Community structure of seagrass in Waai and Lateri waters, Ambon Island, Indonesia

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Abstract. Seagrass ecosystems of Ambon Island have the potential as shelter, feeding, and spawning ground from various organisms and play an important role for the coastal marine environment. However, habitat of seagrass is under pressure as the result of the utilization of increased activity in the region, causing a decrease in the ecological potential and contribution. This study aims at analyzing seagrass communities structure, including species composition, density, frequency of attendance and percent coverage of seagrass in the surrounding waters of Waai and Lateri, Ambon Island, Indonesia. The results show that there are four species of seagrasses, namely *Halodule uninervis*, *Cymodocea serrulata*, *Enhalus acoroides*, and *Halophila ovalis* found in the station of Waai. The highest density was found in *H. uninervis* with a density value of 153.2 shoot m^{-2}. The highest frequency of occurrence is found on the type *H. uninervis* with a value of 0.8, whereas the lowest was found in *H. ovalis* with a value of 0.06. For the Waai station the highest percent coverage contributed by *C. serrulata* with a value of 34.74%. In the Lateri station, two species of seagrasses are found namely *Enhalus acoroides* and *Thalassia hemprichii*. *T. hemprichii* is found as having the highest density with a value of 20.5 shoot m^{-2}. The highest frequency of occurrence is found in *E. acoroides* with a value of 0.62. The total value of the percent coverage in the Lateri station is 42.27%, the highest coverage percent being contributed by *T. hemprichii* (24.95%).

Key Words: community structure, seagrass, species composition, density, percent coverage.

Introduction. Seagrass is the one of typical tropical marine ecosystems, in addition to mangroves and coral reefs. Seagrass ecosystem is widespread in coastal areas, thus easily influenced by public activities on the upper land. Seagrass grow thrives mainly in open areas of tides and coastal waters which are essentially in the form of mud, sand, gravel and rubble dead (Den Hartog 1970). Furthermore, he explains that the sea grass grows well in a sheltered area and sand substratum, stable and close to the sediment that moves horizontally.

Seagrass has several important functions, among others: as a spawning ground, nursery grounds, as a shelter for several species of fauna. Seagrass has a potential which is very important in trapping the sediments, stabilizing the base substrate, purify water, the source of primary productivity, directing food source for many animals and has a good ability to move dissolved nutrients in the waters of the surface sediment. Seagrass also have roots and rhizomes that enable them to bind to sediment, and therefore avoiding the danger of erosion (Dawes 1981).

Ambon Island belongs to the category of small islands with the construction activity levels are quite high. Department of Maritime and Fisheries (2004) reported that the fishery resources of Ambon Island surrounding waters potentially reaching 474 500 tons $year^{-1}$, and largely sourced from coastal areas. However, in line with population growth and the increasing construction activities, there has been a conversion of coastal land for various purposes which resulted into the reduction of water quality. This was proven through the research conducted by Tuahatu (2010), that the water column and sediment of Ambon Bay surrounding waters contain heavy metals. Tuhumury et al (2011) also reported the existence of sedimentation in mangrove ecosystems in Passo village, Inner Ambon Bay, while according to Selanno (2011), there is an increase of organic matter and polyciclic aromatic hydrocarbons (PAH) in these surrounding waters. Environmental degradation has an impact on the potential and diversity of biological resources. Results of previous studies proved that the potential of seagrass ecosystems has decreased over time. Tuhumury (2008) in his study only found six types of seagrass in the Ambon bay with category of community status ranges from less rich/poor to damaged. In order to manage the consequences of resources degradation that leads to long-term management, a research aims at finding current data on the condition of seagrass ecosystems that exist in both location is imperative to be conducted. The purpose of this research was to determine community structure of seagrass consisting of species composition, species density, frequency of occurrence, and percentage of coverage.

