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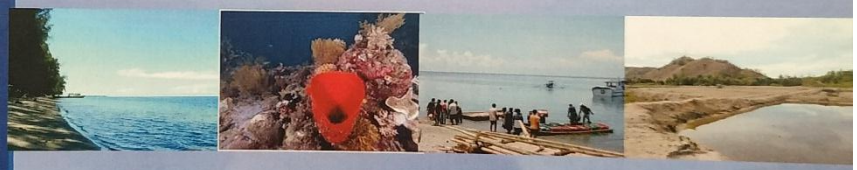

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.VEGETATION STRUCTURE OF SEAGRASS IN SARONDE ISLAND, PONELO ARCHIPELAGO *SUBDISTRICT, NORTH GORONTALO DISTRICT, GORONTALO PROVINCE*

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Abstract

This research aims to determine the structure and condition of vegetation seagrass beds in the Saronde Island, Ponelo Archipelago Subdistrict, North Gorontalo District. The research activities carried out on November 10 until December 10, 2012. This research is explanatory by using the survey method. Observations were made at three stations, covering 5 plot transects, spaced transects of 10 meters. To obtain supporting data also performed measurements of the physical parameters of water, such as current, brightness, depth, temperature, salinity, and substrate type. Analysis was conducted on the composition of vegetation of species, frequency of species, relative frequency of species, density of species, relative density of species, closure of species, relative closure of species, dominance of species, relative dominance of species, diversity index, and the important value index. Research found five types of seagrass, which is *Cymodocea serrulata, Enhalus acoroides, Halophila minor, Halophila ovalis,* and *Thalassia hemprichii.* The first station which is located in the north of the island has the highest value for the vegetation analysis of all the research station.

Keywords : Vegetation Structure, Seagrass, Saronde Island.

I. INTRODUCTION

The waters of eastern Indonesia, have marine biodiversity is very complex. The high diversity is strongly supported by oceanographic conditions across the region. Globally, the circulation of sea water in this region is part of the trajectory oceanis called oceanic conveyor belt. This trajectory brings warm surface sea water and has low salinity of the East to the West, into the deep waters of the North Atlantic with high salinity and low temperature, then flows from West to East and appeared again in the Pacific Ocean (Susetiono, 2007). This makes the territorial waters of eastern Indonesia has a high biodiversity, including diversity of seagrass because this track brings a number of nutrients needed by marine organisms, including sea grass.

Attention to seagrass ecosystems (seagrass beds) is still very less compared to the mangrove ecosystem (mangrove) and coral reefs ecosystem (coral reefs). Perhaps because of the shape and color of seagrass not beautiful as coral reefs. For most people, seagrass just looks like grass which is not useful. So most people, especially the ordinary people who perform activities on the coast, passing in coastal areas without being aware of the importance of seagrass beds in a coastal ecosystem. While pressure on seagrass

ecosystems and seagrass itself is starting to look like exploitation of resources in excess seagrass, seagrass acreage loss due reclamation and resource exploitation in ways that damage seagrass (Kiswara, 1994 in Takaendengan, 2009).

Seagrass is quite important in the shallow ocean waters, such as in waters Saronde Island, one of the islands in the District of North Gorontalo, at Gorontalo Province. One of the functions of seagrass is to maintain or preserve the stability of coastal beaches and estuarine ecosystems. Rhizome and root system of plants seagrass very rooted and spread in the substrate, capable of stabilizing the waters, binding sediments, and to prevent coastal erosion. Given that there is no mangrove forest ecosystems at Saronde Island waters, then the only ecosystem that serves to hold and bind sediments as well precipitate a solid material to the base so that the water remains clear waters and coral reefs are not covered by sediment is seagrass beds. Seagrass beds also serve to protect coastal areas from threats Saronde Island abrasion and maintain the morphology or shape of the beach as well as a habitat for several species of fish.

Saronde Island has a natural beauty, including the beauty of the sea. So that the visitors came and went to enjoy the panorama. However, coastal development plan to boost tourism activities often ignore the carrying capacity of coastal ecosystems. So that such a plan could have potentially negative impact on the presence of seagrass beds in the island.

This research aims to determine the vegetation structure of seagrass in Saronde Island waters, and determine the ratio of seagrass vegetation structure of each research station.

II . MATERIALS AND METHODS

Research activities which basically consists of sample collection, measurement of physical parameters of waters, and the identification of the samples, performed during one month, from November to December 2012 in the waters of Saronde Island, at Ponelo Archipelago Subdistrict, North Gorontalo District.

