IDENTIFYING OF LAND SUITABILITY SEA CUCUMBER (Holothuria scabra) USING GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING BASED ON PHYSICAL PARAMETERS IN WEST LOMBOK

Laily Fitriani Mulyani¹, Marsoedi² & Guntur²

¹Student of Fisheries and Marine Science Faculty, Brawijaya University
²Lecturer of Fisheries and Marine Science Faculty, Brawijaya University

Abstract: This study was conducted on 17th October-27th November 2016 at Gili Asahan, Gili Layar, and Gili Gede in West Sekotong, Lombok, West Nusa Tenggara. The purpose of this study was to analyse a suitable area for sea cucumber cultivation (Holothuria scabra). Data collection had been done by survey method, acquiring primer and secondary data directly related to sea cucumber's life and analyzed by using Geographic Information System software. A physical parameters include temperature 29.14 – 30.24°C, the water transparancy of the 0.78 – 1.35 m, the current speed from 0.2 to 0.7 m/s, rainfall of 174 mm, protection: protected, fairly protected and unprotected, depth 0.78 to 1.35 m, the tide of 0.9 m. Land suitability classes are determined based on the interval between the other classes S1 (40-42), S2 (37-39) and N (34-36). Based on the results of scoring that has been adapted to the class interval obtained sample points with a very suitable category (S1) including A1, C1, C4, C5. Then for the corresponding category (S2) between the A2, A3, C2, C3. Meanwhile, according to the category is not contained in the sample points B1, B2 and B3.

Introduction

Sea cucumbers are a group of invertebrate animals of the phylum of Echinodermata and class of Holothuroidea [1]. Sea cucumbers include important components in the food chain because of its a deposit feeder and suspended feeder. Ecologically, cucumbers helps the process of decomposition of organic matter present in the sediment and release or produce nutrients into the food chain [2]. The Sea cucumbers include animals in the category of Appendix II of CITES, the population continues to decline every year. One effort to maintain this resource by restocking. Therefore, sustainable management to determine the suitable region is needed. It is therefore necessary that adequate information that can be used for sea cucumber management in a sustainable manner. One method used is to use geographic information system (GIS). GIS can facilitate in analyzing the data and determining the suitable cultivation area. Given the importance of the function of the sea cucumber sea cucumber resources management required good.

The purpose of this study was to analyze the suitability of cultivated area Sea Cucumber (Holothuria scabra) in West Sekotong based on physical parameters.

Material and Method

The research location at Gili Asahan, Gili Gede, Gili Layar in Sekotong, Lombok, West Nusa Tenggara. This study was conducted 17th October – 27th November 2016 includes the necessary data collection and sampling were carried out directly in that place.

The method used in this study is a survey, which is collects data on the condition of the field in the West Sekotong and the data were analyzed using geographic information system software.

Tools used namely ships, clippers, sample bottles, stationery, measuring cups, stopwatch, the pipe, cameras, rope, board tide, GPS, thermometer, refractometer, pH meter, DO meter, secchi disk and current meter. Materials used are sea cucumbers, tissue, paper labels, alcohol, sample containers.

2.1 Research Procedure

Area of research conducted in the area of West Sekotong. Western Digital Data Water Sekotong base map used to create thematic maps, then interpolation each parameter. Water conditions that will be measured are: temperature, water transparancy, current speed, protection, tide, rainfall, depth. Then made a map contours of the primary data of each parameter used as background for the digitization process so that every thematic maps divided by several classes. Furthermore, the
condition of the map or the map contours analyzed by the overlay is overlaying analysis that combines multiple information map to generate a new information. Once the criteria of the built and analyzed, will eventually generate suitability maps of sea cucumber cultivation area.

2.2 Spatial Analysis and Scoring Matrix Weighting

2.3 Overlay Analysis

Overlay is combining several map information to generate new information, overlaying a spatial analysis capabilities that can be done effectively in GIS. The results of the spatial analysis is in the form of a map as to the suitability of sea cucumber cultivation area.