Material and Method. This research was conducted from May to July 2015 in coastal surrounding waters of Waai and Lateri, Ambon Island, Indonesia (Figure 1). The process of collecting the data of seagrass was conducted at low tide with the line transect method (Azkab 1999) adjusted to the field conditions. Transects were done by a line perpendicular from the shoreline, with the 25 meters distance between the transects. On each transect plot data capture was placed by using the squares with size of 50 x 50 cm. The distance between the squares of sampling is 5 meters. The sampling was done by quantification the percentage of coverage in each plot and calculating all the stands of seagrasses in each plot to determine the density of each type. The density of the type, frequency of the occurrence and the percentage of coverage is calculated by using the formula proposed by English et al (1994).

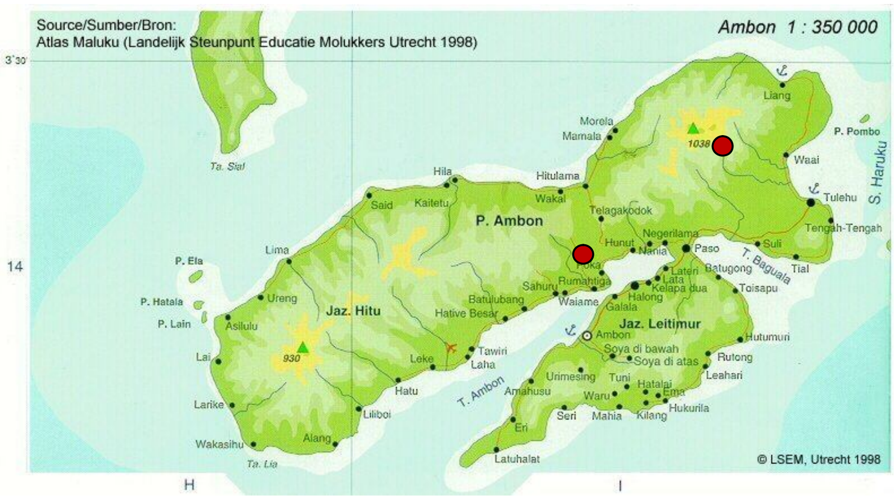

Figure 1. Map showing research location (red circles).

The ratings percent coverage is done by consulting the Table 1.

Table 1

Criteria of percentage coverage

Class	*Total substratum covered*	*% substratum covered*	*Midpoint (M)*
5	1/2 - all	50 - 100	75
4	1/4 – 1/2	25 - 50	37.5
3	1/8 - 1/4	12.5 - 25	18.75
2	1/16 - 1/8	6.25 - 12.5	9.38
1	< 1/16	< 6.25	3.13
0	No seagrass	0	0

Source: English et al (1994).

Seagrass coverage status assessment was conducted by using criteria following Table 2.

Table 2

Criteria for the seagrass coverage status

Condition	*Coverage*	
Abundant	High abundance / healthy	≥ 60%
Average dense	Average abundance / less healthy	30% - 59.9%
Damaged	Lack of abundance	≤ 29.9%

Source: Ministerial Decree of State Minister for The Environment No. 200, Year 2004.

Results and Discussion

Species composition. There are five species of sea grass found as the result of the observation on the overall composition of seagrass species in both location, which are Waai and Lateri surrounding waters. Those five species are classified into two families, namely Hydrocarithaceae and Cymodoceaceae. Species that belongs to the family of Hydrocharitaceae are *Enhalus acoroides*, *Thalassia hemprichii* and *Halophila ovalis*. While the species belonging to the family of Cymodoceaceae are namely *Cymodocea serrulata* and *Halodule uninervis* (Table 3). However the total number of seagrass species found in both locations is much lesser when it was compared to the results of the study conducted by Hernawan (2007) in the surrounding waters of Kei Kecil, Southeast Maluku who found seven species of sea grasses.

Table 3

Species composition and distribution of seagrass in the surrounding waters of Waai and Lateri

Family	*Species*	*Research location*	
		Waai	*Lateri*
Hydrocharitaceae	*Enhalus acoroides*	√	√
	Thalassia hemprichii		√
	Halophila ovalis	√	
Cymodoceaceae	*Cymodocea serrulata*	√	
	Halodule uninervis	√	

Legend: (√) = present.

