BATHYMORPHOLOGIC MAPPING OF COASTAL PLATFORM IN SILADEN ISLAND, NORTH SULAWESI [1]

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I. Introduction

Coral reef ecosystems benefit millions of people around the world. Coral reefs buffer coastal communities against ocean storms, provide a ready supply of animal protein, and harbor organisms with pharmaceutical properties. As the "rainforests of the sea", coral reefs provide esthetic pleasure to tourists and support tourism-based economies. Scientists value reefs as a living laboratory. Some people derive satisfaction from simply knowing that coral reefs exist. Human activities threaten coral reefs and diminish the benefits that reefs provide to society . Agriculture and coastal development pollute coastal waters with sediment and nutrients, smothering reefs and spurring growth of macroalgae. Destructive fishing practices, including the use of explosives, poisons, and fine mesh nets, can reduce entire reefs to rubble or leave them virtually devoid of animal life. Over harvesting by fishers and collectors provides short-term benefits at the expense of long-term sustainability. Boat anchors break apart coral colonies and reduce the physical complexity necessary to support the full diversity of reef species. Nonnative organisms, introduced by aquaculture farms or ship-borne ballast, out compete native reef species and may induce ecological cascades that threaten the integrity of entire reef ecosystems. Natural events, from hurricanes to disease outbreaks, can exacerbate the impact of these human activities.

Bunaken National Park (BNP) encompasses 89,056 hectares of land and sea area, divided into a southern mainland section (the Arakan-Wowontulap coast, protected primarily for its old-growth mangrove forests and dugong population) and a northern island section (including five islands with its fringing coral reefs and a mainland section). Since the establishment of the park, it has been realized that there is a need to form a coordination body. In the period of 1991-2000, the effort to form the umbrella organization always stumbled on legislation problems. However, BNPO (Bunaken National Park Office) itself was not able to cope with the whole range of problems and conflict in managing the park. A collaborative management is important between local government agencies (such as Tourism Agency, Fishery Agency, Environmental Agency, City Planning Agency, and Water Police), tourism private sectors, non-government organization, University, and local villagers who have been living and using the park resources for hundreds of years .

Siladen Island to represent one part of the island network exist in National Park region go out to Bunaken sea, outspread white sand encircle the island is to represent separate typical, in comparison with vicinity island. Other piquancy is Biodiversities coral reef height woke up by is assorted of biotic and a biotic community. This eksotisme attend beautiful panorama like white sand carpet and also the beauty of world underwater view, so that made as maritime tourism object. Of course, positive impact and negative attend in line with existing activity height, natural Coral Reef of pressure either from in (geologies process) and also from outside (human being and nature).

This study was designed to examine differences in Morphologic Coastal Platform use between Coral Reef Distribution around Siladen Island. The specific objectives were to (1) Identify reef morphology

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along Siladen Island coastlines., (2) Identify Coral Reef distribution according each profile measurement., (3) Identify and analyze the surface sediment on the Siladen Islands.

II. Material and Methods

II.1 Study area

Siladen Island resides in upstate from especial continent of Sulawesi Island and also represents the part of island bunch residing in Bunaken National Park (BNP). Individuality from Siladen Island is to have coastal sand carpet turn white and also interesting rocky terrace. Geographical position of Siladen Island resides in between 01º37'36.0" N and 124o48'14.0"E parallels Latitude North and Longitude East, where there are two the island constructor sediment type that is at part of south more dominant is fairish sediment of refinement (sandy beach) while to be upstate woke up by boulders or gravel composition (rock). Two the notching is to represent the part of geomorphology process that happened have hundreds of years , where southland from Siladen island face directly of Sulawesi seas, waving and also stronger tidal current so that island constructor structure more dominant is coral reef also compact volcano rock. On the contrary upstate area is to represent settlement area, farm topography which level off is so that wearied by local resident as countrified and plantation area.

