The Mitigation Of Coastal Abrasion On Islands, Special Reference To The Kodingareng Keke Island Makassar City, Indonesia

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***Abstract*— The research of coastal abrasion prevention on Kodingareng Keke Island aims to analyze types and methods of coastal protection in an effort to mitigate major coastal areas damage to coral reef ecosystem, overcoming the danger of abrasion susceptibility and sedimentation around the island and assessed coastal abrasion prevention methods in the study area.**
The research method used in the form of measurement and data retrieval directly in the field and continued processing data in the laboratory equipped with previous research data, which produces the types and methods of countermeasures. The main factors affecting the shape and shifting of sand sediment is the waves in the western seasons (October-April) that cause abrasion in the western and southern parts of the island. Based on the island's hydrodynamic conditions, it is proposed the installation of break water, revetment and seawall as well as the planting of mangrove trees around the platform of the island.
The research of this study are expected to be useful for the government and stakeholders in terms of handling coastal areas, as a reference for policy making and control measures in an effort to overcome coastal abrasion in order to preserve the environment can be maintained, considering the area of research is a tourist area and as the object of research and location of field practice of students who need attention.

***Index Term*— Abrasion,mitigation, Kodingareng Keke Island, wave**

I. INTRODUCTION

In recent years,the shoreline in someareas of Indonesia has suffered a considerable depreciation (Koddeng, 2011).
Some basic assumptions about it are that coastal areas are negatively impacted by the presence of natural phenomena that are geographically distinct. Natural factors are abrasion, sedimentation, sea level rise, tsunami and rob, which overall impact on the coastal area so that suffered severe damage. In addition to several natural factors, other factors that cause damage in the coastal area is due to the behavior of surrounding communities. This illustrates that a coastal area is vulnerable to environmental changes.

General description and as initial data for further research is the mitigation of coastal abrasion susceptibility in the form of hydrodynamic condition of Kodingareng Keke beach and island shift (sand sediments) north tonortheast along ± 5 meters per year. Massive abrasion occurs in the southern and western parts of the island during the western season (October-April).

Coastal protection can be done with soft solution or hard solution (Triatmodjo, 1999). The soft solution (non structures) can be planting mangrove trees (mangrove), sand nourishment, conservation of sea corals and sand dunes on the beach. Way of hard solution (structure) handling by making the structure of coastal protection building, such as seawall, groin, jetty or breakwater.

II. STUDY AREA

Kodingareng Keke Island is one of the coral islands formed in the Spermonde Islands with an area of about 8774 m2, located west of the Makassar City, South Sulawesi with a distance of 13.48 km and is included in the area of Ujung Tanah subdistrict. Geographically located at position 119º17'17"- 119º17'20" East Longitude and 5º6'18 "- 5º6'22" South Latitude (Fig. 1).

Parts of the western and southern islands are composed of relatively flat and sloping coral reefs, while the eastern and the northeast are relatively steeper. The condition and physiography of the island as such occur by the hydrodynamic activity of coastal waters towards the island, especially the west and east seasons. This tends to occur on all islands in the area of Sangkarang, Makassar Strait.

Fig. 1. Location map of study area in Makassar City

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The coast of Kodingareng Keke Island are shallow waters area with varying depths ranging from 2 to 20 meters. The composed of islands are of coral reef organisms fragments that are clearly visible during low tides of exposure, especially in western waters formed by erosion and sedimentation processes (Fig. 2).

Fig. 2. Illustrates the material of the island composed of coral reef destruction

III. METHODOLOGY

Data processing in this study is based on review and field activities, observation of island morphology, determination of location of abrasion and sedimentation, measurement ofabrasion distance from 5 m depth to shoreline and determination of position and type of coastal protection based on island conditions.

The hydrodynamic analysis is done by making the modeling in accordance with the condition of the island with the help of 2-dimensional hydrodynamics software that is SMS (Surface Water Modeling System). Analyze two seasons (West and East) relating to the proposed design of coastal protection building.