The tools used in this research is the roll meter, sample plots (plot), refractometer, multiparamater analysis, magnifying glass, fins, snorkels, masks, stationary in the water, data book, camera, compass, scope, drawing identification of seagrass which has been laminated, secchi disk, and plastic bags.

Observation of the seagrass is done with the line transect technique. Transect line is made by means of a rope stretched first discovered seagrass perpendicular to the shoreline, to the seaward extent of coral reefs or no longer found seagrass (Fachrul, 2007).

In each transect placed sample plots or plots measuring 50 x 50 cm. Sample plot or plots are placed at a distance 100 m from the shoreline. The distance between the plot is 10 m. The number of plots that can be placed on any transect is not the same, depending on the limits or boundaries of coral reefs where seagrass can be found (Fachrul, 2007).

Then do the counting and recording of data on seagrass. Examples of different types of seagrass at each location transect taken, marked or labeled, rinsed with water and cleaned of sand stuck, and identified by Den Hartog (1970 in Takaendengan, 2010).

Data analysis was performed to determine the species composition, frequency of species, relative frequency of species, density of species, relative density of species, closure of species, relative closure of species, dominance of species, relative dominance of species, diversity index, and importance value index.

III. RESULTS AND DISCUSSION

3.1 Description of Saronde Island

Saronde Island located in the Subdistrict of Ponelo Archipelago, North Gorontalo District at coordinates 00 ° 55' 32" North latitude - 122 ° 51' 54" East longitude. To get to the Saronde Island, we have to go to North Gorontalo District which is about 65 km from the city center of Gorontalo, with a travel time of approximately one half hours using a private car. Saronde Island is 12 miles from the docks of the Port of Kwandang. After arriving at the Port of Kwandang, proceed by boat which is called 'katinting', or better known as the water taxi takes about 45 minutes. This island is one of the tourism activities destinations, with a flat and hilly topography with flat convex slopes (CTF, 2011).

3.2 Composition Species of Seagrass

Seagrass species composition throughout the research station is *Cymodocea serrulata, Enhalus acoroides, Halophila minor, Halophila ovalis,* and *Thalassia hemprichii*. With seagrass beds that form is mixed vegetation. *Thalassia hemprichii* seagrass species has the percentage composition of the highest kind in the entire research station.

More clearly, the calculation results of the composition of seagrass species in the entire research station can be seen in Table 1 below :

Table 1. Composition Species of Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	15,778	33,946	29,674
E. acoroides	13,582	9,954	18,355
H. minor	1,578	0,453	1,861
H. ovalis	0,801	0,435	0,356
T. hemprichii	68,260	55,212	49,754

Source : Results of Primary Data Processed, 2012.

3.3 Frequency of Seagrass

Frequency is used as a parameter to indicate the distribution of vegetation or the distribution of plant species in the ecosystem, or show the pattern of distribution of plants (Fachrul, 2007). More clearly, the calculation results of the frequency of seagrass species in the entire research station can be seen in Table 2 below :

Table 2. Frequency of Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	0,7520	0,8800	0,7120
E. acoroides	0,5680	0,4240	0,6320
H. minor	0,1520	0,0400	0,0880
H. ovalis	0,1600	0,0320	0,0720
T. hemprichii	1,6720	1,2160	1,0640

Source : Results of Primary Data Processed, 2012.

Table 2 shows that seagrass distribution in first station have a broader, more equitable, and more dense than the second station, and third station.

3.4 Relative Frequency of Seagrass

The relative frequency is the ratio between the frequency of seagrass species with the number of frequencies for all types of seagrass. The relative frequencies used for comparison lowest value and the highest value reached by the frequency of each seagrass observed, to the amount of the overall frequency of seagrass species. More clearly, the calculation results of the relative frequency of seagrass species in the entire research station can be seen in Table 3 below :

Table 3. Relative Frequency Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	0,3473	0,5716	0,4400
E. acoroides	0,2593	0,2507	0,3780
H. minor	0,0649	0,0288	0,0560
H. ovalis	0,0701	0,0230	0,0456
T. hemprichii	0,8583	0,7260	0,6803

Source : Results of Primary Data Processed, 2012.

3.5 Density of Seagrass Species

The density of seagrass species (K_i) is the total number of individual types of seagrass in a unit area measured. The density of seagrass species in first station is the highest among all the research station. Because the first station had no direct influence on the activities of the people in the Ponelo village and Dudepo village, and not the access in and out of boats or fishing boats and tourists. Because more often exposed to the activity of the tourists only in the South, East, and West.

