0	0.00	
Coral Encrusting	CE	1	1.00	
				91.77
Dead Scleractinia				
Dead Coral Algae	DCA			0.00
Other Fauna				
Sponge	SP	2	1.37	
				1.37
Algae				
				0.00
Abiotik				
Silt	Si	6	6.20	
Water	WA	0	0.67	
				6.87
Unrecord/missing data	DDD	0	0.00	0.00
T o t a l		17	100	100.00

(source: Aryanto, N.C.D., 2004)

Table 3. Heavy metal content of sea water at study area

No.	X	Y	Locations	Copper (mg/l)	Zinc (mg/l)	Pb (mg/l)	Mercury (mg/l)	Cad-mium (mg/l)
41B	109.060194	-1.496500	P.Buan	0.0060	0.0042	0.0021	0.0013	0.0008
42B	108.855083	-1.563611	P.Karimata	0.0060	0.0042	0.0019	0.0014	0.0008
45B	108.720750	-1.706917	Tl. Nipah	0.0080	0.0043	0.0021	0.0013	0.0007
48B	108.954278	-1.572750	Pasir panjang	0.0080	0.0043	0.0020	0.0014	0.0008
49B	108.799194	-1.584611	Betok	0.0070	0.0044	0.0021	0.0013	0.0007
50B	108.902528	-1.287167	P. Nilam	0.0060	0.0044	0.0030	0.0018	0.0008
53B	109.146333	-1.287611	Tj. Bulu	0.0100	0.0043	0.0320	0.0019	0.0009
55B	109.270306	-1.204139	P. Haji	0.0100	0.0049	0.0098	0.0020	0.0015

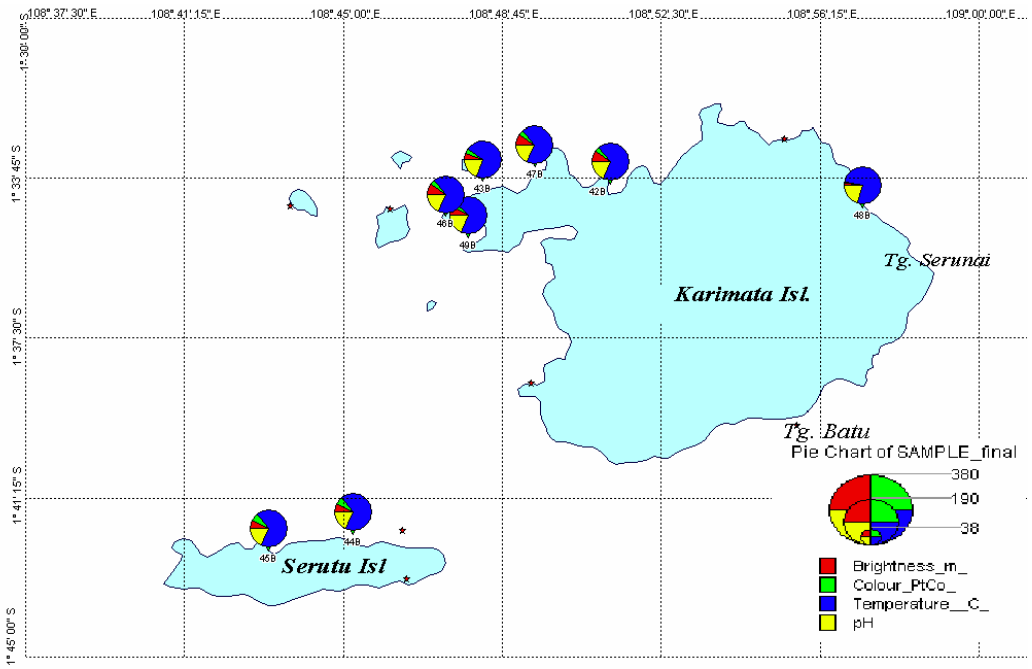

Figure 4. Water sample locations and physical's content map (Aryanto, N.C.D., 2004)

