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ANALYSIS OF SUITABILITY AND CARRYING CAPACITY OF MARINE TOURISM AT BANDENGAN WATERS IN JEPARA DISTRICT

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ABSTRACT

Marine tourism is an activity that is very dependent on water quality and carrying capacity of the area. Bandengan waters is one area which is used as a marine tourism destination in Jepara district, therefore environmental sustainability in Bandengan waters must be maintained. That is why the analysis of suitability and carrying capacity of marine tourism in Bandengan waters, Jepara must be carried out. This study aims to determine the suitability of marine tourism index method of tourism suitability based on biophysical-water parameters. Biophysical-water parameters which are used as the criteria are coral reef coverage, harmful biota, depth, brightness, current velocity, water-base material, slope and width of the beach, and land cover and type of beach and the availability of clean water. These parameters are considered to be the most important factor in supporting the activities of marine tourism in recreation and swimming category, snorkeling, diving and boating, banana boating and jet skiing. Analysis of the carrying capacity of the area was conducted to determine the width of the area and the carrying capacity for each category of marine tourism. Based on the analysis of the suitability of marine tourism and the carrying capacity of the region, there are two categories of tourism which are very suitable to do in Bandengan waters. The first category is recreation and swimming with total area of 52.46 hectares and a capacity of 27,978 tourists. The second category is boating, banana boat and jet ski with a total area of 99.68 hectares and a capacity of 11,961 tourists. The suitability carrying capacity in Bandengan waters are strongly influenced by the condition of aquatic ecosystems, especially poor coral reefs and extremely low water transparency, so that we need rehabilitation in these waters, especially to the coral reef ecosystem.

Keywords: Marine Tourism, Suitability Analysis, Carrying Capacity

I. INTRODUCTION

Marine tourism is one of the growing tourism in Indonesia, because Indonesia is an archipelagic country and high potential of coastal and ocean resources. Coastal and ocean resources can be found in Indonesia for the example ornamental fish population is estimated at about 263 species, coral reefs, sea grass beds, mangrove forests and other coastal landscapes or unique coastal landscape. Those conditions are of the natural landscape have become a huge attractions for tourists. Areas that have coastal and beach potentials beach or nautical tourism development is a promising challenge, given the tourism is a sector which is capable to provide high contribution to the local economy (Hunger and Wheelen, 2003).

Bandengan waters is one of the area in Jepara district with an area of 586 ha with a 3.85 km long coastline and has clean water, as well as a vast expanse of white sand and coral reefs existence. The natural beauty of Bandengan waters is the main attraction for tourists, so the Bandengan waters have been used as one of the marine tourism destination. Based on data from the Department of Tourism Jepara regency, in 2011 the number of tourists who come to the beach Bandengan is constantly increasing. In 2006 the number of tourists was 61,657 and in 2011 increased to 203,637 or an increase of 3.5 times in five years.



If not managed properly the increasing number of tourists and marine tourism activities will affect the environment. This is cause Bandengan waters including coastal areas that are vulnerable to a variety of changes in ecosystems. Based on the results Supriharyono (2007) stated that the Coastal Bandengan has experienced environmental degradation, especially on live coral cover which is only 5% and only in the form of new coral colonies or coral colonies that are not all in living conditions. It is also supported by data from the Department of Marine and Fisheries Jepara (2010) which stated that coral reefs in Bandengan waters has been damaged, and there were only 17.5 ha of coral reefs which are also damaged. Damages to coral reefs occurred in Bandengan waters a result of the activities done in the Bandengan waters, both tourist activities, catching activities and retrieval of coral reefs by the public to be sold and used as decorations

Marine tourism activity is one of the factors which contributes to the changes in the ecosystem in Bandengan waters. This is the result of marine tourism activities which have not been adapted to the biophysical condition and carrying capacity of the area. The development of nautical tourism in Bandengan waters must comply with the water and the biophysical conditions of the carrying capacity of the area. This study aims to analyze the suitability of marine tourism (recreation, swimming, snorkeling, diving) and category of boating, banana boat and jet ski, based on marine biophysical parameters and marine tourism carrying capacity in Bandengan waters. It is useful to prevent constant environmental damage on Bandengan marine tourism area, as well as the basis for the management of marine tourism in the Bandengan waters.

II. METHODS

Observation stations in this study consist of nine points and are determined based on the location which represent, the state of general study and an area that can be used for marine tourism activities in Bandengan waters (Figure 1). The data capture of the parameter of marine biophysic was done for three months.

Analysis of the suitability of marine tourism is classified into three classes, namely suitability, highly suitable (S1), suitable (S2), and not suitable (N). Determination of suitability are based on the values obtained from the sum of the multiplication between the scoring categories and weighting value of each parameter for each marine tourism activities. Analysis of the carrying capacity of the region (DDK), which was conductin the study, calculates the total area corresponding to each activity and determined the type and maximum number of visitors that can be afforded in a region that has been provided at any given time without causing disturbance to the environment and people in the vicinity.

