

# IDENTIFYING THE PHYSICAL CHARACTERISTICS AND COASTAL DYNAMICS FOR THE SEA TURTLES SPAWNING GROUND AT GOA CEMARA COASTAL AREA, YOGYAKARTA

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**Abstract.** The sea turtles existence are endangered because of the natural circumstances and the human activities, therefore they are being protected under the law. One of the sea turtle's spawning ground located at Goa Cemara coastal area, Yogyakarta. The sea turtle's spawning ground has specific physical characteristics of the coastal area. Those characteristics could be assumed as the reference to construct the suitable habitat for the sea turtle's conservation. The aims of this research are to identify the physical characteristics for the sea turtle's spawning ground at Goa Cemara coastal area, Yogyakarta, and to identify the coastal dynamics at Goa Cemara coastal area which potential to influence the sea turtle's spawning ground. This research is using the field observation, laboratory analysis, image interpretation, and modeling map. This research also using Unmanned Aerial Vehicle (UAV) record from east and west monsoon period. The result from the UAV allows to produce the high-resolution of aerial photographic image which helpful for identifying the physical characteristics of the sea turtle's spawning ground and the coastal dynamics at Goa Cemara coastal area. The results of this research are the physical characteristics of the sea turtle's spawning ground and the coastal dynamics map at Goa Cemara Coastal Area.

## 1. Introduction

Sea turtle is categorized as endangered animal because of the natural circumstances and the human activities. In Indonesia, sea turtle's existence is critically endangered and protected under the law which regulated in Government Regulations 7/1999 about protection of endangered animals and plants. There are six different species of the sea turtle which live in Indonesia. Those species are *Lepidochelys olivacea*, *Chelonia mydas*, *Dermochelys coriacea*, *Caretta caretta*, *Eretmochelys imbricate*, and *Natator depressus*.

Sea turtles have their own life cycle which is consist of three main habitat such as the habitat for foraging, mating and spawning (Uchida 1983). Sea turtles habitat for spawning requires on shore area. Sea turtles come to the shore only when they need to spawn their egg, and the surround environment must be in a wide heterogeneous ecosystem. The sea turtles choose a location with some specific geomorphic characteristics.

The Sea turtles spawning ground has its own physical characteristics that related to the geomorphological characteristics. The physical characteristics consist of morphology, granulometry, wind, wave, and land use. The physical characteristics also related to the coastal dynamics such as wave erosion and the changes of shore line (Zarkasi et al. 2011).

One of the sea turtles's spawning ground is located on Goa Cemara coastal area, Yogyakarta. Goa Cemara coastal area has its own sea turtle's conservation. By identifying the physical characteristics and the coastal dynamics for sea turtle's spawning ground, we are able to describe both the potentials and the barriers as the reference to construct the suitable habitat for the sea turtles life cycle.

## **2. Objective**

This research is aim to (1) identify the physical characteristics for the sea turtle's spawning ground at Goa Cemara coastal area, Yogyakarta and (2) observe the coastal dynamics at Goa Cemara coastal area which have the potential for influencing the sea turtle's spawning ground.

## **3. Literature Review**

Geomorphology is the systematic study of the earth surface, but for simplicity it is also may well called as the study of landform. Landform refers to the physical surface features such as beaches, rivers, hills, plains, and others (Hugget 2007). Bird (1969) defined that coastal geomorphology is the study of coastal landforms, their evolution, the processes at work on them, and the changes now and taking place. Coastal geomorphology focus on the zone of varying width, including the shore and extending to the landward limit of penetration of marine influences (Bird 1969). The coastal systems vary greatly in their dynamic range and in their response to change controls.

The coastal zone is particularly important to ecological perspective. The coastal zone is used for fishing, transportation, source of energy from tidal and wave power, recreation, or tourism. In addition to their natural beauty and the unique form of coast area, coast area are a significant resource for human activities including their contribution to a host of recreation activities. Beaches along the length of the seaward side are a major part of the attraction for recreational purposes. Those activities threat to coastal systems, both physical and biological of coastal zone.