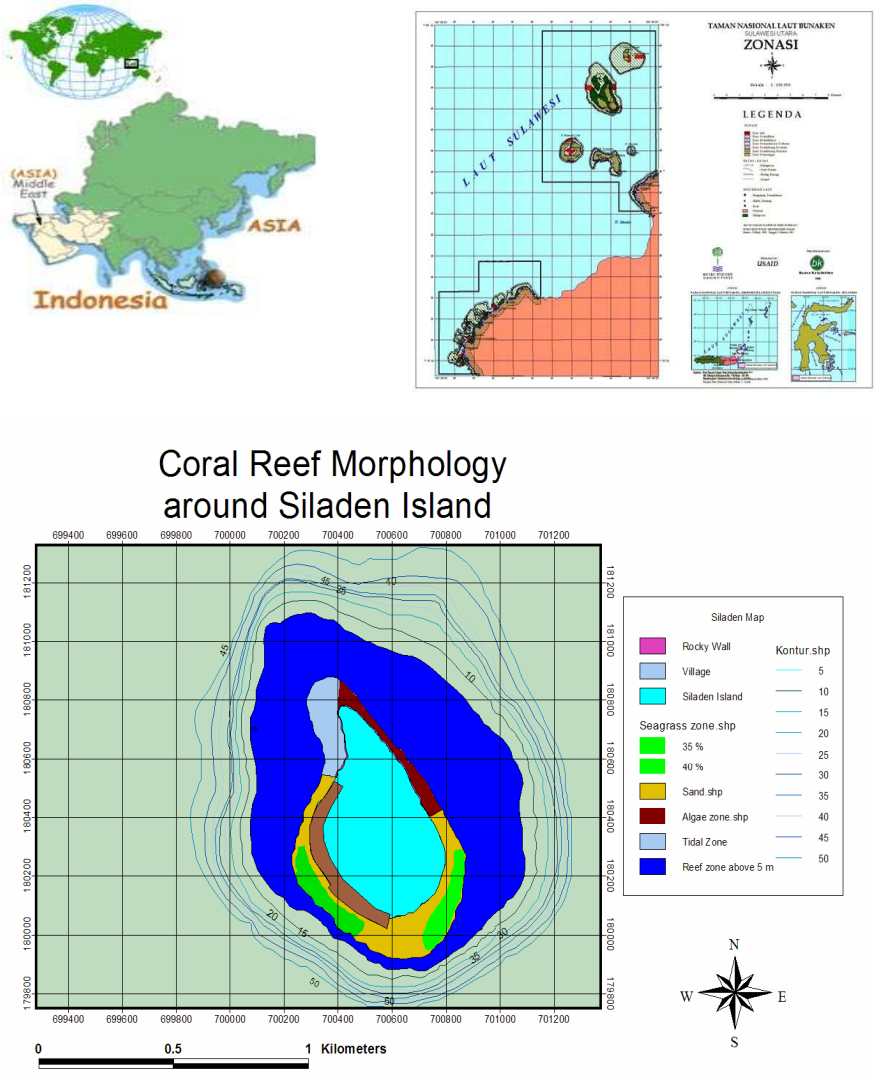


Fig1. Study Area at Siladen Island

II.2 Surveys and sampling

II.2.1 Beach Profiling and Bathymetric

This method utilizes a set of 1.5-m poles, graduated to 1-cm intervals, and attached by a 3 m graduated rope. Researcher's start by taking a vertical reading at the front stake, and continue making horizontal and vertical measurements along the length of the transect to the water's edge. The person holding the rod on the landward side sights to the horizon and records the elevation loss or gain. Measurements are taken every 3-m horizontally, or wherever a significant change in topography occurs. The record from each transect consists of a series of horizontal distances, vertical distances and appropriate annotations (end of dune grass, last high tide line, etc.) where warranted (Hill et al. 2002). Furthermore, Bathymetric survey, digitize from Bakosurtanal Map (1991).

II.2.2 Reef classification

There are several approaches to habitat classification in coral reef habitats (see, for example, English et al., 1994; Mumby & Harborne, 1999). Yet so little baseline documentation exists on links between reef habitats and ecosystem functions in Southeast Asia that good empirical evidence can not be invoked for favoring any one system in particular (Tomasick et al., 1997). Indeed, the very definition of 'habitat' depends on whose habitat is being referred to, and it makes little sense to classify a landscape in great detail unless such reference points are well defined. A rare, coral-reef example of habitat being classified specifically with respect to named species is the work by Holbrook et al. (2000). We considered the comprehensive ASEAN-AIMS classification scheme (English et al., 1994), which has some 30 coral categories in a hybrid scheme of coral growth-form and taxonomy. Two independent groups of marine park staff with experience in diving and coral line-transect survey were allowed to classify the same video recordings using this scheme, but with a classification discrepancy of >85% the results were discouraging. This and several other schemes have been developed for line-intersect transect studies (English et al., 1994), and are poorly suited for characterizing areas, which usually comprise a mosaic of bottom types. Yet landscape classification in coral reefs must tackle the latter problem. Work is currently in progress to evaluate various approaches to area classification of Malaysian reefs based on geocoded reef data from several marine parks. For the purposes of this limited survey, we chose to use a very broad classification scheme comprising six categories of dominant bottom type: Branching, Massive or Tabulate corals, and Rock, Rubble or Sand. In addition, the seafloor was classified into six categories of live coral coverage, with the scale 0–5 representing low to high coverage: 0 (0–5%), 1 (6–20%), 2 (21–40%), 3 (41–60%), 4 (61–80%), and 5 (81–100%).

II.2.3 Sediment Sampling

Surface sediment samples were taken from four (4) sites. A total of 20 samples was taken by hand (scooping the upper 5±10 cm into a sample bag) from back reef to fore reef by hand or using a small Van Veen grab. Sediment and core samples were analyzed for grain size using a particle sizer (Granulometric). Sediment sample from the field was sieved through 7-sieve (-2 to 4 ϕ) size to determine grain sizes, the weight of each sieve is measured by using a weigh pan. Approximately 100 g of sediment was retained for analysis. In the laboratory, sediment samples were divided using a sediment splitter, with one-half of the sample used to determine grain size parameters, the remaining half to determine constituent composition of the sediments. Grain size parameters (mean grain size and sorting) were calculated following standard dry sieving techniques (McManus, 1988 *in* Perry, 2003). Constituent composition was determined following resin impregnation of samples and thin-section preparation. Three hundred grains were counted in each section, and results converted to percentages.**Result**

Geomorphologic Attribute in Siladen Island

Conducted by measurement at 4 (four) transect that is : West, South, North And East in Siladen Island show that morphology from Siladen island is same and consist of 5 (five) type: Back Reef, Reef Flat, Reef Edge, Reef Slope and Fore Reef Slope. From 5 (five) reef morphology type such as those which shown by Figure 02 hereunder that morphology and structure from situation of Siladen island differ one another.

