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Seagrass Species Composition and Physicochemical of Waters in Siput Island, Indonesia

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Abstract **Original Research Article**

Seagrass is the one of important coastal ecosystem in Siput Island, Lembata, East Nusa Tenggara, Indonesia. The study aims were to determine the composition of seagrass species and the physicochemical of waters are important for design sustainable management resource of Siput Island. The method used in this study is field observation using line transect. The results of this study have found three species of seagrass around the waters of Siput Island i.e. *Enhalus acroides*, *Thalassia hemprichii* and *Halophila ovalis*, with the composition were 73.33 %, 46.67%, and 66,67% respectively.. While the range of the waters physicochemical i.e. temperatures: 30−33 °C, salinity 32−33 ppt, and pH 7.3−8.5, whereas the species of substrate was muddy sand. The condition of the waters physicochemical and type of substrate are supporting the life and development of seagrass communities and other organisms associated in this ecosystem.
Keywords: Composition, Species, Seagrass, Physicochemical, Waters.

INTRODUCTION

Seagrass is one of the coastal ecosystems that is important for supporting biodiversity and mitigating climate change. Seagrass existence provides many benefits for supporting food security and is a source of income for coastal communities [1-5]. One of the coastal areas in Indonesia, which has a seagrass ecosystem is Siput Island, Lembata, East Nusa Tenggara.

The Siput Island Waters Area is an area within the Lewoleba Bay area. In addition, around the waters of this Siput Island there is also a variety of ecosystems in it including one of which is a seagrass ecosystem which is part of the marine ecosystem and has a versatile function, including as a place for developing marine life, a place for the development of flora and fauna and also made ecotourism area. Some species of fauna that live in this ecosystem are gastrophods, echinoderms, bivalves, crustaceans and other groups of finned fishes [3, 6].

The various potentials contained in the seagrass ecosystem around the waters of the Siput island mentioned above, then all activities in terms of exploiting or capturing fish or other biota in the area around the seagrass ecosystems continue to be carried out, so it is suspected that it is likely to affect the existence of seagrass ecosystems around the Siput island.

Other conditions can also be seen that the territorial waters of the Siput island are also areas that are used by the community for tourism activities so that the ships that deliver the tourists will also be anchored around the waters of the Siput island which are overgrown with seagrass ecosystems. Likewise, the existence of the waters of the Siput island also has a distance not far from the residential areas and the port of Lewoleba, so that all activities in the form of ship dunes around the Siput island and also from the port will certainly contribute to the spill of oil into the waters that are thought to affect seagrass ecosystem conditions that exist around the waters of the Siput island. Furthermore, with the existence of settlements around the waters of the Siput island which contributes to the activity of disposal of garbage and waste leading to the sea, it is suspected that it will affect the condition of seagrass ecosystems in the waters of the Siput island, so it is necessary to conduct research related to the composition of seagrass and physicochemical of waters, as basic data in the preparation of strategies for sustainable management of marine resources on the Siput Island.

RESEARCH METHODS

The study was conducted from June to July 2019 in the waters of the Siput Island, Lembata, East Nusa Tenggara, Indonesia. It is a quantitative study using the line transect method. Equipment and materials used in this study are GPS, digital cameras, transect quadrants, plastic samples, DO (dissolved oxygen) meters, pH meters, refractometers and thermometers.

Fig-1: Location of The Study: Siput Island, Lembata, Indonesia (Source: Google Map)

The number of transects used was four transects with the position of each transect namely transect I: S = 8 ° 21'51.13 "and E = 123 ° 24'24.57", transect II: S = 8 ° 21'48.36 "and E = 123 ° 24'40.12 ", transect III: S = 8 ° 21'47.26" and E = 123 ° 24'57.82 ", and IV transect: S = 8 ° 21'39.40" and E = 123 ° 25'2.00 " (Figure-1). The line transect is placed perpendicular to the coastline towards the sea in seagrass ecosystems. Sample plots in the form of a square or quadrant with a size of 1 x 1 m totaling 10 sample plots or quadrants, with the distance squared on each transect 10 m. The seagrass found was identified, then the species composition of each transect is calculated using the formula below [7].

$$K_i = \frac{n_i}{N} \times 100\%$$

Where:

Ki: Composition of the ith species (%)
Ni: Individuals number of the ith species
N: Total number of invividuals

Observations of water physicochemical parameters were carried out at each transect location, including temperature, salinity, and pH. In addition, the substrate type data retrieval was also carried out using a pipe to take the sample and put in a sample container and then analyzed the type of substrate in the Laboratory Fisheries, University of Muhammadiyah Kupang. Data from the calculation of species composition and measurement of physicochemical of waters were analyzed using quantitative descriptive analysis with SPSS 24 software.

RESULTS AND DISCUSSION

Composition of Seagrasses

The study found three species of seagrass in the waters of the Siput Island, Lembata, Indonesia. The three species of seagrass consist of *Enhalus acroides*, *Halophila ovalis*, *Thalasasia hamprichi* (Figure-3). Seagrass habitat at this location is located along the southern coast of the island. Sloping coastal elevation along the southern side of the island makes it an ideal habitat for seagrass ecosystems.