Seagrass species *Thalassia hemprichii* is a seagrass species which is spreading most extensive, and often grow on substrates that depth is low, has a distribution vertical, ranging from zones near shore up zone subtidal bottom, and able to survive in all types of habitat (Nainggolan, 2011).

Density calculation results for all types of seagrass in the entire research station can be seen in Table 4 below :

Table 4. The density of Seagrass Species in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	4,308	6,772	3,616
E. acoroides	3,324	1,744	1,908
H. minor	0,424	0,080	0,212
H. ovalis	0,212	0,048	0,052
T. hemprichii	15,632	8,472	5,804

Source : Results of Primary Data Processed, 2012.

Table 4 shows that the first station is a station that has the highest density value from all types of existing research station, which is 24 individuals/m². Where as the third station is a station that has the lowest value of density types, with a density value for all types of seagrass species only 12 individuals/m². Because, at the third station there are many types of sea urchins such as *Temnopleurus alexandrii* and *Diadema setosum*. Sea urchins can also be found in algae growth areas (coral reef ecosystem). This is because in addition to eating the leaves of seagrass, sea urchins are also living from grazing activity or consuming algae (Lawrence, 1975 to Aziz, 1994).

3.6 Relative Density of Seagrass

Relative density of seagrass is a comparison between the number of individual types of seagrass to the total number of individuals of all types of seagrass. Calculation results of relative density of seagrass in the entire research station can be seen in Table 5 below :

Table 5. Relative density Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	18,0251	39,5653	31,1939
E. acoroides	13,9079	10,1893	16,4596
H. minor	1,7741	0,4674	1,8288
H. ovalis	0,8870	0,2804	0,4486
T.hemprichii	65,4059	49,4975	50,0690

Source : Results of Primary Data Processed, 2012.

3.7 Closure of Seagrass Species

Closure of seagrass species illustrate the extent of seagrass cover a body of water (Nainggolan, 2011). Closing calculation results of seagrass species in the entire research station can be seen in Table 6 below :

Table 6. Closure Type of Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	0,3760	0,4400	0,3560
E. acoroides	0,2840	0,2120	0,3160
H. minor	0,0760	0,0200	0,0440
H. ovalis	0,0800	0,0160	0,0360
T. hemprichii	0,8360	0,6080	0,5320

Source : Results of Primary Data Processed, 2012.

Table 6 above shows that the type of *Thalassia hemprichii* has the highest closing species because it has a large shape or morphology. Although this type of *Enhalus acoroides* shape or morphology were great, but the kind *Enhalus acoroides* often found broken or damaged truncated propeller of the boat engines and ship visiting the island Saronde.

Judging from the closing of seagrass found in the field, the criterion condition of seagrass in Island waters Saronde according to the Decree of the Minister of Environment No. 200 of 2004, are included in the category of poor or less healthy (less than 29.9 %). This suggests that the impaired Saronde Island waters originating from human activity, whether it be fishing activities as well as the visitors.

3.8 Relative Closure of Seagrass

Relative closure of seagrass is the ratio between the closure of the individual seagrass types with a total closure of all types of seagrass. Relative closure used for comparison of lowest value and the highest value achieved by the closure of each seagrass observed, to the number of total closure of seagrass species.

Calculation results of relative closure of seagrass in the entire research station can be seen in Table 7 below :

Table 7. Relative Closing of Seagrass in the entire Research Station

Kind of Seagrass	*Station*		
	I (North)	II (Westt)	III (East)
C. serrulata	4,3416	7,1445	5,5002
E. acoroides	3,2418	3,1332	4,7250
H. minor	0,8115	0,3597	0,7001
H. ovalis	0,8768	0,2878	0,5705
T. hemprichii	10,7283	9,0749	8,5041

Source : Results of Primary Data Processed, 2012.

3.9 Dominance of Seagrass Species

Dominance describe a type of plant that is able to influence the community by way of the large number of species and the dominant growth (Fachrul, 2007). The calculation result dominance in the entire research station can be seen in Table 8 below :

Table 8. Dominance of Seagrass Species in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	0,1376	0,1147	0,1753
E. acoroides	0,1264	0,0785	0,1442
H. minor	0,0157	0,0000	0,0062
H. ovalis	0,0075	0,0000	0,0017
T. hemprichii	0,3384	0,3814	0,1950

Source : Results of Primary Data Processed, 2012.

