DIGITAL MAPPING FOR CORAL REEF IN BINTANGOR ISLAND, WEST SUMATRA PROVINCE, INDONESIA

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ABTRACT

Digital mapping method is used to present the information of coral reef data of Bintangor Island, West Sumatra Province Indonesia.The available Bintangor's coral reef data is secondary data from LIPI and Bung Hatta University field survey during 1998. These data involve number of fish' species, type of fishes, and percentage of coral. Primary data is field survey data in 1999 consisting of percentage of living coral. Every transect position and sampling station have been measured by using navigation GPS. Each of transect position is generated as point data in shape file format ArcView GIS software. One point represents the information of transect data in 30-m length. Percentage of living coral, percentage of benthic lifeform, number of coral reef fishes species and type of species are attributes of point. Using ArcView facilities can be shown percentage of living coral or number of fish species in each sampling position. Based on that map, it is recognized that the number of fish' species in eastern Bintangor is higher than in that of western Bintangor. Dead coral in eastern Bintagor (St-1) is higher than that of western Bintangor (St-2) for the 10-m depth. Conversely, dead scleractinian in St-2 is higher than St-1 for 5-m depth.

1   INTRODUCTION

The Indonesian archipelago is the center of species diversity of coral reef ecosystem. Indonesia has generated great income from coral reef richness. Coral reefs give many advantages i.e. sources of food product, building material, and raw material for pharmaceutical, beach protection, tourist place, education and research (Dahuri, 1996). Million people in coastal areas depend on coral reef fishes for their livelihood. Assessment of the present status of coral reefs in Indonesia show that it is just 6.41 percent of the reef areas are in excellent condition (Suharsono, 1998). Many reefs lack of living coral cover and have small coral reef fishes. Mostly this is caused by uncontrolled exploitation of the reefs. It requires great concern in information of coral reefs ecosystem condition. Coral reefs condition is change dynamically. It requires the effort to update rapidly the information of its changes. Digital mapping is one of the alternative solutions in informing the dynamic coral reef condition.

There are three advantages in using digital mapping to inform the changes of coral reef ecosystem condition. Its advantages are accuracy, changeability and flexibility (Masry, 1988). Storing the map in digital form reduce the problems of degradation of the media and data loss from transfer. Using digital mapping methods reduce the problem of repetition of entire map reproduction stage during map updating. In this paper discusses digital map use to inform coral reef condition of Bintangor Island.

2   DIGITAL MAPPING FOR CORAL REEF OF BINTANGOR ISLAND

2.2   Method

Bintangor is one of Indonesia's coral reefs islands. Figure 1 shows the location of Bintangor Island. Bintangor Island lies in Sungai Pisang water, Padang West Sumatra province. Morphology of Bintangor Island is dominated by flat morphology with white sand beach. Steep slope is found at the southeastern part of the island. The available coral reefs data of Bintangor are secondary data and primary data.