Fig-2: Seagrasses Spesies in Siput Island

The chart above explains that the composition of seagrass species around the waters of Pulau Siput Regency in the transect I were E. *acroides* by 80%, T. *hamprichi* by 60%, H. *ovalis* by 40%, with an average presence value of all species by 60.00%. In transect II, the composition were E. *acroides* by 60%, T. *hamprichi* by 60% and H. *ovalis* by 20%, with an average attendance value of all species by 46.67%. In transect III, the composition were E. *acroides* by 80%, T. *hamprichi* by 80%, H. *ovalis* by 40%, with an average presence of all species by 66.67%. While in transect IV, the composition were E. *acroides* by 60%, T. *hamprichi* by 40%, H. *ovalis* by 25%, with an average value of the presence of all types of 41.67% (Figure-3).

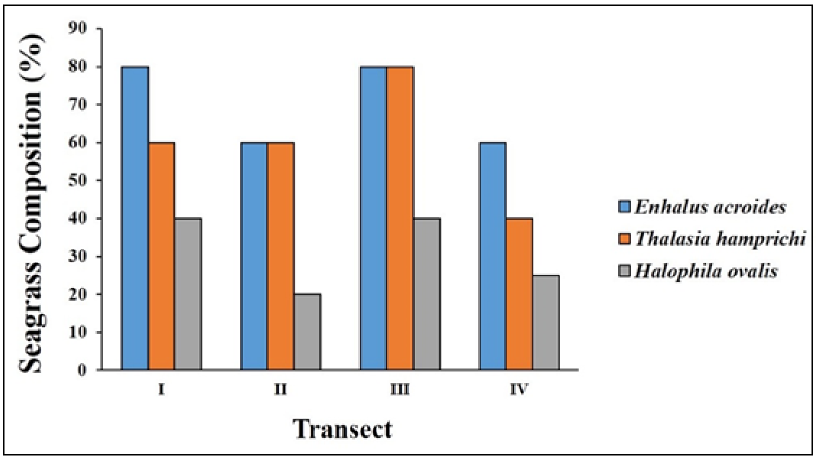

Fig-3: Seagrasses Composition in Siput Island

Physico-Chemical of Waters and Substrate

The value of waters physicochemical in Snail Island Regency is low relative to the three transects, i.e. temperature 30−33 °C, salinity 32−33 ppt, except for pH values that are slightly varied, ranging from 7.3−8.4. The substrate at the three transects is the same relative, namelymuddy sand (Table-1).

Table-1: Physico-Chemical of Waters and Substrate in Seagrass Habitat

Parameter	Transect			
	I	II	III	IV
Suhu (°C)	30 − 33	30 − 33	30 − 33	30 − 33
Salinitas (ppt)	32 − 33	32 − 33	32 − 33	32 − 33
pH	8,2 – 8,3	7,6 – 8,4	7,3 – 7,7	7,5 – 7,9
Substrat	Pasir berlumpur	Pasir berlumpur	Pasir berlumpur	Pasir berlumpur

DISCUSSION

The composition of seagrass species, namely E. *acroides*, T. *hamprichi* and H. *ovalis* were significantly different. The highest seagrass composition found in transect I was E. *acroides*, followed by T. *Hamprichi* and the lowest was H. *Ovalis*. In transect II, the highest composition of seagrass was E. *acroides* and T. *hamprichi* species, then the lowest was H. *Ovalis*. In transect III, the highest composition of seagrass species was E. *acroides* and T. *hamprichi*, then the lowest was H. *ovalis*. transect IV the highest composition of seagrass species was found in the species of seagrass E. *acroides*, followed by the type of seagrass T. *hamprichi* and the lowest was found in seagrass species H. *ovalis*. The seagrass composition in this island is lower than the results of a study in the Myeik Archipelago and Rakhine Coastal Areas, in Myanmar, which found 11 species of seagrass [4].

Seagrass composition values at all points between transects as described above, although there are high and low variations, they are still below 100%. Likewise with the composition, value of all species at each point between transects, although It shows different values but are still below 100%. The percentage of the presence or composition of seagrass species in an area obtained through observations is one alternative or formula used to estimate the presence of seagrass species in seagrass from class, certain genera and species that live in these habitats. If the percentage of the presence or composition of seagrass species in a habitat reaches 100%, the condition of the habitat as a place to live seagrasses are still in natural conditions or have not experienced certain disturbances and pressures. In fact if the percentage of the presence or composition of seagrass species in an aquatic habitat below 100%, it can be said that the condition of the seagrass habitat or place of life has experienced various disturbances and certain pressures, resulting in the increasingly low number of individuals from each species of seagrass that lives in it [8].