Table 8 shows that seagrass species *Thalassia hemprichii* dominates all research stations. The second station (in the West) and the third station (in the East) has a low specific dominance, because they got a direct influence in the form of run-off from the Ponelo village and the Dudepo village, as well as an area of entry and exit of boats or fishing boats as well as visitors.

3.10 Relative Dominance of Seagrass

Relative dominance is the ratio between the number of a type of dominance by the number of all types of seagrass. Relative dominance used for comparison of lowest value and the highest value reached by the dominance of each seagrass observed, to the total number of seagrass species dominance.

The results of the calculation of the relative dominance for all types of seagrass in the entire research station can be seen in Table 9 below :

Table 9. Relative Dominance of Seagrass in the Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	18,0251	39,5653	31,1939
E. acoroides	13,9079	10,1893	16,4596
H. minor	1,7741	0,4674	1,8288
H. ovalis	0,8870	0,2804	0,4486
T. hemprichii	65,4059	49,4975	50,0690

Source : Results of Primary Data Processed, 2012.

3.11 Diversity Index Species

Diversity index species is very useful parameter to compare different plant communities, especially for studying disorders environmental factors (abiotic) to the community or to know the state of succession and stability of the community. Because in a community, in general, there are many different types of plants. Then the older or more stable circumstances of a community, the higher the diversity of that plant (Fachrul, 2007).

Diversity index calculation results in the entire research station can be seen in Table 10 below :

Table 10. Diversity Index of Seagrass in the Entire Research Station

Kind of Seagrass	H' of Each Station		
	I (North)	II (West)	III (East)
C. serrulata	0,0890	0,1146	0,0799
E. acoroides	0,0758	0,0295	0,0422
H. minor	0,0169	0,0014	0,0047
H. ovalis	0,0097	0,0008	0,0011
T. hemprichii	0,1566	0,1434	0,1283

Source : Results of Primary Data Processed, 2012.

3.12 Importance Value Index

Importance value index is used to calculate and predict the overall role of seagrass species in the seagrass beds community. The higher value of important value index of a type of the other types, have the role of these types communities they occupy (Kordi, 2011).

The value of the Index Value Important heavily dependent on the value of the relative density, relative closure, and the relative frequency of each type of seagrass (Nainggolan, 2011).

Results of calculation of the importance value index for the entire research station can be seen in Table 11 below :

Table 11. Importance Value Index of Seagrass in the Entire Research Station

Kind of Seagrass	Station		
	I (North)	II (West)	III (East)
C. serrulata	22,7141	47,2813	37,1342
E. acoroides	17,4091	13,5731	21,5627
H. minor	2,6504	0,8559	2,5850
H. ovalis	1,8340	0,5912	1,0647
T. hemprichii	76,9924	59,2984	59,2535

Source : Results of Primary Data Processed, 2012.

Table 11 shows that seagrass *Thalassia hemprichii* is a type of seagrass that has the highest important value index of all the existing research station, with important value index for the seagrass *Thalassia hemprichii* is 76.99. Thus, seagrass *Thalassia hemprichii* types have the highest role of all types

of existing seagrass ecosystems in maintaining stability on any existing research station, and the flow of energy in the community seagrass growing on Saronde Island waters.

3.13 Comparison Seagrass Vegetation Structure in Each Station

Seagrass vegetation structure formed in the Saronde Island as follow :

1. To a depth of less than 1 meter, grew *Thalassia hemprichii, Cymodocea serrulata, Enhalus acoroides, Halophila ovalis* and *Halophila minor.* But, *Thalassia hemprichii* growing along *Enhalus acoroides* meanwhile *Cymodocea serrulata* found growing along seagrass species *Halophila ovalis*, and *Halophila minor.* Because the root form of *Halophila ovalis*, and *Halophila minor* not as strong as seagrass species that dominates the surface of the substrate such as *Thalassia hemprichii*, or *Enhalus acoroides.*
2. To a depth of 1 to 3 meters below sea level, growing seagrass species *Enhalus acoroides, Thalassia hemprichii* and *Cymodocea serrulata,*but didn't found *Halophila ovalis* and *Halophila minor.*

The first station had the highest form of the vegetation structure analysis of all existing research station. Overall value vegetation structure analysis of the most high compared to the second station and the third, for the first station has the highest level of depth than the second and third stations. Where the depth of the substrate plays a role in the stability of the sediment that is as protective plant of ocean currents, and as a supplier of nutrients. Substrate at the first station was preferred seagrass because it consists of fine sand mixed with a little mud, rubble, rubble and molluscs compared to the type of substrate in the second and third stations are almost the same as the first station just not mixed with a little mud. This is in accordance with the opinion of Kiswara (2004) in Nainggolan (2011) which states that the seagrass growing on mud and sand substrate density will be higher than the seagrass growing on dead coral substrate.