3. Result and Discussion

Parameters of observation in this study is a water-quality based on physical parameters such temperature, water transparancy, current speed, protection, tide, rainfall, depth. The parameters used are parameters associated with the growing requirements of sea cucumbers will be cultivated. Determining the condition of life adapted to the cultivation of cucumbers quality standards. Research carried out directly or through observation satellite image data which indicates the difference between the value of each sampling point. The point difference between the value adjusted with the quality standards of each parameter. The use of quality standards to facilitate the scoring rate of land suitability.

3.1 Rainfall

Rainfall data obtained from the Meteorology and Geophysics Agency Class I Climatological Station West Lombok, West Nusa Tenggara. The observations in this study gained an average value of rainfall during the last 12 months in the range of 45-353 mm/month. Calculated based on the observation station district. The average rainfall in the study site during the study was 174 mm/month. Map of the distribution of rainfall in the study site can be seen in Figure 1.
3.2 Temperature

Water temperature value obtained from observations in the field show the range that is not much different. The temperature range in the District of West Sekotong in the range of 29-31 °C. The range of values are the lowest temperature at the sampling point A1 which is in Gili Asahan and the highest at the point A3 (Gili Asahan), points B2 and B3 (Gili Layar), and the point C1, C2 and C3 (Gili Gede) The results interpolation distribution of water temperature indicates the color green to red in the range of 29-31 °C. Based on the analysis, comparison using quality standards of sea cucumber cultivation there is only one category that is very suitability classes (S1). Temperature distribution maps at the study site can be seen in Figure 2.

3.3 Protection

The observations for protection parameter in the research area, there are three categories of which is very suitable that there point research sites A1, A2, B3, C1, C4 and C5. Then for the corresponding category contained in the location point A3, B1, C2 and C3. The location does not fit there at the location point C2.

3.4 Tide

Tide Data obtained from the Office of the Port Authority Kesyahbandaran and processed sheet and generate a constant ebb and flow. Sampling was conducted two replications of the first on October 17, 2016, with the tide height 1.0 m, while the second replay on November 27 with a high tide of 0.8 m. Thus obtained value average tide when the study was 0.9 m.

3.5 Depth

The water depth at the site of cultivation should range between 0.5 to 1.0 m is calculated at the time of low tide, while at high tide the water depth should be no more than 2 m. This is to prevent sea cucumbers from drought or water temperatures can disrupt life [7].

The observation of the depth of water at the study site were obtained ranged from 0.78 to 1.35 m. There are two classes were seen in these parameters among classes is suitable and corresponding class. Classes are very suitable artifacts at A1, A3, B2, C1, C2, C3, C4 and C5. Very suitable depth in the dominance in the waters of Gili Gede, all point locations in the area has water depths suitability very suitable. Then, the suitable classes are A2, B1 and B3. Map of the distribution of the depth in the research area can be seen in Figure 5.
3.6 Water Transparency

Based on the results of interpolation most areas of green to red, it indicates the brightness level of the water in the area where research is still good. Based on the brightness of the water quality standards for the cultivation of sea cucumbers, there are only two types of land suitability level is very suitable category (S1) and suitable (S2). Very suitable category (S1) contained in the points A1, A3, B2, C1, C2, C3, C4 and C5 while the other points that are in the suitable category (S2). Map of the distribution of brightness in the research area can be seen in Figure 6.

3.7 Current Speed

The observation of the current speed in the study ranged from 0.2 to 0.7 m/s. [8] explains that sea cucumbers organisms able to live in waters with the current speed levels ranged from 0.30 to 0.50 m/s. The value of the current speed obtained in the study site resulted in two categories of land suitability, which is very suitable and suitable. Category very suitable (S1) only in Gili Asahan (A1, A2 and A3), while the category suitable (S2) contained in Gili Screen (B1, B2, and B3) and Gili Gede (C1, C2, C3, C4 and C5 ). Map of the distribution of current speed in the research area can be seen in Figure 7.