Refer to the explanation above, if it is connected with the average percentage of the presence of all seagrass species at each point between transects that only reach 46.67−66.67% and the composition of each species of seagrass at all points between transects that only reaching a value of 20−80%, it can be said that the condition of the habitat or place of seagrass living around the waters of Pulau Siput, Lembata Regency has experienced various disturbances or degradation pressures from certain factors. This is in line with what was reported by several previous studies that the factors that influence the presence of seagrass in a habitat usually comes from internal factors (natural factors) and external factors (humans). Internal factors that affect seagrass life can be either high or low speed of currents and waves. Where the higher current and wave velocity in a seagrass habitat will have an effect on the death of seagrass plants which impact on the lower number of seagrass individuals in the habitat. While external factors that affect the growth and life of seagrass in a habitat that can come from community activities originating from the mainland, such as the disposal of garbage and waste to the sea and industrial activities and other anthropogenic activities. Furthermore, the external activities in the seagrass ecosystem can be in the form of sea transportation activities, fishing boat anchoring activities, tourism activities, seaweed farming activities and fishing activities at the lowest tide [6, 9, 10, 11]. Seagrass is one of the biological resources found in coastal areas that are very vulnerable to various disturbances such as activities from the mainland which includes landfill and household waste disposal heading to the coastal area. Other than the activities carried out directly in the coastal watershed itself, such as boat landing activities and fish catching at the lowest tide which is likely to contribute negatively to the degradation of the coastal and marine environment as seagrass habitats [6, 12, 13].

A number of studies have indicated that the ecosystem ecosystem is declining in many locations [5]. Various activities are carried out either directly or indirectly effects on the coastal waters which are seagrass habitats, then explains that activities are carried out from the mainland, such as direct disposal of garbage into the sea will cause sedimentation and will also cover the mouth of the seagrass leaves so that it will affect the disruption of the photosynthesis process for a series of plants for growth and survival which then impacts on the death of a series [14]. Furthermore, activities in the form of waste disposal leading to coastal and marine areas will influence the change in nutrient composition for growth and survival of seagrass [15]. Besides the existence of sea transportation and anchoring activities of fishing boats in the area that is overgrown with seagrass, it will contribute negatively to the occurrence of oil spillage in the seagrass habitat, which will then influence the occurrence of changes in nutrient composition for growth and survival of seagrass [6]. The catching of fish and macrobenthos during low tide using traditional equipment such as pieces of iron and pieces of wood for gouging and digging for substrates and activities that often step on the substrate can also affect the decline in the amount of nutrient composition and result in low water fertility and environmental quality as a habitat and then will impact on the disruption growth and survival of seagrass and biota associated in it [16, 17, 18, 19]. The community activities such as waste disposal and waste that lead to the sea, industrial activity, shipping activity, sea transportation activity, seaweed cultivation activity and catching biota in intertidal, is influence to the condition of seagrass ecosystem [6]. In addition, changes in seagrass ecosystems are also influenced by global climate change, as well as the various centers of diversity, areas of high human impact, areas where seagrasses are already stressed by light and temperature, and areas susceptible to invasion, either from adjacent waterways or from import of plant material [21]. However, diversity of species can be used as an indicator to estimate the status of the waters environmental conditions [3].

The explanation above if related to the results obtained in this study, it can be seen that internal factors (natural factors) in the form of current and wave velocity may not affect the composition of the existing seagrass species, considering the waters around the Siput island are areas that are flanked by the bay, so that the duration of the high and low waves and the current speed is stable or constant. Thus, the main triggering factor of the low composition of seagrass species in the area around the waters of Siput Island, Lembata Regency, is its external factors, which are various factors caused by humans who carry out certain activities such as settlements dumping garbage into coastal and marine waters, which causes disruption of photosynthesis. in seagrass, then disposal of household waste into the sea which affects the low nutrient composition and also the activities carried out in areas that are overgrown with seagrass such as sea transportation activities, fishing boat anchoring activities that have an effect on changing the amount of nutrient composition and decreasing the fertility of the waters of the fiber quality of the environment which then resulted in changes in the composition of seagrass species that dominate the waters around the Siput Island, Lembata Regency.

The variations of high and low values of physicochemical parameters of waters such as temperature, substrate, waters, salinity, pH and dissolved oxygen above are still in the range tolerated by seagrass for growth and survival. The range of physicochemical parameters of waters that are ideal for the growth of aquatic ecosystem including seagrass is for temperatures ranging from 27−32 °C, salinity ranges from 28−33 ppt, pH ranges between 7.3−8.4 and the substrate muddy sand [20]. The content of nitrate and C-organic (in the water), turbidity, TSS, temperature, current speed, depth and substrate are the main limiting factors of seagrass distribution [3]. The condition of the waters of the Siput Island supports the growth and development of seagrass ecosystems, but in the future, it is important to conduct sustainable management of these waters, considering that this island is a producer of shells and snails which are the source of production for the Lewoleba coastal community and this location will also be developed as a marine ecotourism object.

CONCLUSION

The spesies of seagrasses found in Siput Island were E. *acroides*, T. *hamprichi* and H. *ovalis*. The composition of seagrasses were E. *acroides*: 60−80%, T. *hamprichi*: 60−80%, and H. *ovalis*: 20−40%. The physicochemical of waters such as temperature, salinity and pH in Siput Island is supporting for growth and survival of seagrasses i.e. temperatures 30−33°C, salinity 32−33 ppt, pH 7.2−8.5, with the type of substrate is muddy sand.

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