Therefore, the type of *Thalassia hemprichii* that found dominance in all station. Because *Thalassia hemprichii* is a seagrass species which is spreading most extensive, and often grow on substrates that depth is low, has a distribution vertical, ranging from zones near shore up zone subtidal bottom, and able to survive in all types of habitat (Nainggolan, 2011).

More clearly, the comparison seagrass vegetation structure in each station can be seen in Table 12 bellow :

Table 12. Comparison seagrass vegetation structure in each station

Number	Type of Seagrass	Vegetation Structure Analysis of Seagrass That was Measured	Value in Each Station		
			Station I	Station II	Station III
1	2	3	4	5	6
1	*Cymodocea serrulata*	Composition of Spesies	15,7783	33,946	29,674
2		Frequency of Species	0,7520	0,8800	0,7120
3		Density of Species	4,3080	6,7720	3,6160
4		Closure of Species	0,37600	0,4400	0,3560
5		Dominance of Species	0,1376	0,1147	0,1753
6		Biodiversity Index (H')	0,0890	0,1146	0,0799
7		Important Value Index	22,7141	47,2813	37,1342

Continue of Table 12

Number	Type of Seagrass	Vegetation Structure Analysis of Seagrass That was Measured	Value in Each Station		
			Station I	Station II	Station III
1	2	3	4	5	6
8	*Enhalus acoroides*	Composition of Spesies	13,5823	9,9538	18,3548
9		Frequency of Species	0,5680	0,4240	0,6320
10		Density of Species	3,3240	1,7440	1,9080
11		Closure of Species	0,2840	0,2120	0,3160
12		Dominance of Species	0,1264	0,0785	0,1442
13		Biodiversity Index (H')	0,0758	0,0295	0,0422
14		Important Value Index	17,4091	13,5731	21,5627
15	*Halophila minor*	Composition of Spesies	1,5784	0,4529	1,8615
16		Frequency of Species	0,1520	0,0400	0,0880
17		Density of Species	0,4240	0,0800	0,2120
18		Closure of Species	0,0760	0,0200	0,0440
19		Dominance of Species	0,0157	0,0000	0,0062
20		Biodiversity Index (H')	0,0169	0,0014	0,0047
21		Important Value Index	2,6504	0,8559	2,5850
22	*Halophila ovalis*	Composition of Spesies	0,8006	0,4347	0,3559
23		Frequency of Species	0,1600	0,0320	0,0720
24		Density of Species	0,2120	0,0480	0,0520
25		Closure of Species	0,0800	0,0160	0,0360
26		Dominance of Species	0,0075	0,0000	0,0017
27		Biodiversity Index (H')	0,0097	0,0008	0,0011
28		Important Value Index	1,8340	0,5912	1,0647
30	*Thalassia hemprichii*	Frequency of Species	1,6720	1,2160	1,0640
31		Density of Species	15,6320	8,4720	5,8040
32		Closure of Species	0,8360	0,6080	0,5320
33		Dominance of Species	0,3384	0,3814	0,1950
34		Biodiversity Index (H')	0,1566	0,1434	0,1283
35		Important Value Index	76,9924	59,2984	59,2535

IV . CONCLUSIONS

The conclusions from this research is :

1. Saronde Island waters has five types of seagrass, which is *Cymodocea serrulata, Enhalus acoroides, Halophila minor, Halophila ovalis,* and *Thalassia hemprichii* with seagrass vegetation types forming a mixed vegetation.
2. Seagrass vegetation structure formed in the Saronde Island is :
   a. To a depth of less than 1 meter, grew *Thalassia hemprichii, Cymodocea serrulata, Enhalus acoroides, Halophila ovalis* and *Halophila minor.* But, *Thalassia hemprichii* growing along *Enhalus acoroides* meanwhile *Cymodocea serrulata* found growing along seagrass species *Halophila ovalis,* and *Halophila minor.* Because the root form of *Halophila ovalis,* and *Halophila minor* not as strong as seagrass species that dominates the surface of the substrate, such as *Thalassia hemprichii,*or *Enhalus acoroides.*
   b. To a depth of 1 to 3 meters below sea level, growing seagrass species *Enhalus acoroides, Thalassia hemprichii* and *Cymodocea serrulata, Halophila ovalis,* but didn't found *Halophila minor.*
3. The first station have the highest vegetation analysis among all research stations.

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