After the type of coastal protection that can influence the current direction and velocity, the design and type of coastal protection building can be determined with due regard to field conditions

Interpretation of field data is intended to link the data of each measurement to a conclusion that summarizes the entire data. The final result at this stage of the research in the form of information about coastal abrasion mitigation covering type and shape and position of coastal protection.

IV. RESULTS AND DISCUSSION

Kodingareng Keke Island is composed of coral reefs and rework coral sand, part of the island that appears above sea level in the form of coral sand deposits that are underline by the coral body. These coral reefs have undergone tectonic uplift since the Quaternary period, resulting in silting and causing most coral reefs to die and destroyed by waves and accumulate on reefs to form sandy islands.

The west wind during the west season (October-April) causes the movement of waves from southwest to northeast and from south to north, in this region will occur erosion, especially the sand island body. Further in the north and north-east where there is wave diffraction accompanied by the deposition of the sediment transport material of the wave and the shoreline currents, causing the shape of the island to curve eastward.

On the east season (June-March) movement of the waves from southeast to northwest and east to west, so on the south and east of the island there is a wave diffraction accompanied by sedimentation of sedimentary material, causing the form of a curved island to the west (Bloks and Mappa, 1986) . Fig.3

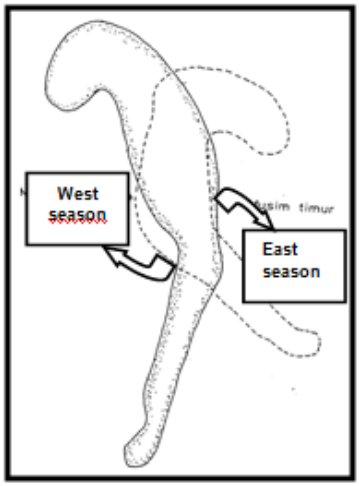

Fig. 3. Changes in the shape of Kodingareng Keke island in the west and east seasons (Bloks and Mappa, 1986).

The year-round wave activity occurs mainly peaked in the west season, so the sand island shows a movement toward the northeast, with an average speed of 5 meters / year due to erosion.

The interpretation of satellite imagery, it shows that within 10 years there were significant changes in the shape and shift of Kodingareng Keke Island in 1998, 2003 and 2007, and field

research in 2008.

Fig. 5. Seawall made of wood damaged as a resultwaves hit in the west season

The occurrence of this change is strongly influenced by the activity of currents and waves in each season, especially in the west season which causes the erosion and deposition on the other side every year, so that the change of shape, extent and position (Sirajuddin, 2011). Kodingareng Keke Island, based on the interpretation of satellite imagery, has increased the extent, shape and position due to coast dynamics activities and geological processes (Table 1 and Table 2 and Figure 4).

TABLE I
Changes of wide of Kodingareng Keke Island based on satellite image interpretation and field measurement.

Satellite image interpretation	Wide (m^2)
1998	4.875
2003	7.119
2007	8.741
Field measurements 2008	8.774

TABLE II
Changes in longitude and latitude positions of Kodingareng Keke Island

Years	Longitude Position	Latitude Position
1998	119º17'15,4" - 119º17'18"	5º6'18,2" - 5º6'21,4"
2003	119º17'16,5" - 119º17'18,7"	5º6'18" - 5º6'22,1"
2007	119º17'16,5" - 119º17'19,8"	5º6'18,2" - 5º6'22,8"
2008	119º17'17,5" - 119º17'20,2"	5º6'18,5" - 5º6'22,5"

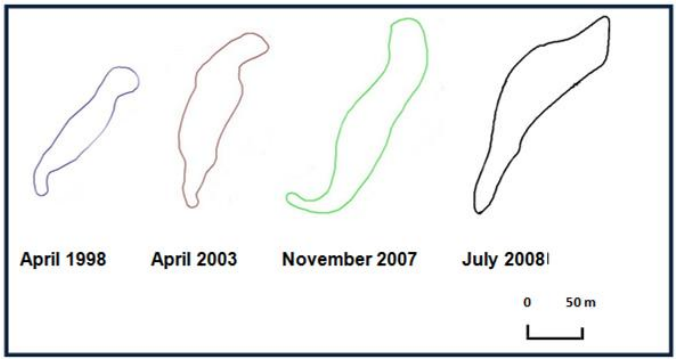

Fig. 4. Changes in morphology of Kodingareng Keke Island based on satellite image interpretation (1998, 2003, 2007) and fieldwork (2008); (Sirajuddin, 2011).