Calculation of carrying capacity of the area was obtained by the following formula (Yulianda, 2007):

$$DDK = K \frac{L_p}{L_t} \times \frac{W_t}{W_p}$$

caption:

DDK: Zone Capability

K: Ecology potential of visitors per area unit



Lp: The area width or length that can be utilized

Lt: area unit for certain categories

Wt: The time provided by the district for tourism activities in 1 day

Wp: Time spent by visitors to any particular activity

Yulianda (2007) states, a visitor activities (Wp) is calculated based on the length of time a visitor spends to do outdoor activities. The time spend by visitors are also calculated based on the time provided by a tourist area. The area time is the length of time an area is opened in one day. The area time at Bandengan marine tourism based on working hours it from 8:00 am to 04:00 pm, or as much as 8 hours per day. Ecology potential area unit visiting time and the area can be seen on the Table 1 based on Yulianda (2007) and were obtained by interviews done at the beginning of the study, directly to tourists.

Table 1. Prediction of Ecology Potential, Area Unit, Wp and Wt

No	Type of Activity	Number of Visitors (ΣK)	Area Unit Lt (m ²)	Wp (hour)	Wt (hour)
1.	Recreation and Swimming	1	50	3	8
2.	Snorkeling	1	250	2	8
3.	Diving	1	500	3	8

III. RESULTS AND DISCUSSION

1. Aquatic Biophysical Conditions

The result observations which were conducted on the percentage of the cover of coral reefs in Bandengan waters, suggests that coral reefs are in a bad category. The percentage of coral cover only ranged from 0 to 24.52%. Damage to coral reefs caused by a variety of factors both from human activities and damages caused by nature. One of the factors that cause damage to coral reefs in Bandengan waters is that some local people take coral reefs to sell. According to Supriharyono (2007), coral reef damages can be caused by physical, chemical and biological factors. Coral reefs are extremely sensitive to environmental influences, either physical, the damage caused by human activity, chemical contamination or damage caused by biological activity (Burke et al., 2002; Dahuri, 2003). Condition of coral reefs in waters with bad category causes marine tourism activities such as snorkeling and diving categories cannot be done. This is cause the main purpose of snorkeling and diving is to enjoy the underwater scenery which is dominated by the presence of coral reefs in the waters

The result of observations made on harmful biota with sea urchins as key indicators in this study showed that there was no harmful biota. Sea urchins used as a leading indicator because they have poisonous spines and if trampled by tourists who are doing activities such as swimming, snorkeling and diving, spines will be broken because it has a fragile nature, so it will be embedded in the skin that can lead to infection. Although sea urchins harmful



ns including marine tourism activities but have a big enough role in coral reef ecosystems, ie in the food web
ariety of positions, including as herbivores, carnivores, omnivores or as detritus eaters (Birkeland, 1989 and
fez, 2006).

Bandengan water depth is 1.5 to 15 m. The depth of water is one of the physical parameters that needs to be
The water depth in this research is the primary factor used to determine the research station. Based on the
if research Edward, et al (2002), states that water depths ranging from 3.2 to 35.5 is still worth to be made as
ourism area of swimming, snorkeling and diving.

The measurement of the brightness in Bandengan waters is only about 1-2 m. Brightness is also a measure
transparency, which can be determined visually. Brightness values are generally expressed in meter unit.
ss value is strongly influenced by weather conditions, time of measurement, turbidity and suspended solids.
htness in Bandengan waters very low because the value of TSS (Total Suspended Solid) is very high, which
tigh turbidity and leads to the very low penetration of sunlight into the water.

Flow velocity is very influential on the activities to be carried out in a marine area. The results of measurements
elocity in Bandengan waters is 0.07 to 0.42 m / sec. Flow velocity is influenced by the season difference, in
season it relatively is higher than in the dry season (Riyadi et al, 2005).
e flow velocity for marine tourism of swimming ranged from 0.20 to 0.40 m / sec, snorkeling ranged from 0.15
/ sec, and diving ranged from .15 to .40 m / s. Based on these results, the flow velocity in the water at some
an waters stations is still feasible for marine tourism of swimming, while although the current speed parameter
t a, because the main parameters such as coral reefs and the brightness are not supported for snorkeling and
ctivities.

Based on the analysis of materials in Bandengan water-base, it was obtained the material in Bandengan
se consists of gravel, sand, silt and clay. The percentage of gravel is 2.54 to 35.11%, 0.30 to 94.19% of sand,
to 89.71% and clay 10.67 to 22.22%. One of the factors that affects a marine ecosystem is water base material.
se material greatly affects the water turbidity and is also one of supporting factors for marine tourism activities
in the waters.

Based on the measurement results it was that obtained 5-15 degrees of beach tilt and beach width from 12.3
n. These results indicate that Bandengan waters is sloping and has beach width that can support marine
activities that will be developed in the waters. Such conditions lead to Bandengan beach is visited by many
or activities such as lounging around the beach while enjoying views of the beach and enjoy the sunset. It is
d also by open land in Bandengan waters and the white sandy beach.

Fresh water availability in the Bandengan waters is enough to meet the needs of tourists. Facilities such as
id bathrooms provide clean water, so it can be used by visitors to clean up after doing swimming activity in
an waters. The facility is managed by the Department of Tourism Jepara.