Table 3 shows that the species composition of seagrass found in each of the research location was distributed unevenly. It is only *E. acoroides* which was found on both sites. The distribution of seagrasses in surrounding waters of Waai have more number of species, namely four species. However the number of species of seagrass found in Waai is still lower when compared to the results of the study conducted by Elly (2008) in the surrounding waters of Tulehu who found five species of seagrasses. We found *H. uninervis* from a single spot and grow in sandy substrate about 120 until 130 m from the shore in the surrounding waters of Waai. At the distance of 130 m we found a combination of *H. uninervis* and *E. acoroides*. The vegetation of seagrass found in towards the open sea is a mixed one consisting of *E. acoroides*, *C. serrulata* and *H. ovalis* with the type of substrate varies, sandy, rocky rubble mixed. The surrounding water of Waai are open and get the direct influence by the Banda Sea. This condition causes the formation of substrate varies in the middle of the waters. This substrate type is an indicator of a growing type of *E. acoroides*, *C. serrulata* and *H. ovalis* and also helps embedding a strong rooting for the seagrass species (Kiswara 1992). These species were also found by Jumawan et al (2015) in the research on coastal waters of Paligue, Philippines.

In surrounding Waters of Lateri, seagrass vegetation began to be found at a distance of 40 metres from the beach. *E. acoroides* and *T. hemprichii* are the species we found here. These species are the same ones found in the study conducted by Tuhumury (2008). The number of seagrass species found in the surrounding waters of Lateri is less than the number of seagrass species found in surrounding water of Halong (Tuhumury 2008) which found five species of seagrasses. The distribution of two species is almost evenly because of the influence of the substrate. The types of substrates found in these surrounding waters are sand, muddy sand, rocky and mixed rubble, but predominantly by sandy substrate. The sand and mud accumulation is due to the activity on the upper land and since the surrounding water of Lateri is situated in Inner Ambon Bay, then the speed of current is medium. The sediment grain particles in this area are also small to medium sized. According to Wimbaningrum (2003) in Sudiarsa (2012) due to the same factors of environmental needed by *T. hemprichii* and *E. acoroides,* both of these are always found in one place. The results indicate that the seagrass growing in two research locations is included into the category of mixed vegetation. Mixed vegetation is composed by two or more species of sea grass that grow together in one habitat.

Species density. The density of seagrass species was influenced by a growing seagrass itself as the type of substrate. Based on the observations on surrounding waters of Waai, sea grass species which present the highest density was represented by *H. uninervis* with a value of 153.2 shoot m^{-2}. On the contrary the lowest density is found on the species *H. ovalis* with a value of 13.3 shoot m^{-2} (Figure 2).

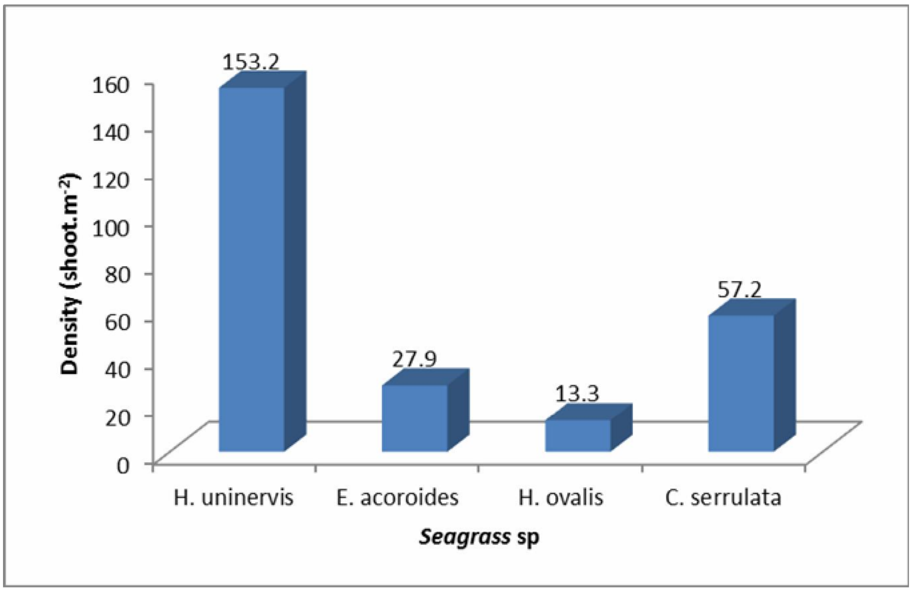

Figure 2. Density of seagrass in surrounding water of Waai.