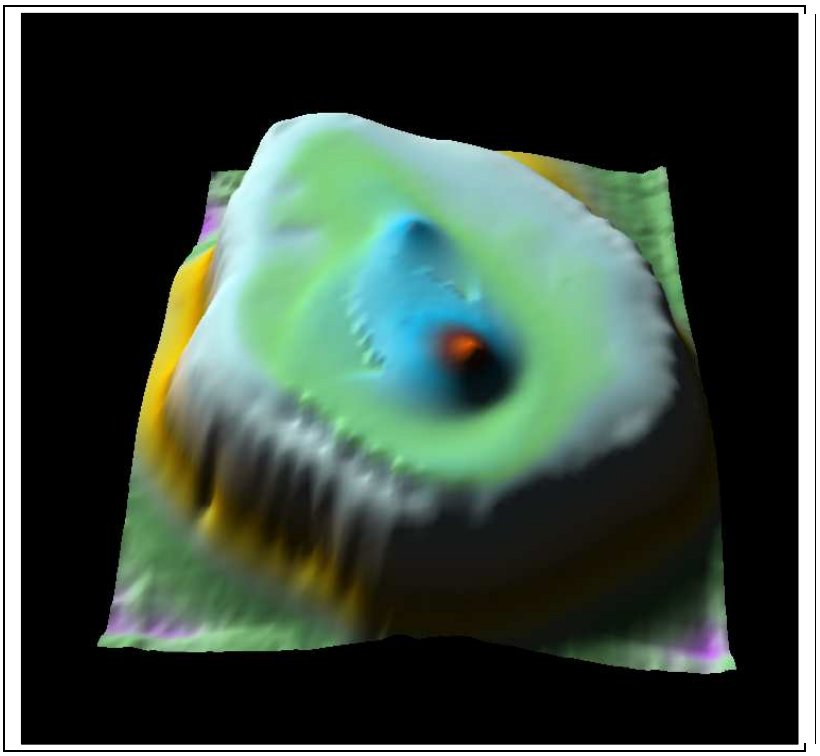


Fig. 2 Location and characteristics of study transects used in this study. Transect numbers are as referred to in the text. Positions and numbers of sediment sample points on each transect are also noted

Tidal (ebb and flood tide) condition of Siladen Island (Fig. 3) like informed by DISHIDROS and Watershed Department North Sulawesi that ebb range from 2-3 meters. Condition of Siladen Island influenced many by local conditions from Manado Bay residing in side East and South, while at part of its West there is Bunaken Island so that the condition of this area form its tight strait part of East which nearby Tongkeina beach. On the contrary, at Northern site influenced many by condition of territorial water of Open Sea (Sulawesi Seas), so that very is differing from of other condition in this island. Hard rock composition predominate tidal area and also the happening of erosion at some place because of environmental influence of physical condition from Sulawesi Sea which continuously break its area. Such as those which shown by picture hereunder ebb tide areas around Siladen Island where condition of bathymetric from this is sea water boundary very having an effect on to condition of ebb tidal.