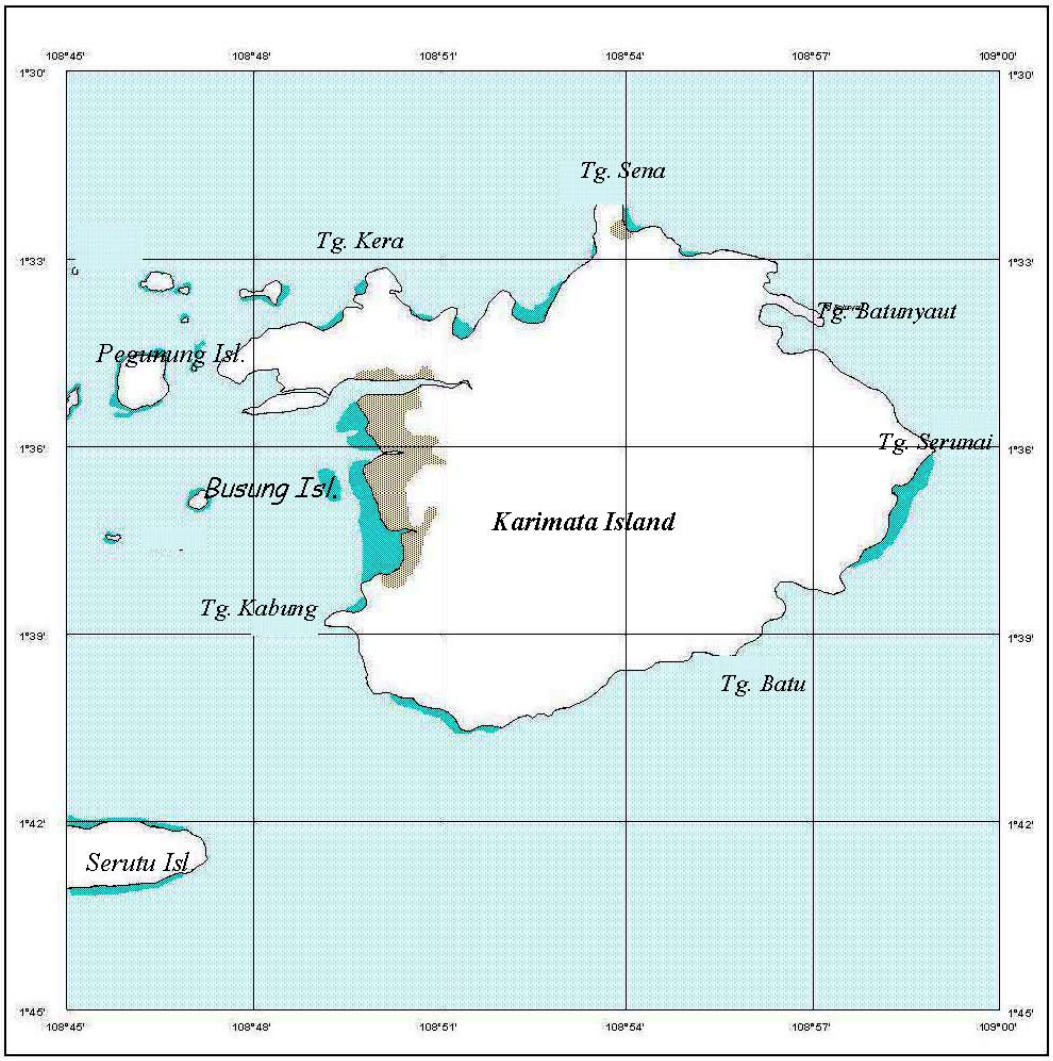

Figure 5. Coral reef and mangrove distributions map (light blue is coral reef distribution and grey is mangrove distribution)

4. Natural mangroves have an effective role in the coastal protection from natural pressure and eroding. It is suggested to plant the Mangrove trees as much as possible, especially *Mangroves Api-api* (*Avicenia Martina Spp*). This type can be developed for protection a metal pollutan on the coastal zones.
5. The result of metal value in each matter of sample is as followed:

- The content of Copper is 0,001 - 0,012 mg/l
- The content of Zinc is 0,014 - 0,106 mg/l
- The content of Pb is <0,01 – 0,04 mg/l
- The content of Mercury is 0,06 - 0,24 mg/l
- The content of Cadmium is <0,0002 - 0,0003 mg/l