The presence of *H. uninervis* with the highest density is strongly influenced by the type of substrate dominated by sandy substrate. According to Hutomo (1997) in Fauziyah (2004) *H. uninervis* lives on a substrate of fine-coarse sand in the intertidal and subtidal zones. On the contrary the presence of *H. ovalis* with the lowest density is due to not being able to adapt to the conditions that are exposed to the low tide and not flooded in a long time. This is in line with the opinion of Campbell et al (2006) in Short et al (2010) which states that *H. ovalis* is a species that is susceptible to high temperatures than other species. Thus climate change is also a threat to this species of seagrasses. In surrounding waters of Lateri with two species of seagrass, the highest density is represented by *T. hemprichii* with a value of 20.5 shoot m^{-2}. In contrast, seagrass species with the lowest density is represented by *E. acoroides* with a density value of 10.6 shoot m^{-2} (Figure 3).

The existence of *T. hemprichii* with high density is possibly caused by the substrate characteristics in surrounding water of Lateri which are dominated by fine sand. This species has a wide range enough for habitat characteristics of the turbidity, from single vegetation to mixed vegetation, according to Kiswara (1997) in Hernawan (2007). *T. hemprichii* is also included in the group of magnozosterid. One characteristics of magnozosterid group is its ability to live in a wide variety of substrates, particularly in sublittoral areas which are still submerged in water at low tide (Azkab 2006). When compared to the two sites, Waai waters have a higher density than Lateri waters. This is due to Lateri waters are part of inner Ambon bay which is a semi-enclosed water receiving lots of influences from mainland activities. The same thing was found by Hamsiah et al (2016), in his research in coastal waters Labakkang, Pangkep, South Sulawesi, where the activities around these waters affect the condition of seagrass.

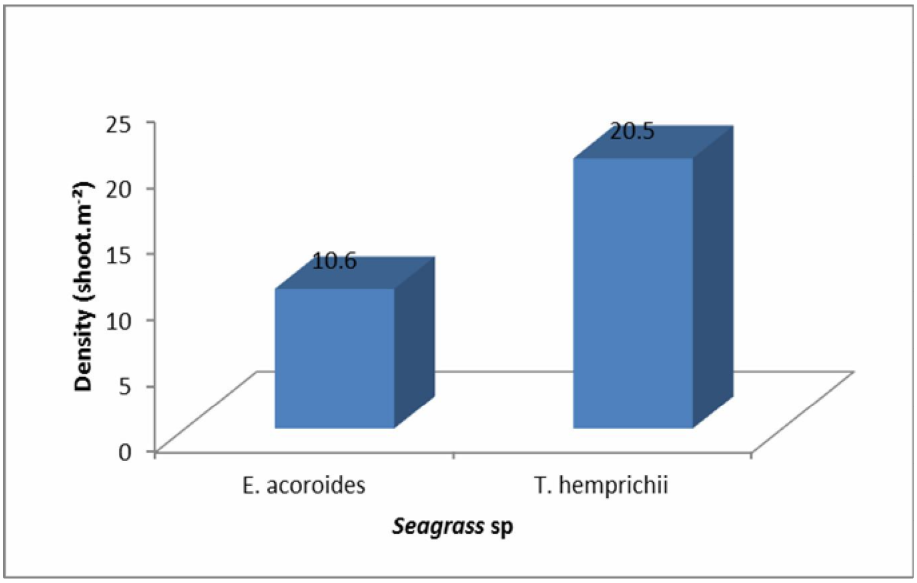

Figure 3. Density of seagrass in surrounding water of Lateri.