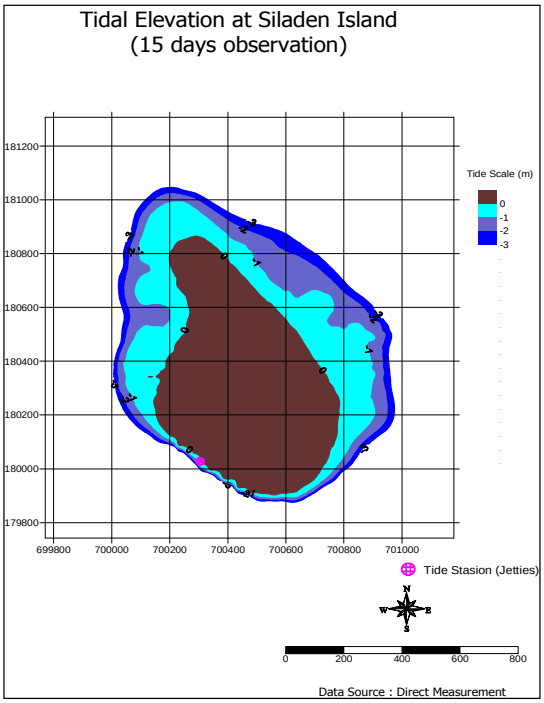


Figure 3. Tidal elevation at Siladen Island

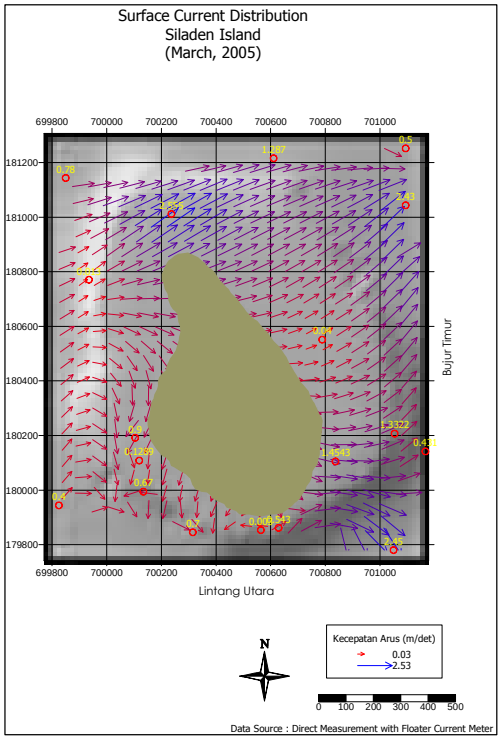
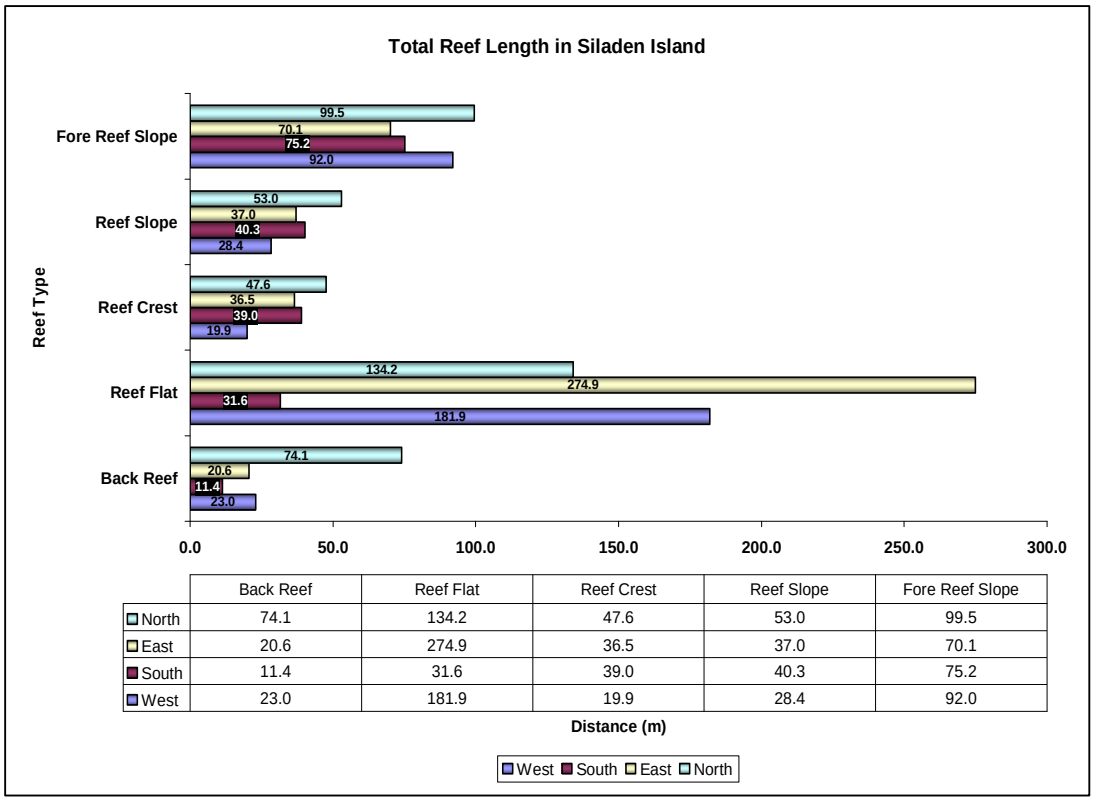


Figure 4. Surface Current Distribution at Siladen Island

As for, water mass circulation go out to sea influenced many by local condition, where territorial water around Siladen island represent solidarity between semi enclosed water (Manado Bay) and open territorial water (Sulawesi Seas). From picture, above, representing result of measurement at certain a time gap, where, measurement at sampling point with eularian method, Where movement of sea current seen with object float to get speed (cm/sec) and direction (degree) of current. From result of measurement; then made by simulation to get current model around March 2005, which got by movement of dominant current eastwards. This matter, supporting with situation of coral reef morphology from Siladen island where at side part of west from the island is to represent area have strait (between Bunaken and Siladen Islands), hence mass waters exist in this place entering from north direction and south emit a stream of to go to part of east.