Based on Marfai (2005), coastal zone has different characteristics than any others. There are several specific characteristics that belongs to the coastal zone such as:

1. Very dynamics and always has its physical transformation that shaped by wind and wave
2. Being one of the high value ecosystem because of its productivity and the high biodiversity.
3. Has its own landform such as coral reef, mangrove forest, shore, sand dune, and any others landform which able to protect the area from flood, storm, hurricane, and tsunami.
4. Having high rate economical activities because of its high amount of settlement.
5. Central of the activities that related to the human activities in the ocean or sea.

Coastline is a dynamic systems which affected on a daily basis either by the marine sedimentary processes or the related affects of changing weather systems. Beside that, according to the physical process, coastal zone is an area that has very high complexity and dynamics. Coastal zone is having a huge pressure either from physical processes or human activities. Coastal zone dynamic is usually reflected by its shoreline transformation. Shoreline transformation is usually affected by the decreasing of the shoreline which caused by the erosion process and accretion (Marfai 2015).

Coastal erosion is an occurrence which cause the coastal zone mainland disappear (Marfai 2015). Coastal erosion is linked with important environmental implications, often influencing hundreds of kilometres of shoreline (Aiello 2013). The factors that drive the coastal erosion are wave, current, morphology/lithology condition, the existence of the vegetation, and some of the destructive human activities.

Coastal geomorphology studies describe various physical characteristics of turtle habitat in order to suit the present characteristics and future characteristics. Various limitations of physical characteristics for spawning habitat has been widely studied. Pradana et al. (2013) uses parameters such as the length of the beach, the slope, distance of the nest, the highest tide and low tide. Richayasa (2015) uses five parameters such as the width of the beach/island, beach slope, sand temperature/humidity, substrate texture and coastal vegetation. Zarkasi et al. (2011) also studied the characteristics of the sea turtle habitat using six parameters, which is the length of the coast, beach width, the slope, sand thickness, distance of vegetation, and distance of the nest. All three studies were not done in Java. There is one

study of sea turtle spawning in Java which located in Samas Beach. The study uses parameters such as the width of the beach, slope, substrate surface temperature at a depth of 50 cm , water content, grain size and mineral content (Satriadi et al. 2003).

#### 4. Methodology

The research is located at Goa Cemara coastal area in Sanden Subdistrict, Bantul Regency. Goa Cemara coastal area is one of the sea turtles spawning ground which is located between Pandansari coastal area on the eastern part and Kwaru coastal area on the western part. Goa Cemara coastal area is represented on the figure 1 below.



**Figure 1.** Goa Cemara coastal area in Bantul Regency, Special Region of Yogyakarta

The physical characteristics identification for the sea turtle habitat is being observed and measured directly in the location spot. The physical parameters in this research consist of several aspects such as morphology, granulometry, wind, wave, and land use. Granulometry aspect processed by laboratory analysis with sieving technique to get grain size and grain mass. The variable are described in this table 1 below.

**Table 1.** Research variables of the physical characteristics of sea turtle spawning ground

Physical Characteristics	Measured Variable	Tools
<b>Morphology</b>	Coastal length	Measured by measure tape
	Coastal wide	
	Coastal slope	Measured by geological compass
<b>Granulometry</b>	Sediment texture	Measured and processed by sieving technique
	Sortation	
	Skweness	
	Kurtosis	
<b>Wave</b>	Wave height	Direct observation
	Wave period	Measured by stopwatch
<b>Wind</b>	Wind speed	Measured by anemometer
<b>Land use</b>	Land use type	Direct observation

Coastal dynamics identification is being observed and measured toward the abrasion of Goa Cemara coastal area. The Coastal dynamics is also being observed by the shore line transformation of Goa Cemara coastal area. The transformation is analyzed by comparing the Google Earth imagery and the recent imagery for 2016. The recent aerial photography collected by recording the image using Unmanned Aerial Vehicle quadcopter series. UAV is a tool for recording and photographing the detail- scale aerial photography due to its automatic mapping feature which allow the user to manage the flying – track or the recording – track and the time recorded based on the user demand. The UAV details is represented in the figure 2 below.