Frequency of occurrence. Frequency of species occurrence describes seagrass opportunities in the plot observations. It appears that *E. acoroides* was found in both locations out of five species of seagrasses that were found. This means that *E. acoroides* was able to adapt to live on a variety of substrates which are fairly evenly distributed.

The Figure 4 explains that in surrounding waters of Waai, *H. uninervis* has the highest occurrence frequency with value of 0.8, and *H. ovalis* has the lowest occurrence frequency with value of 0.06. This means that *H. uninervis* is mostly found in all observation plots. The low frequency of occurrence of *H. ovalis* in surrounding waters of Waai might be caused by the fact that this species is not evenly distributed on all the plots due to the condition of the substrate which is not suitable for this species.

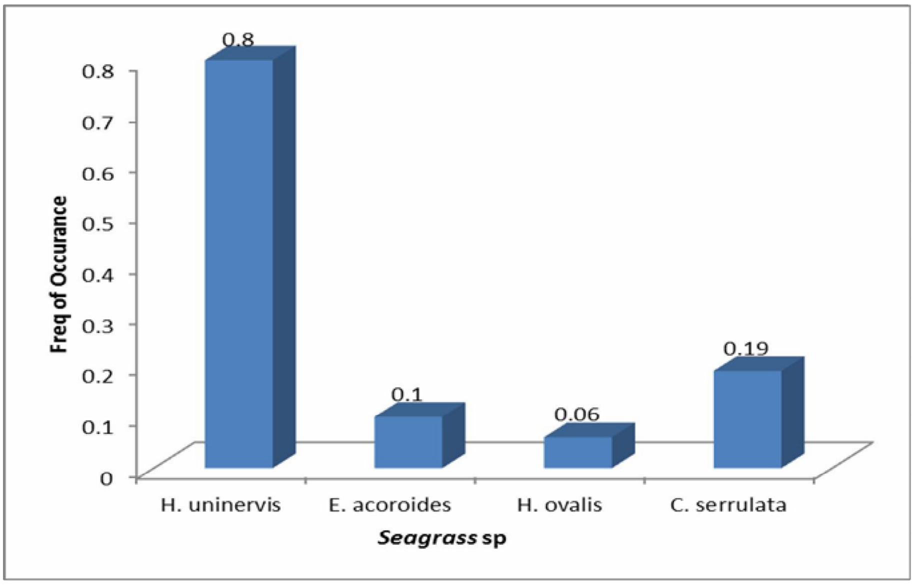

Figure 4. Frequency of occurance from seagrass species in surrounding water of Waai.

In surrounding waters of Lateri we found two species of seagrasses with the value of the frequency of occurrence for each species as follows: *T. hemprichii* is 0.37 and 0.62 for *E. acoroides* (Figure 5).