Reef Length

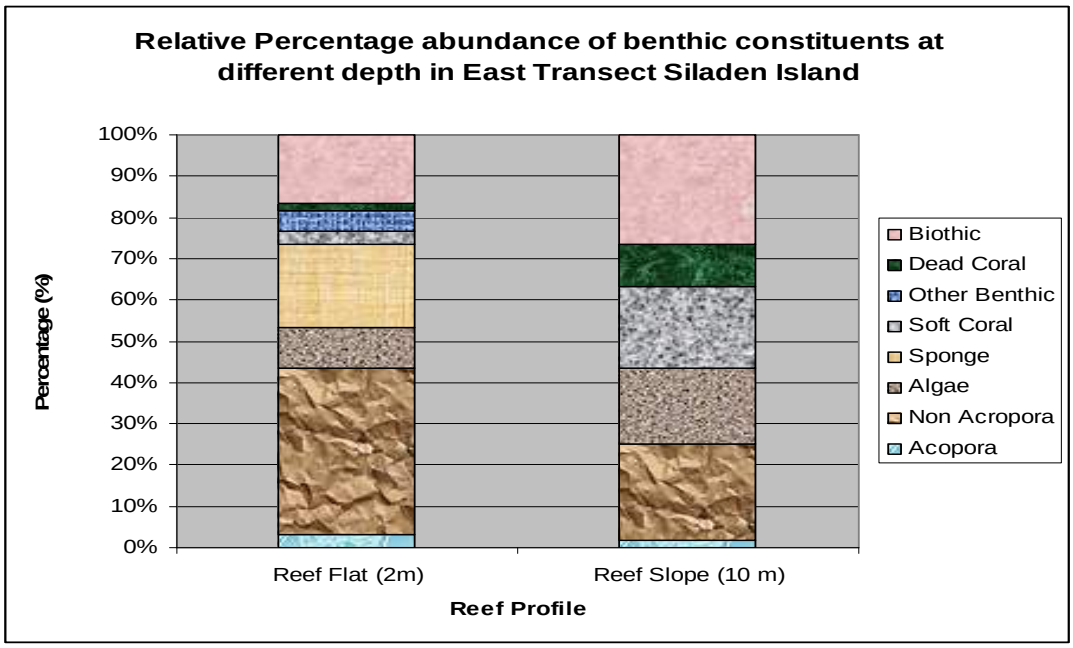
Condition of reef morphology at Siladen island, owning some variation of like condition and length from place structure is growing of some sea biota. From result of measurement of reef flat at east side have length that is : 274,9 m. However, contrast seen that back reef this very short side also, that is: 20,6 m.



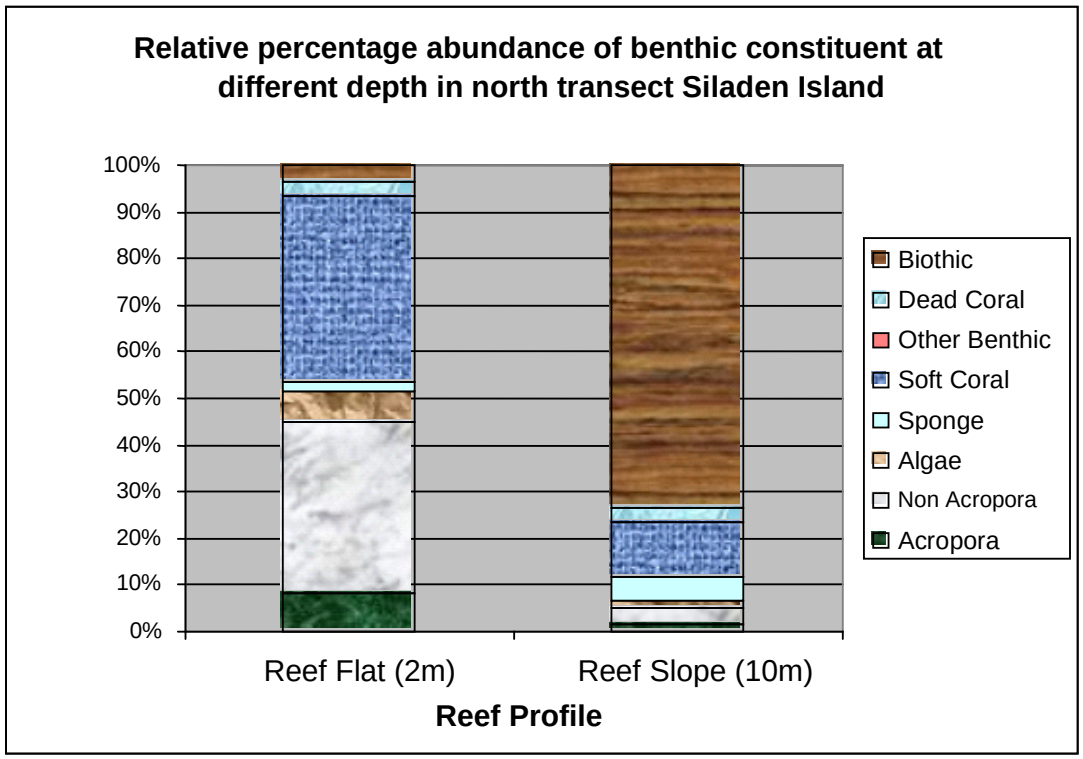
	Back Reef	Reef Flat	Reef Crest	Reef Slope	Fore Reef Slope
North	74.1	134.2	47.6	53.0	99.5
East	20.6	274.9	36.5	37.0	70.1
South	11.4	31.6	39.0	40.3	75.2
West	23.0	181.9	19.9	28.4	92.0