2. The Suitability Analysis of Marine Tourism

The analysis results of the suitability of biophysical parameters based in Bandengan waters in the dry season there are three categories of suitability for marine tourism of recreation and swimming, i.e: very suitable, suitable and not suitable.

The parameters that have the highest score to determine the suitability index for recreation and swimming category is the depth, type of beach and beach width. This is because all of the three parameters are considered most important for recreation and swimming category. This is supported by research conducted by Bahar and Rahmadi (2011), which stated that the location selection which is planned for marine tourism destination cannot be suitable from the state of the location, so it would not danger the safety of visitors.

The results of the data analysis based on biophysical parameters in Bandengan waters, produced two categories of suitability class for marine tourism category of snorkeling, i.e suitable and not suitable. Based on the results of measurements of all water parameters which is made to calculate marine suitability index at each station.

Regions with suitable category has a limiting factor, namely the existence of bad coral reefs, so this study does not recommend any snorkeling activities in Bandengan waters. This is cause the main purpose of snorkeling is to see the beauty beneath the sea such as coral reefs and organisms that live on the coral reefs. In areas with categories with some limiting factors, we need to rehabilitate the coral reef ecosystem, so that in the future they can be re-used as a marine tourism destination for snorkeling category. Pragawati (2009), also stated that on the marine location with the required conditions water rehabilitation needs to be done, especially on coral reef ecosystems which is the main tourist destination for snorkeling.

Based on the calculation of marine suitability index, it showed that Bandengan waters is unsuitable for marine tourism activity of diving category, because the site has a limiting factor which cannot be tolerated. A major limiting factor in the Bandengan waters is brightness and very poor coral reef ecosystems. Based on the results of all water parameters measurement to calculate marine basis suitability index at each research station.

Senoaji (2009), states that the location which can be used as a marine tourism area for diving category must meet six water quality parameters. These parameters are brightness, type of coral reef, live coral cover, reef fish species, current speed and depth of the water. Bandengan water conditions do not meet the requirements of the six water quality parameters, so that it cannot be used as a marine tourism diving category.

3. Analysis of the Carrying Capacity of Marine Tourism

Based on the analysis of the carrying capacity of the area for marine tourism activities of recreation and swimming category it was obtained an area of 52.46 ha with a capacity of 27,978 people. While the results of the carrying capacity analysis of the area for marine tourism activities category snorkeling and diving in the marine tourism at Bandengan water is not appropriate, so that the carrying capacity of the area is not fulfilled. Results of analysis of



the carrying capacity of the area for marine tourism activity category of boating, banana boating and jet skiing in the acquired area was very suitable for a capacity of 99.68 ha with tourists as 11,961 people.

Carrying capacity of the area for marine tourism is inseparable from the water biophysical condition. Dodds (2007), states that marine tourism activities are closely related to the natural resources termed 3S, the sea associated with the presence of coral reefs, mangroves and other biota, sun associated with sunbathing activity and sand associated with recreation activities on the beach. Marine tourism area should keep the characteristics of the ecosystem that is in it, because, according to Wheat (1994) and Steele (1993) in the I Gusti (2011) states that marine tourism is a special market for people who are aware of the environment and are keen to observe the nature and is an economic process with the intention to market exciting and rare ecosystems.

It is also supported by the World Conservation Union (WCU), which states that sustainable tourism development is the construction process of a place or area without reducing the functional value of the use of existing resources. Development is achieved through monitoring and maintenance of natural resources, to be enjoyed for years to come. Meanwhile, according to the World Commission on Environment and Development, the concept of sustainable tourism is part of the sustainable development which needs of the current four need by considering the needs of future generations (I Gusti, 2011).

Based on the above opinion, the management of marine tourism in Bandengan waters should still take advantage optimally of the natural resources that currently exist but should still pay attention to the sustainability of the region in the long term so it can be enjoyed by the next generations. Spatial planning, improvement of facilities and infrastructure, human resources as well as legislation that would be set out in the management of marine tourism in Bandengan waters should optimize the current natural resource by taking into account the preservation and sustainability of the marine tourism area.

IV. CONCLUSION

Suitability index in Bandengan waters which consists of four marine tourism categories, namely recreational and swimming, snorkeling, diving, banana boating and jet ski produced very suitable category for recreation and swimming category, banana boating and jet skiing. While marine tourism category of snorkeling and scuba diving based on marine suitability index is not included in the appropriate category.

Analysis of the carrying capacity of the region in Bandengan waters was calculated based on the area suitability index. Based on the analysis, there are only two categories of marine tourism which are eligible to calculate the carrying capacity of the region. These categories are recreation and swimming an area of 52.46 ha which can accommodate 27,978 tourists and categories of boating, banana boating and jet skiing it was obtained an area of 99.68 ha to accommodate 11,961 tourists. The main limiting factor for marine tourism of diving and snorkeling



categories in Bandengan waters are brightness and been coral reef ecosystems. So it is necessary to rehabilitate ecosystems, especially on coral reefs.

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