Secondary coral reef data is obtained from LIPI and Bung Hatta University field survey during 1998.There're two survey location i.e. St-1 (eastern Bintangor Island) and St-2 (western Bintangor Island)**.** Survey location is selected through considering the location as the representative area for the whole area. Transect method has been done in both location in 5-
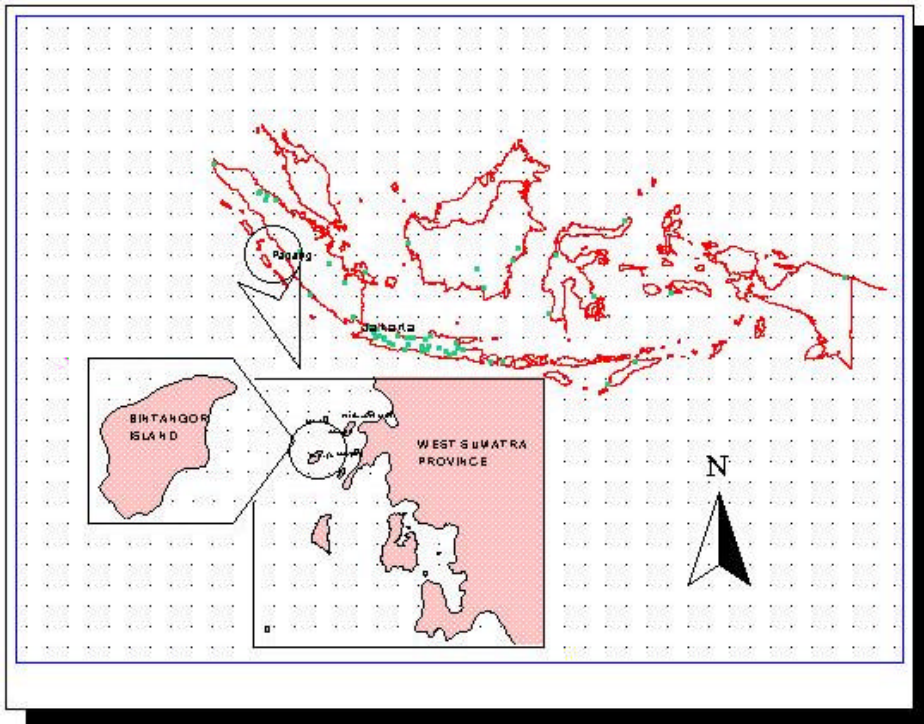
Figure 1 Location map of Bintangor Island
⬤ cities

m and 10-m depth. Length of line transect is 30 meter. The documented data involve number of coral reef fishes, type of species and percentage of benthic lifeform. GPS navigation is used for coordinate measuring of transect position. Based on these survey, it is found 30 colony of coral in 10-meter depth at the northern side of the island. Total coral cover is 14,91 m^2 in 10-meter depth and 21,45 m^2 in 5-meter depth. Primary data involve coral field survey data on 1999. Mantatow method is used during the survey in 1999. The documented data is percentage of living coral that found along 200-meter tow. The sampling stations are distributed around the island. Position of sampling stations has been measured. Figure 2 show the position of survey during 1998 and 1999. Percentage of living coral can be visualized as area on the map. The area is generated using ArcView spatial analyisis tool.
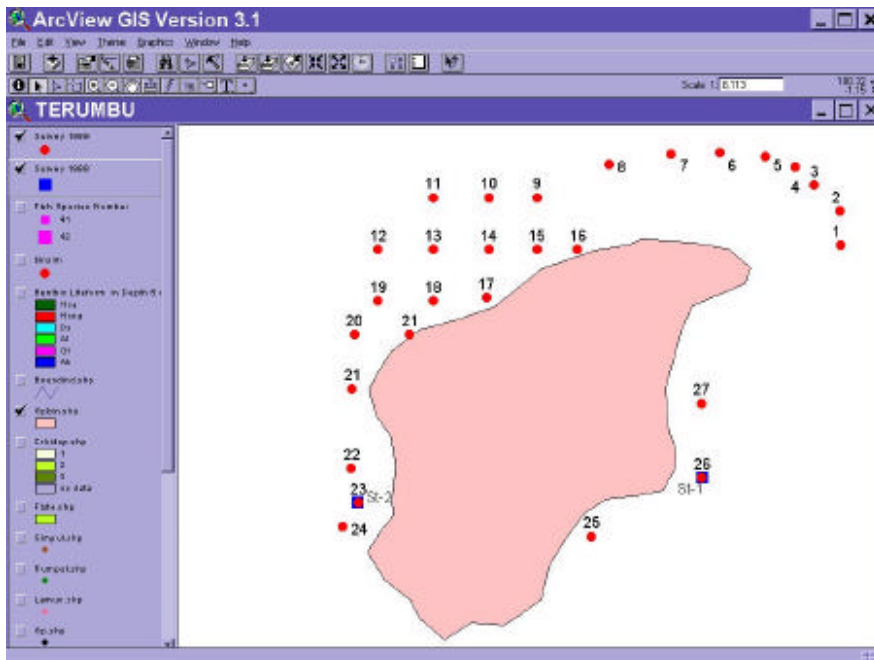