Reef and Coral Reef Communities in Siladen Island

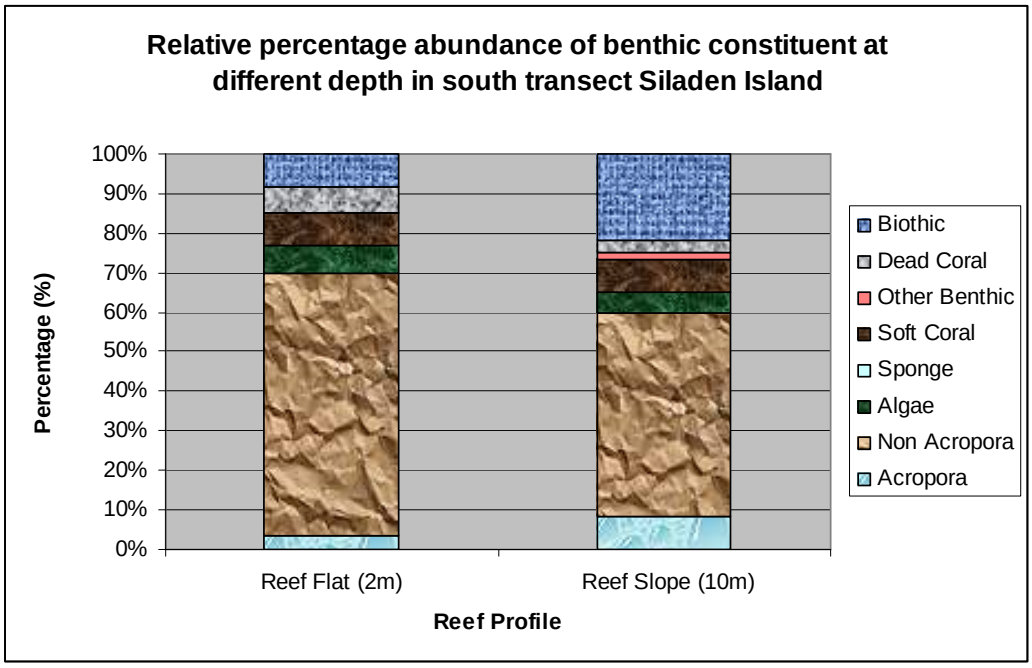
East Transect



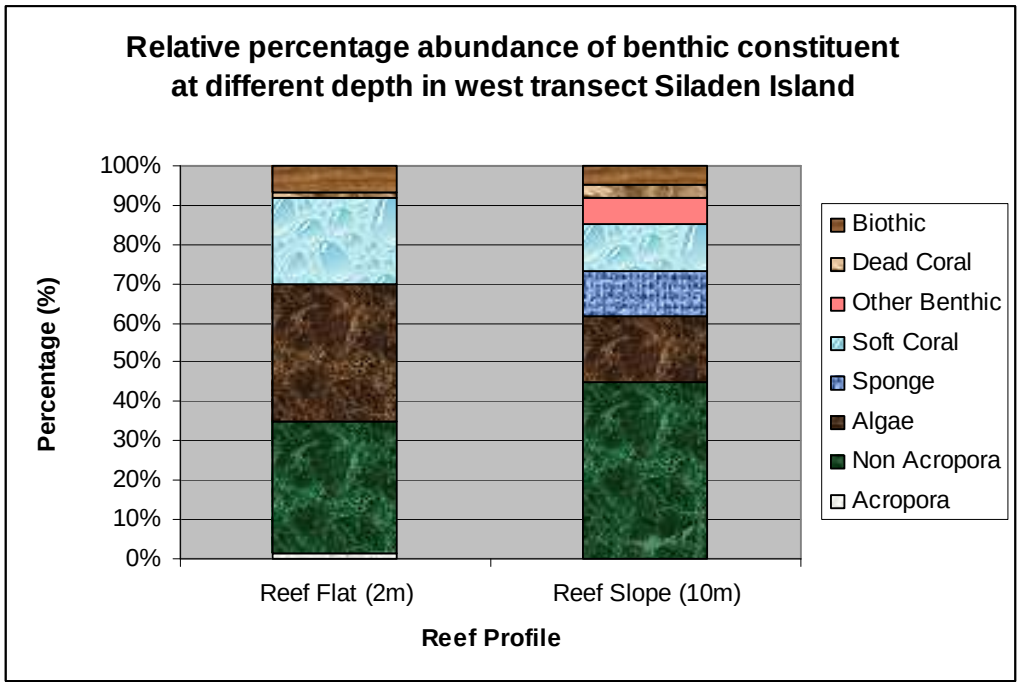
North Transect



South Transect