3.8 Overlay of Land Suitability Sea cucumbers (H. scabra) Based on Physical Parameters

The observation of physical parameters include temperature, water transparencies, current speed, protection, tide, rainfall, depth waters West Sekotong analyzed using Geographic Information System (GIS) that produce thematic maps of land suitability sand sea cucumber aquaculture (H. scabra) can seen in Figure 8.
of the [9], the abundance of sea cucumbers in the waters of Lombok relatively very low, from 64 point surveys, the presence of sea cucumber found only in 10 point survey of Gili Asahan, Gili Gede, Gili Layar (Lombok Barat ), Gili Lawang West, Gili Sulat, East Sapakoko, Heaven on the Planet, Gili Maringkki (east Lombok), West Sire and Soraya Reef (North Lombok). The abundance of sea cucumbers were found less than 50 ind/ha.

The low number of animals due to the abundance of H. scabra is one kind of high economic value of sea cucumbers are the main target of the hunt so that the population has been greatly reduced. In addition due to overfishing, the low number of individuals of H. scabra likely caused by the habit of immersing myself in the substrate so as not detected during the observation. Among the factors causing low density of sea cucumbers in a region is due to natural factors, namely support of the environment and way of life are solitory [10]. The natural density of sea cucumbers is closely connected with the carrying capacity of the environment [11]. Overall seen that H. atra is found in all observation stations and the most dominating than the sand. H. atra was the most abundant species of sea cucumbers and very wide distribution in most of the Indo-Pacific region [12].

Most of the Asian region, the sea cucumber fisheries have been overfished and the population of high-value species such as H. fuscogilva been exhausted, H. whitmaei, H. scabra and Thelenota ananas [13]. Based on field surveys also show that some high-value sea cucumber species have also been heading for extinction in some areas in Indonesia, Vietnam, and the Philippines. According [14], as a result of increasing demand, most of the economic value of sea cucumber stocks have been exploited in excess so that the sea cucumber fishery began to shift toward low-value species of sea cucumber. the impact of excessive exploitation of sea cucumbers is a decline in natural population stock, the smaller body size, and distribution in the deep [2].

Predatory sea cucumbers are invertebrates such as starfish, fish, crab, some gastropod species, birds, and turtles [15]. According to [16], predatory sea cucumbers are starfish sized, crab species Dardanus megistos, Atergatis floridus, and species Tonna perdix. The main factor reducing the stock of sea cucumbers in Indonesia allegedly was the result of overexploitation and habitat destruction by humans (anthropogenic causes). The more dense a population and the more advanced region of the pressure posed for marine life, especially species of sea cucumbers are also higher. This causes several regions in Indonesia that the condition of its waters have been damaged and polluted due to such pressures, population teripangnya declining and increasingly rare. Conversely, the lower the anthropogenic pressures on the water environment, the better the condition of its waters, including the organisms that live in it.

Overall, based on physical parameters suitable areas for cultivation sand sea cucumbers (H. scabra) is an area of Gili Asahan and Gili Gede, while Gili screen is unsuitable for the cultivation of the sea cucumbers (H. scabra). Most areas of the Gili Layar also have a substrate that is not suitable for cultivation sand sea cucumbers (H. scabra). It is as described by [17], that the sea cucumber including members of the phylum Echinodermata commonly inhabit the sandy beach. One pattern adaptations made by the inhabitants of aquatic organisms beach with sandy substrate is to immerse himself in the substrate. When the digging substrate biota, organic fine particles other than grains of sand will be digested in the body. the reasons cucumbers avoid muddy substrate only because the substrate is a possibility of environmental anoxic or without oxygen [18]. Sea cucumbers may have difficulty in actuating the muddy substrate [19]. Sea cucumbers tend to concentrate in areas with high levels of organic matter [20]. H. sanctori have food selectivity against sediment with high concentrations of organic matter. Consumption of organic material will increase with the increased availability of organic material [21].

4. Conclusions

The conclusion based on the results of research in the District of West Sekotong is the degree of conformity Sand Sea Cucumber cultivation in the district of West Sekotong very suitable for the category S1 (40-42) is A1, C1, C4, C5. Then for the corresponding category S2 (37-39) are at the point A2, A3, C2, C3. Meanwhile, the category is unsuitable N (34-36) are at the sampling point B1, B2 and B3.

5. Acknowledgments

We thank the NASA for the production and distribution of SeaWiFS and MODIS data.. We are very grateful to four anonymous referees who contributed greatly to manuscript improvement.

6. References