Determination of Types and Methods of Abrasion Protection

Has been carried out by the residents of Kodingareng Keke Island to cope with coastal abrasion such as planting protective trees, coral piles around the abrasion area, the installation of stoned piles filled with stones and others, but all failed to ward off the ferocious waves eroding the shore, trees and ignited rocks (Figure 5).

The ferocity of waves accompanied by longshore current, especially in the western seasons, is very difficult to break directly against the side of the island. By that it must first be reviewed the condition of oceanography and island physiography as well as interpretation of other data that can overcome or reduce the abrasion of the coastal area. In the results of observations and field research either directly or from previous research data (Bloks and Mappa, 1984; , 2011 and Kaharuddin 2016) on the condition of the island and the nature of hydro oceanography and its interpretation, the steps to overcome coastal abrasion in Kodingareng Keke were chosen by type and method according to Triatmodjo (1999) and Luqman H.F and Yessi NK (2016), among others:

1. Breakwater, or breakwaters are placed on the exterior of the shoreline at a certain distance according to island conditions and wave characters. In addition to its function as a wave breaker or waveguide, it is also due to its nature that the occurrence of wave diffraction can lead to sediment accumulation at the back of the breakwater position as a natural dike (tombolo. Based on observation of Kodingareng Keke island condition, there are 10 proposed breakwater locations to be placed around the island with varying distance between 15-100 meters from shoreline.
2. Revetment and Seawall, is a beachfront that is placed on the beach to protect the erosion that may still occur, although the breakwater has been installed in several places around the island. According Triatmodjo (1999) this building has advantages that is :
   - more massive resistant to the wave, although it must be taken into
   account suction power wave (backswash) at the foot of the building
   - The use of building materials is relatively small
   - Construction is relatively cheap
   - Can function as a dock

   From the field observation, the revetment and seawall are placed as many as 6 locations.
3. Planting of plants, selected mangrove trees grown in coastal waters on certain conditions. For the time being expected breakwater can help in the case of break / wave absorbers at the time of early monitoring of mangrove growth. From the field observation, 5 mangrove cultivation sites were proposed based on water conditions suitable for growth. Distance from coastline varies between 3-15 meters (attachment Map of Abrasion Mitigation)

On the ground there was a public effort and the government built seawall from the ironwood pegs and on the inside of the island filled with boulder rocks of a kind of basalt rock, but its durability has not been tested because based on observations at the time of the east season where seawall is placed to the west of the southern edge sedimentation island. So have to wait for the west season whether to survive or not.

V. CONCLUSION

Kodingareng Keke Island is composed of coral reefs covered by sand sediments and coral reefs that are vulnerable to erosion

The influence of the dominant currents and wave erosion in the west season causes the sand island to shift northeast to an average of 5 meters per year

Based on the unique and specific Kodingareng Keke Island conditions, the types and methods of abrasion prevention are breakwater, revetment and seawall as well as planting (mangrove trees)