Figure 2 Sampling position of coral reef survey in 1998 &1999

and 1999 ⬤

Digital mapping is used to visualize information for the transect data above. Based on coordinate of sampling, those coral reef data are generated as point data. One point represents information of coral and fishes in 30 m transect length. ArcView GIS software is used to visualized the spatial data in shapefile format. MS Excel is used to manage its attributes data that can be import in ArcView format. In this case, there are two theme containing biotic information i.e. coral theme and coral reef fishes theme. One point in coral theme represents percentage of benthic lifeform in 30-m transect. Figure 3 visualizes percentage of benthic lifeform in 5-meter. Table 1 shows an attribute data of coral theme. One point in coral reef fishes theme
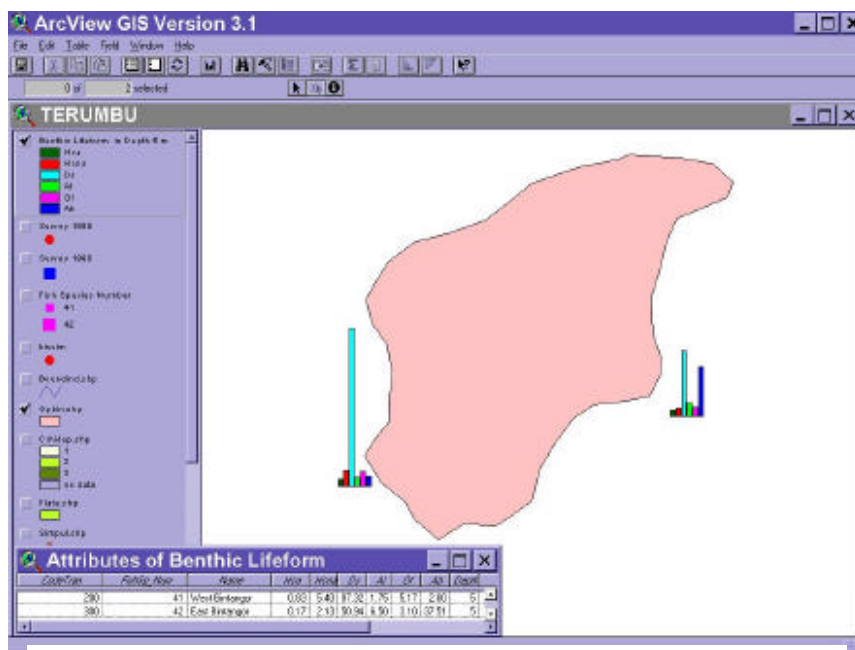
Figure 3 Percentage of Benthic lifeform in 5-meter depth
■ HCA   ■ HCNA   ■ DS   ■ AL   ■ OF   ■ AB

visualizes number of species that are found along the 30-transect as well as their taxonomic. Figure 4 visualizes number of species that are found in both location of survey.

Table 1. Percentage of Benthic Lifeform of Bintangor Island, West Sumatra Province (LIPI, 1998)

Location	HCA	HCNA	DS	AL	OF	AB	Depth
East Bintangor	0.17	2.13	50.94	6.5	3.1	37.51	5
West Bintangor	0.83	5.4	87.32	1.75	5.17	2	5
East Bintangor	0	7.92	63.6	3.29	7.68	26.25	10
West Bintangor	0	11	36.5	0	40.5	12	10