West Transect



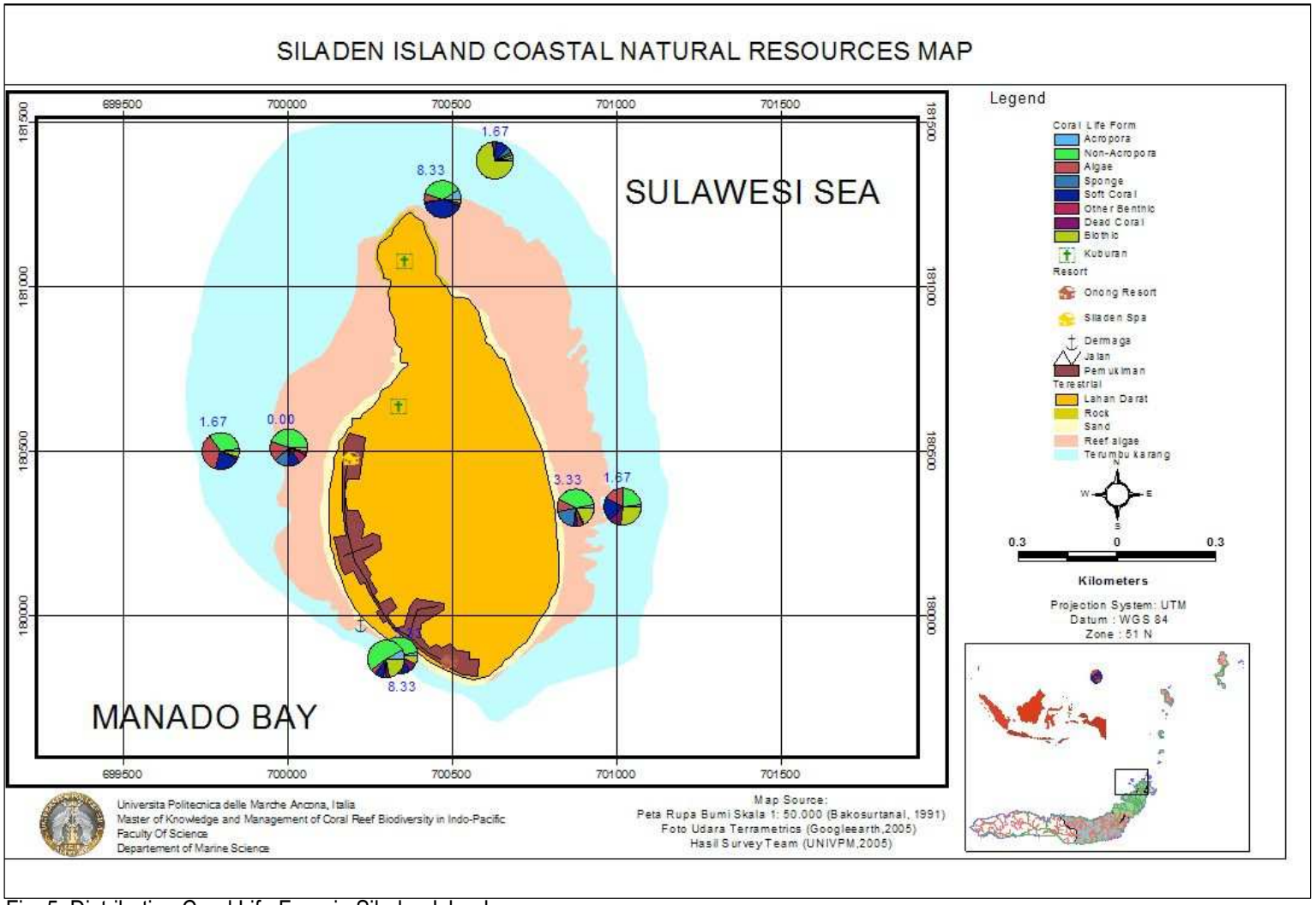
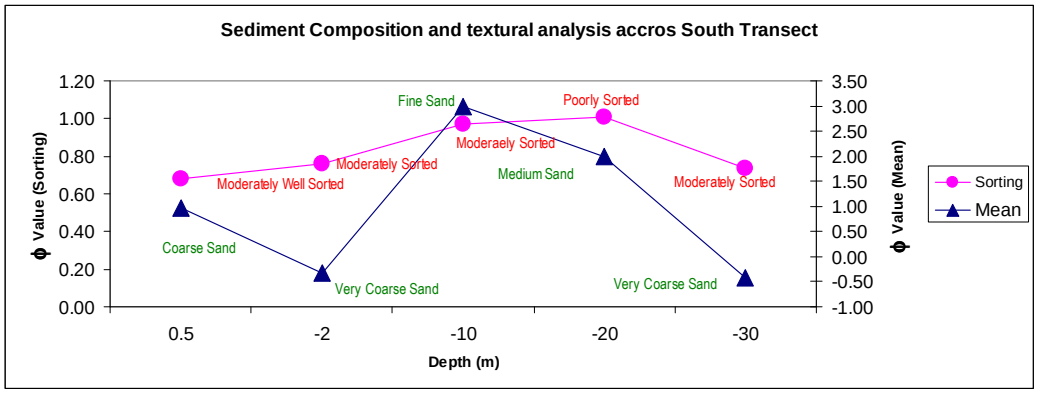
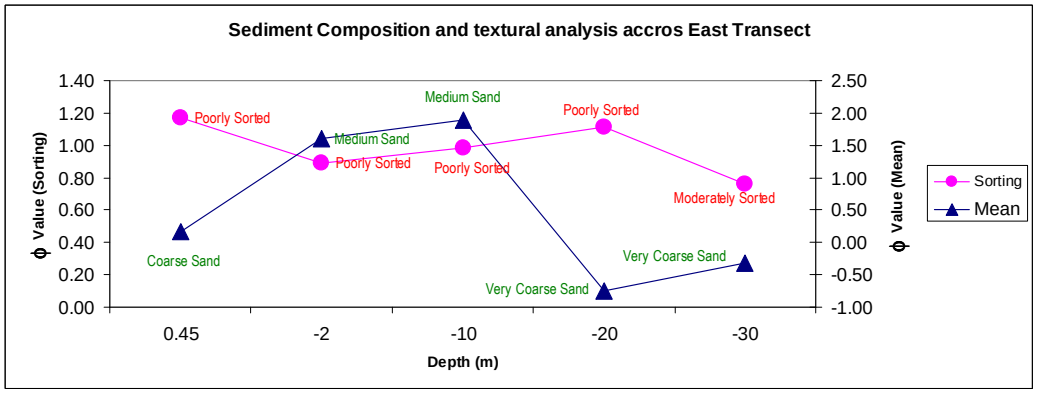
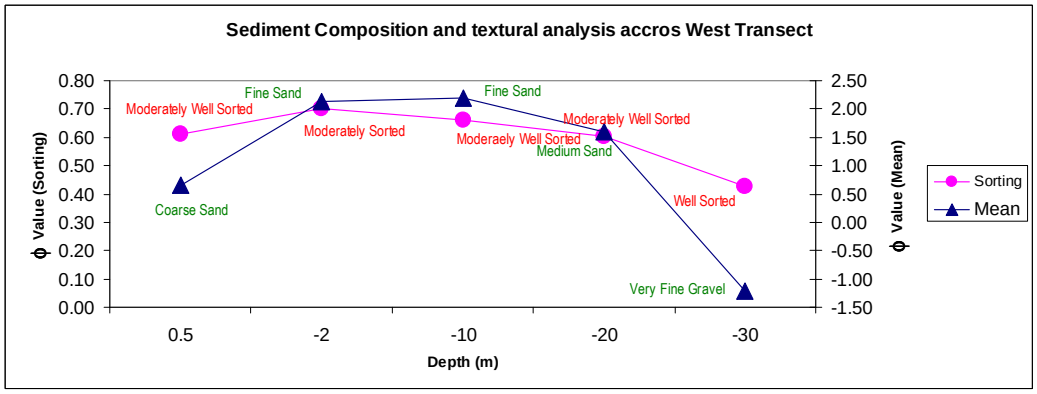