**Figure 2.** UAV (Unmanned Aerial Vehicle) quadcopter

It is quite simple to record the Aerial photography using UAV quadcopter based on the description above. The gaps between each line are automatically demanded after the length and the width of recorded area had been fixed. The higher UAV fly, the wider flying – track gets.

The processing of physical characteristics and the coastal dynamics about sea turtles spawning ground habitat will be done according to the spatial aspect based on the sea turtle's remain spawn spot that spread out along the Goa Cemara coastal area. The spatial illustration allows to identify the physical characteristic and the coastal dynamics that possibly become the threats of the sea turtles spawning habitat. The possible threats such as Abrasion and the shore line transformation. The physical characteristics and the coastal dynamics analyzing are using descriptive technique.

## **5. Result and Discussion**

### *5.1 Physical Characteristics of Sea turtle's Spawning Ground*

Goa Cemara coastal area is one of the existing sea turtle's spawning habitat. The spawning habitat has its own specific physical characteristics from the different point of aspects such as morphology, granulometry, wave, wind, and land use. The morphology measurement focus on the coastal width aspect and the coastal slope which are measured on two remains sea turtle's spawn spots. The physical identification result for the sea turtles spawning ground is shown in the table 2 below.

According to the morphology aspect, the sea turtles spawning ground on this Goa Cemara coastal area has the measured coastal length approximately 2,1 Kilometers. The coastal width is the distance between the sea turtles spawn spot and the highest tide border. The coastal width is about 28,3 meters and 35,8 meters. The tilt from the two spawn spots regarded for each spot are  $16^{\circ}$  and  $6^{\circ}$ . The coastal slope condition makes the sea turtles easier to reach their own spawn spots. According to the granulometry aspect, the sediment material on the Goa Cemara coatal area has the grain size approximately about 0,56 mm. The sediment sortation level is categorized as moderately sorted. The kurtosis category is sort of mesokurtic class with the texture group is slightly gravely sand.

**Table 2.** The result of measuring and observing physical characteristics of sea turtles spawning ground at Goa Cemara coastal area

Physical Characteristics	Measured Variable	Result
<b>Morphology</b>	Coastal length	2,1 km
	Coastal wide	28,3 m and 35,8 m
	Coastal slope	16 <sup>0</sup> and 6 <sup>0</sup>
<b>Granulometry</b>	Sediment texture	Slightly gravelly sand.
	Sortation	Moderately sorted
	Skweness	symateric
	Kurtosis	mesokurtic
<b>Wave</b>	Wave height	0,10 – 0,5 meter
	Wave period	7,13 second
<b>Wind</b>	Wind speed	39 meter per second
<b>Land use</b>	Land use type	Thriving pine trees

The oceanographic processes of coastal area that influence to sea turtle's spawning ground consist of wind and wave. The wind condition when took the sample was approximately about 39 m/s and catagorized as gentle breeze. The wave period was approximately about 7,13 second. The wave height was 0,10 – 0,5 meter and catagorized as smooth – average. Those conditions are suitable for the sea turtle's to hatch, so that we often found the hatching sea turtles. The kind of sea turtle whom spawn at Goa Cemara coastal area are *Lepidochelys olivacea* and *Chelonia mydas*.

The vegetation type on the Goa Cemara coastal area is dominated by the thriving pine evergreen plants and shrubs along the coastal area. The vegetation amount could be reached about 7-9 per 10 meters. The vegetation is giving some advatages toward the sea turtles as their protection from the local predators (dogs and wild lizard), protection for the direct sunlight, and protection for the coastal erotion. The vegetation condition in this description is shown on the figure 3 below.



**Figure 3.** Thriving pine trees at Goa Cemara coastal area

### 5.2 The Coastal Dynamics at Goa Cemara Coastal Area which Influence Sea turtle's Spawning Ground

Abrasion is one of the biggest barrier on the sea turtles habitat conseravtion. The Abrasion measurement results has shown that the Abrasion level is heterogeneous. The measurement result is shown on the table 3.