HCA= Hard Coral Acropora HCNA = Hard Coral Non Acropora DS= Dead Scleractinia AL= Algae OF=Other fauna
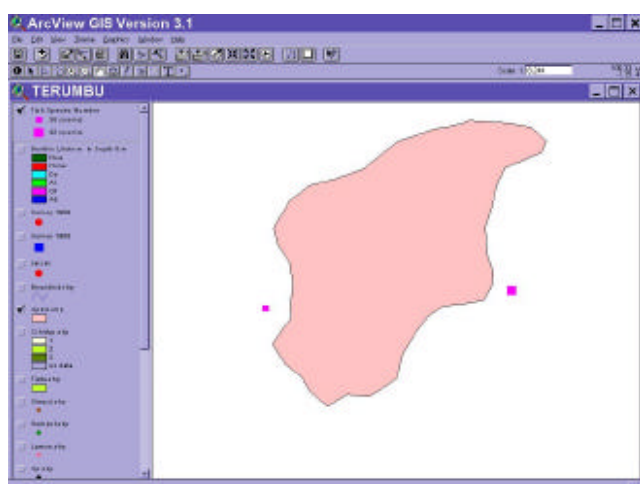AB= Abiotic   0= no data

Figure 4   Visualisation of species number of fish. It is visulaized using different size of the symbol. ■ 38 species ■ 42 species

LandSat TM 1998 is used to assessed the location of coral reef cover area and its clasification. Based on unsupervised classification it can be shown the area and type of coral reef cover in Bintangor Island. It is classified into vegetation, coral and sand (Figure 5). Figure 6 shows composite band 321 of Bintangor Landsat TM. Light color is assessed as shallow water where possibility of coral reefs cover occured. ERMapper software is used for image processing.

2.2 Coral Reef Digital Map of Bintangor Island
Based on fish map, it is visualized that eastern Bintangor Island has higher number of fishes species than western Bintangor (Fig 4). It is assessed that in eastern Bintangor has high diversity. Index species *Caranx melampygus* can be found in west Bintangor. Generally coral reef fishes in both locations are composed of *Acanthuridae, Balistidae, Chaetodontidae, Labridae, Pomachantidae, and Pomacentridae*. Coral map visualizes that in East

Bintangor (St-1) percentage of dead Scleractinia for 10-m depth is higher than that in the West Bintangor (St-2). Conversely, dead Scleractinian in St-2 is higher than that of St-1 for 5-m depth.
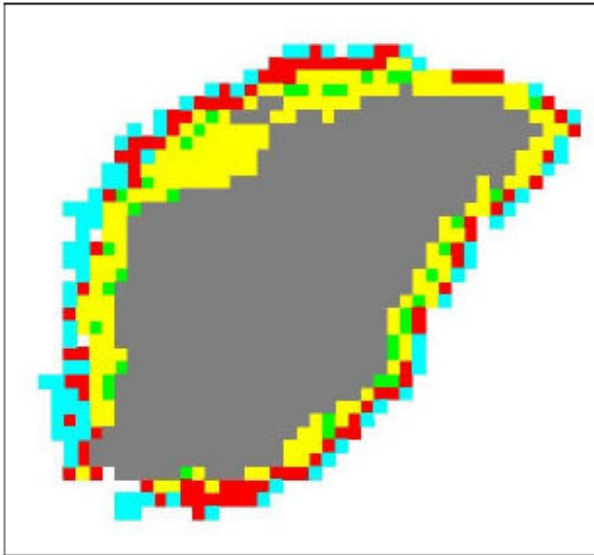

Figure 5 show unsupervised classified image
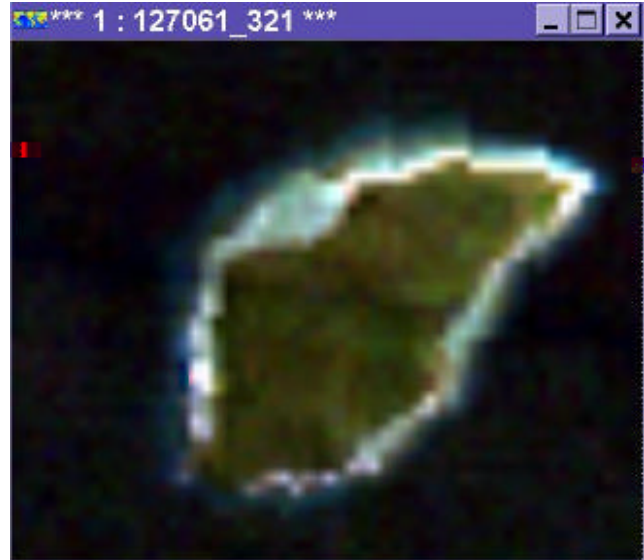🟩 vegetation 🟨 sand 🟦 living coral 🟥 dead coral

Figure 6 show composite band 321 of Bintangor Landsat TM Image Copyright 1998, LAPAN.