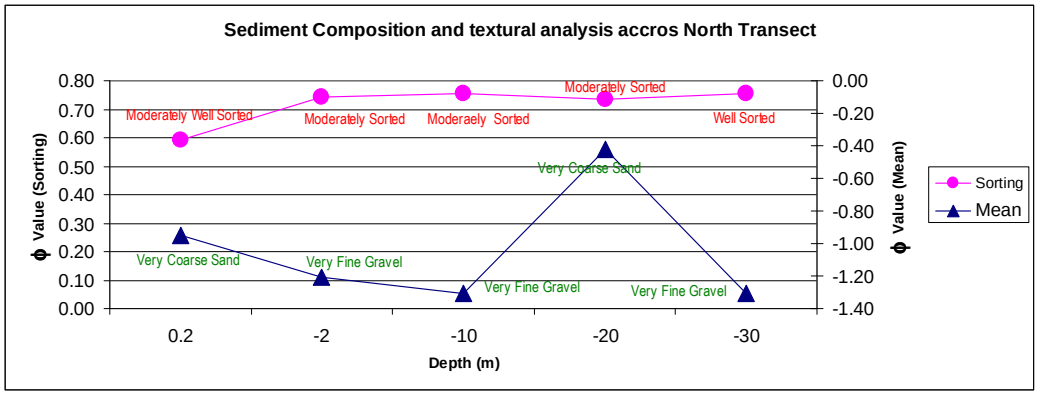
Fig. 5. Distribution Coral Life Form in Siladen Islands

Sediment Composition and Textural at Siladen Island








Sediment Composition and textural analysis accros North Transect
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
ϕ Value (Sorting)
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
ϕ Value (Mean)
Moderately Well Sorted
Moderately Sorted
Moderaely Sorted
Moderately Sorted
Well Sorted
Very Coarse Sand
Very Fine Gravel
Very Fine Gravel
Very Coarse Sand
Very Fine Gravel
Sorting
Mean
0.2
-2
-10
-20
-30
Depth (m)

Conclusion

1. Reef framework (morphology) around Siladen Island is both Spatially and Bathymetrically varied to each transect, where distribution from reef length is *reef flat*.
2. Coral reef communities, generally present *high coral cover in reef flat* as well as many spur and grooves distribution.

Sediment distribution, generally in deeper area sediment have *coarse sand* and *poorly sorted*

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Perry, C.T. 2003. Coral reefs in a high-latitude, siliciclastic barrier island setting: reef framework and sediment production at Inhaca Island, southern Mozambique. *Coral Reef*, 22, 485 – 497.