Table 4. The regulation that refferenced to marine-use area

No.	Parameter	Unit	Kep.MenKLH No.Kep.02/ MENKLH/1988		Kep.Men.Neg.Lingkungan Hidup Nomor 51 Tahun 2004		
			Fisheries Bussines	Conserva-tion of Marine	Harbour	Marine Biota	Marine Tourism
1	Brightness	metre	>3	>10	>3	Coral:>5 Mangrove:- Sea grass : >3	>6
2	Temperature	^{0}C	natural	natural	natural	natural	natural
3	pH		6-9	6-9	6.5-8.5	7-8.5	7-8.5
4	Colour	PtCo	<50	<50	-	-	
5	TDS	mg/l	-	-	-	-	
6	TDS	mg/l	80	80	80	Coral: 20 Mangrove:80 Sea Grass : 20	20
7	Salinity	ppm	10% natural	10% natural	natural	Coral: 33-34 Mangrove: sd 33 Lamun : 33-34	natural
8	Sulfide	mg/l	<30	<30	0.03	0.01	nothing
9	Amonia	mg/l	<1	<1	0.3	0.3	nothing
10	Nitrate	mg/l	-	-	-	0,008	0,008
11	Nitrite	mg/l	nothing	nothing	-	-	-
12	COD	mg/l	<80	<80	-	-	-
13	BOD	mg/l	<45	<80	-	20	10
14	Cadmium (Cd)	mg/l	<0.01	<0.01	0.01	0.02	-
15	Copper (Cu)	mg/l	<0.01	<1	0.05	0.05	-
16	Zinc (Zn)	mg/l	<0.1	<15	0.1	0.05	-
17	Lead (Pb)	mg/l	<0.06	<0.05	0.05	0.008	-
18	Mercury (Hg)	mg/l	<0.003	<0.005	0.003	0.002	0.01

The final analyses for the next step is to know the ideal use in the marine area. It should be compared to all paramaters with the standard quality shown on Table 4. The comparing of physics, chemical and metal contents on the sea water reffers to Kepmen KLH 02/1988 and Kep. Men.Neg. Lingkungan Hidup Number 51 year 2004.

CONCLUSIONS

The growth of coral reefs in Karimata Islands is dominated by *non-Acropora spp,* that arises between the depths of 3 – 15 m. The percentage of reef's closure is still sufficiently high ranging between 49%-91%, but some part of coasts have lower closures ranging between 20-30%.

Based on the data of the coral reef identification in the study areas, it is still proper for supporting the abundant biological diversity and it frequently contain a valuable assortment of natural resources, conservation of marine biota.

The sea water condition has the salinity between 33.0-34.0 ppt. The brightness of sea water is good, the content of suspended sediment is small, less than 1 mg/l. The temperature of sea water on observation ranges between 28.0 C – 29°C. The difference of the sea water between surface and 5 metre depth is more and less 0.5°C.

The water quality is as an important parameter to control the quality environment; this areas must be protected for coral reef condition. Besides, the belt of mangroves, is important for the mitigation of the effects of natural disaster, such as storm-tide surges, and floods.

For sustainable development in the study area, especially of coral reef ecosystem, it needs a multiple-use concept. Single use management of coastal reef should be avoided as this forecloses the many direct and indirect benefits and services that natural coastal ecosystem can offer on a continuing base. A policy statement on the need for multiple use management of the coastal reef resources should therefore be formulated and politically supported at the highest level of the government.

ACKNOWLEDGMENTS

We wish to thank our colleagues in MGI who give assistance, and discussion (E. Usman, D.A.S Ranawidjaya, Y. Noviadi, and A. Setyanto). The author also thank to Mr. Subaktian Lubis and K. Budiono for their support and to Mrs. M. Karmini for helpful correction to publish this paper.

REFERENCES

Aryanto, N.C.D., Y. Noviadi, D.A.S., Ranawidjaya, E. Usman and A. Ibrahim, 2004. Marine Coastal Management Resources Project on Karimata Waters. *Bappeda Kalimantan Barat, PT. Nincec.* Unpubl Report.

de Keyser, F., & Rustandi, E., 1989. Ketapang 1:250.000 Quadrangle, West Kalimantan. *Geological Research and Development Centre.*

Pieters, P.E., and Sanyoto, P., 1993. *Geologi Lembar Nangataman dan Pontianak, Kalimantan (Geology of the Long Nawan Sheet areas, Kalimantan). Geological Research and Development Centre.*