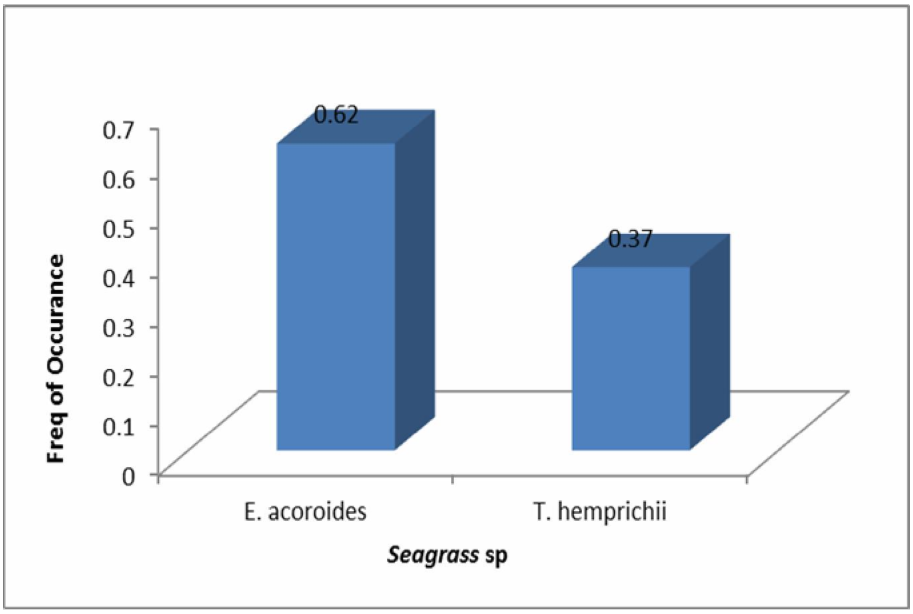

Figure 5. Frequency of occurance from seagrass species in surrounding water of Lateri.

There is a difference between species density and frequency of occurrence in case of *T. hemprichii*. This species has a high density but low frequency occurrence. This is because *T. hemprichii* was just found in 23 observation plots from the total of 62 plots. On the other side *E. acoroides* has high frequency of occurrence and was found in 40 plots of observation. The variety of substrate types (sandy, rocky sand and rubble mixed) also influenced the value of frequency occurrence. Based on the observations *E. acorides* can be found on almost all substrates in Lateri. This condition is supported by Bengen (2001) who states that *E. acoroides* is a species that often dominates the seagrass communities. There is also the opinion of Sangaji (1994) in Sudiarsa (2012) who stated that *E. acoroides* is dominant on the sandy substrate and rubble mixture.

The percentage of coverage. The percentage of coverage describes the level of coverage covered by seagrass community. A density value is not necessarily able to describe the level of a percent coverage of species because of the percentage of coverage is affected by species density and is also very closely related to the morphologic types of seagrass species (Sudiarsa 2012).

The total percentage of coverage of seagrass at both research locations ranges from 42.22% (Lateri waters) to 77.84% (Waai waters) (Table 4).

Table 4

Percent coverage of seagrass species at Waai and Lateri

Species	*Waai*	*Lateri*
	% Coverage	*% Coverage*
Enhalus acoroides	8.37	17.27
Thalassia hemprichii		24.95
Halophila ovalis	5.43	
Cymodocea serrulata	34.74	
Halodule uninervis	29.30	
Total	77.84	42.22

This result displays that although *H. uninervis* has the highest percent coverage but because of the smaller morphologic structure then it caused its coverage on the beach of Waii is lower than *C. serrulata*. Meanwhile *E. acoroides* whose bigger morphological structure has lower coverage percentage since its occurrence in every observation plot is uneven which cause its coverage percentage is lower than *C. serrulata* and *H. uninervis*.

The result of observing the potential width of seagrass growth, indicate that this water has average environment quality to the growth of seagrass. Having 77.84% as the grade coverage percentage, this seagrass field at Waai water is categorized into fertile/rich based on the Decree of Minister of Environmental Affair number 200 (2014).

In surrounding waters of Lateri the total percent coverage is 42.27%, consisting of *E. acoroides* (17.27%) and *T. hemprichii* (24.95%). These low values of percent might be caused by the limited number of seagrass species that exist in surrounding waters of Lateri and has grown on a substrate of sand mixed with dead coral rubble. With a total percent coverage 42.27%, the status of sea grass in Lateri can be classified in the category of less healthy.

Conclusions. The composition of seagrass species that were found in surrounding waters of Waai consists of 4 species, whereas two species were found in Lateri surrounding waters.

The highest species density in surrounding waters of Waai is represented by species *H. uninervis*, while the one in Lateri is represented by *T. hemprichii*.

In the surrounding water of Waai, the species *H. uninervis* was found in the highest percent coverage. The coverage criteria categorizes rich/healthy. The species *T. hemprichii* was found in the highest percent coverage in Lateri. Their status was fallen into less rich/less healthy according to the coverage criteria.

H. uninervis is the species with the highest frequency of occurrence found in surrounding waters of Waai, whereas Lateri surrounding waters has *E. acoroides* as the species with the highest frequency of occurrence.

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