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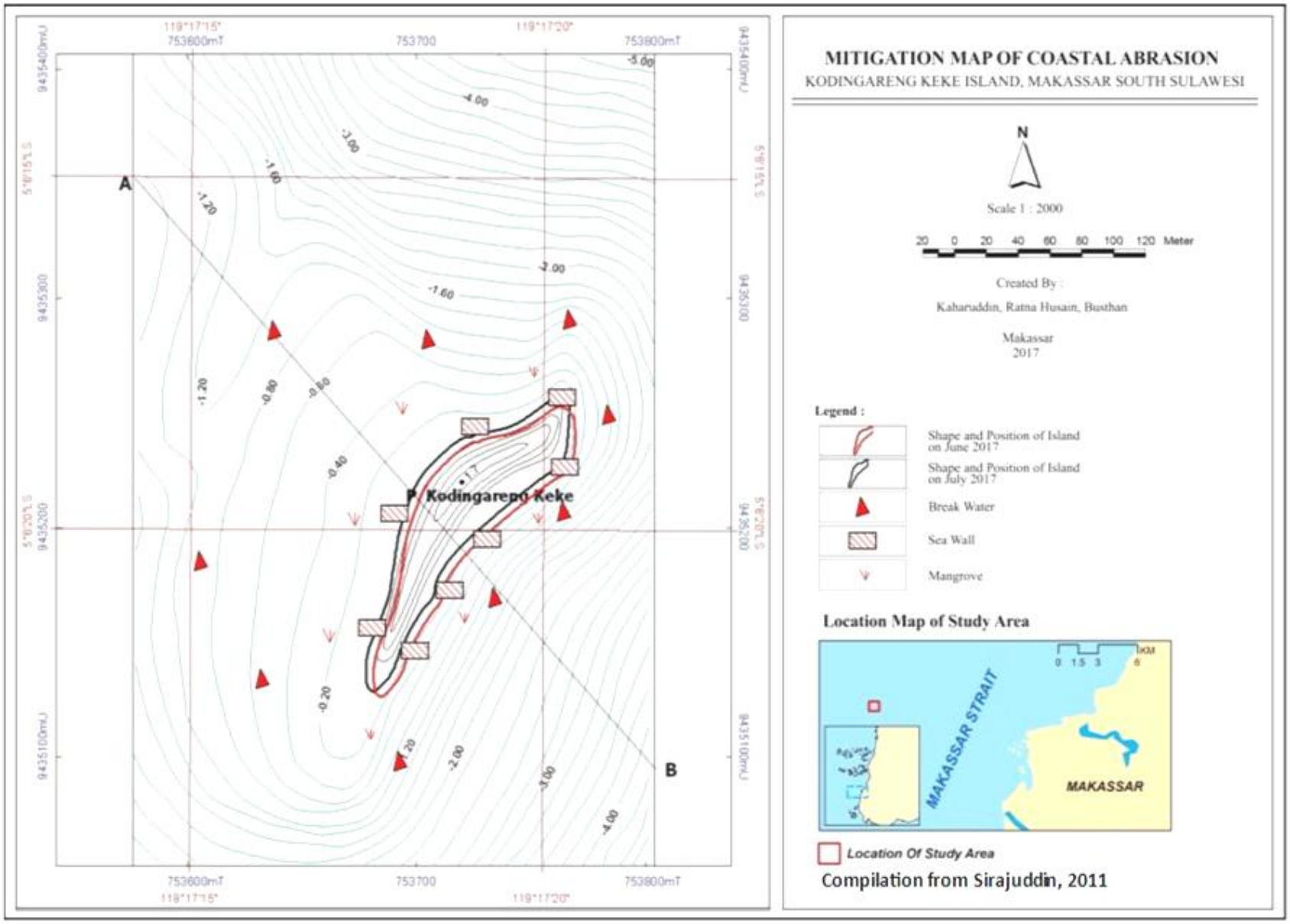
MITIGATION MAP OF COASTAL ABRASION
KODINGARENG KEKE ISLAND, MAKASSAR SOUTH SULAWESI
N
Scale 1 : 2000
20 0 20 40 60 80 100 120 Meter
Created By :
Kaharuddin, Ratna Husain, Busthan
Makassar
2017
Legend :
Shape and Position of Island on June 2017
Shape and Position of Island on July 2017
Break Water
Sea Wall
Mangrove
Location Map of Study Area
MAKASSAR STRAIT
MAKASSAR
Location Of Study Area
Compilation from Sirajuddin, 2011
P. Kodingareng Keke
A
B
753600mT
753700
753800mT
119°17'15"
119°17'20"