**Table 3.** The result of measuring and observing of abrasion at Goa Cemara coastal area

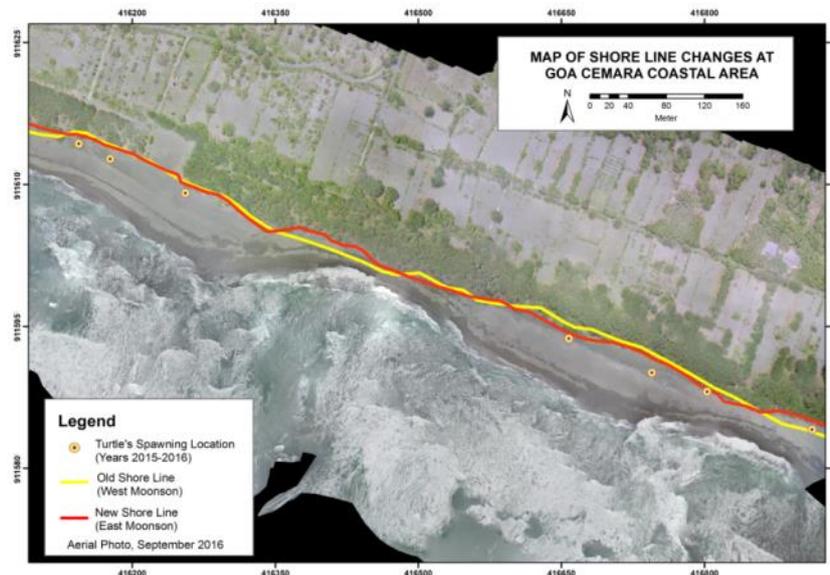
Coordinat location		Abrasion height (cm)
x	y	
417111	9115763	52
417058	9115776	86
416948	9115821	84
416948	9115839	48
416906	9115857	240

The abrasion that occur on the Goa Cemara coastal area has the average height more than 0,5 meter and might possibly more than 2 meters. Based on the measurement, Goa Cemara abrasion level is a natural process which possibly threat the sea turtle spawn ground habitat. Basically, coastal abrasion is natural phenomenon but several of human activities might boost up the abrasion potency. The abrasion process cause the sea turtle's difficult to reach into the spawning area and its able to destroy the sea turtle's nest that contain many eggs. The abrasion at Goa Cemara coastal area is shown on the figure 4 below



**Figure 4.** Map of abrasion line at Goa Cemara coastal area

The abrasion mostly caused by the wave current. The abrasion impact either direct or indirect might lead to the sea turtle move to other place for spawning. Based on the aerial photography interpretation, there are two different kind of current that found on the Goa Cemara coastal area, there are Rip current and longshore current.



**Figure 5.** Map of shore line changes at Goa Cemara coastal area

Based on figure 5, it shows that there is two rip current that found on the Goa Cemara coastal area. The rip current shows at the middle of the map and the right part on the edge of the map. Based on the remain nest plotted, it shows that sea turtles is prefer to choose the spawning spot at the longshore current part and prevent to spawn at the rip current part.

Rip current lead to erode the coastal mainland otherwise the longshore current is not. The geomorphic characteristics where the rip current occur has the offshore morphology shaped like a cusp (Marfai and Mutaqin 2014), and the short breaker zone is height (Komar 1985). Marfai and Mutaqin (2014) believe that logshore current has a huge role upon the coastal dynamics such as the rip current, beside that it can be trigger for the beach-drift, litoral-drift and also longshore-drift. Longshore current occurs on the shallow shore upon the subside angle less than the normal shoreline and the underwater contour.

## 6. Conclusion

The conclusions from this research are :

1. The physical characteristics of sea turtle spawning spots at Goa Cemara coastal area are consist of several parameters such as morphology, granulometriy wave process, wind process, and land use.
2. The Coastal dynamics that take control on the sea tutles spawning ground is linked to the Abrasion process and the shore line transformation.

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