Coral in both locations is composed of *Porites, Favites, Montipora, Galaxea, Anemon, Astreopora, Psamopora, Leptopora, Hypnopora, and Pavona.* Base on coral map for 1999 (figure 7), in many locations including in st-1 and st-2 percentage of living coral is 0. High percentage of living coral has been found in the northwestern parts of the island. Based on coral maps of 1998 and 1999, it is assessed that coral reef degradation occurs in location St-1 and St-2.
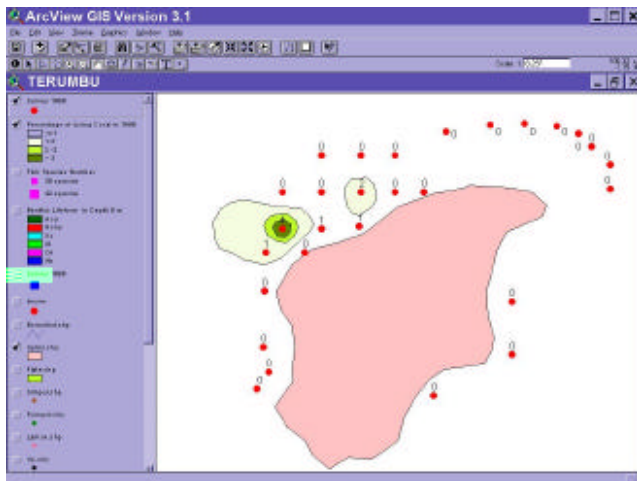

Figure 7 Percentage of living coral
⬜ <= 1% 🟩 1-2% 🟩 2-3% 🟩 >3
🔴 Sampling position with label of percentage of living coral

Both fishes and coral maps can define the status of coral reef cover. Good condition of coral is can be shown through the high diversity of fishes and high percentage of live coral in this ecosystem. It is still required more coral and fishes data as well as predator, vegetation and socio economic to define the status of coral reef in Bintangor Island.

3 CONCLUSIONS

Using digital mapping, coral reefs data of Bintangor island can be visualized easily. Based on coral sampling coordinate, those coral reef data is generated automatically as point data. Those information can be used to monitored and define the coral reefs status of Bintangor Island. It is assessed that there's heavily damage of Bintangor coral reef especially in location St-1 and St-2 from 1998 to 1999. Nevertheless it is still require more detail and complete information to ensure the condition of Bintangor's coral reef and to analysis the cause of their damage.

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REFERENCES

Dahuri,H.R., Jacub Rais, Sapta P. Ginting, and M.J. Sitepu. 1996. Pengelolaan Sumber Daya Wilayah Pesisir dan Lautan Secara Terpadu. PT.Pradnya Paramita, Jakarta

IUCN, 1993. Protected Areas Information: IUCN Protected Areas Management Categories.
http://www wcmc.org.uk/protected_areas/data/sample/iucn_cat.htm (14 August 1998)

LIPI and Bung Hatta University, 1998. Management Plan and Social Assessment of COREMAP project West Sumatra. End Report COREMAP project, Centre of Fisheries Study of Bung Hatta University, Padang West Sumatra

Masry, S.E. and Y.C.Lee, 1988. Introduction to Digital Mapping. Dept. Of Surveying Engineering University of New Brunswick, Canada, pp. 1 - 6

Suharsono, 1998. Condition of Coral Reef Resourcesin Indonesia. Journal Pesisir dan Lautan, Jakarta Vol. 1 No.2, pp.44-52