A study on the density and the cover of seagrass species along the West Coast of Natal

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Abstract. The objective of the research was to analyze the condition of seagrass ecosystem in the waters of Natal coastal area. The research was conducted from April until July, 2017. The research location was divided into four areas: Pantai Galon, Pantai Sikara-kara, Pantai Buburan, and Pantai Bintuas. The observation on the seagrass was done by using transect quadrate 1m x 1 m with 5 repetitions. The measurement of density and the percentage of the cover was done in each transect. The result of the research showed that there were four seagrass species which grew along the coastline of Natal: Enhalus acoroides, Halophila ovalis, Cymodocea rotundata, and Halodule pinifolia. E. acoroides was a type of seagrass with the highest density. The highest percentage of seagrass cover in the Buburan coastline area was 89% and the lowest one was in Galon coastal area (51.2%). In general, the condition of seagrass in the waters along the coastal area of Natal is in good/health category. The intensity of light and the velocity of current are the most influencing factor which influences the density and the percentage of seagrass cover along the Natal coastal area.

1. Introduction
Seagrass is a kind of sea plant with flowers (angiosperma) which grows in the tidal area; it has rooting and rhizome system [1-3]. Seagrass beds can function as coastal protection against abrasion [4, 5]. It can also function as the shelter, spawning, and feeding ground for various kinds of marine animals [6, 7]. Seagrass field ecosystem is one of the marine ecosystems with high productivity. Seagrass productivity is limited by the intensity of light and the availability of nutritive substances [8]. Besides its great benefit for marine biota life, seagrass is also vulnerable and easily degraded ecosystem. It is estimated that the world’s seagrass ecosystem decreases 58%, while in Indonesia the decrease reaches 30%-40% [9, 10].

Natal is one of the regions in North Sumatera which has potential seagrass resource. The local people in Natal call it jerango lauk or sea wild lily. Their lack of knowledge of it has caused the seagrass ecosystem to be neglected at this coastal area. Reports on the existence of the types of seagrass and its condition in Natal are still inadequate. The objective of this research was to find out the varieties of types of seagrass and its ecosystem condition in the west coast of Natal.
2. Materials and Methods

2.1 Research Location
The research at the coastal area of Natal was conducted from April until July, 2017. The observation was done in four locations: Pantai Galon, Pantai Sikara-kara, Pantai Buburan, and Pantai Bintuas.

2.2 Design of Taking the Samples
The samples were taken by using direct observational method when the tide was on the ebb so that there would be no obstacle with the current and waves, and the seagrass samples could be easily taken. The observational quadrant was with transects quadrate 1 x 1 m$^2$. The starting point of placing transects from the coastal line was as far as 5 meters toward the sea. The samples were taken 5 times each (Figure 1).

![Figure 1. Sampling Design](image)

2.3 Data Analysis

2.3.1 Density of Seagrass Species. The density of seagrass species is the amount of seagrass individually (stand) per area unit. The density of seagrass can be calculated based on the formulation [11]:

\[ D_i = \frac{n_i}{A} \]

Explanation:
- $D_i$ = density of type (ind/m$^2$)
- $n_i$ = total of stands C-i species
- $A$ = the area of observational plot

2.3.2 Percentage of Seagrass Cover. The percentage of seagrass cover can be measured by using Saito and Atobe methods [12] as follows:

\[ C = \frac{\sum C_i}{N} \]

Where:
- $C$ = percentage of seagrass cover in each station
- $N$ = the number of transect plots in station
- $C_i$ = percentage of seagrass cover in each transect plot

The criteria of seagrass condition, based on the percentage of cover used are as follows:
3. Results and Discussions

3.1 Variety of Seagrass Species

The result of the research shows that there are four species of seagrass along the coastal area of Natal which are included in two families (Table 1). The seagrass species found in the four research locations are not always similar. The family of Hydrocaritaceae is *Enhalus acoroides* and *Halophila ovalis* and the family of Potamogetonaceae is *Cymodocea rotundata* and *Halodule pinifolia*. This finding is in accordance with what is revealed by Kawaroe [13] that there are two families and 10 species of seagrass found in the three waters areas in Indonesia.

| Family/Species               | Galon Beach | Sikara-kara Beach | Buburan Beach | Bintuas Beach |
|------------------------------|-------------|-------------------|---------------|---------------|
| *Hydrocaritaceae*            |             |                   |               |               |
| *Enhalus acoroides*          | +           | +                 | +             | +             |
| *Halophila ovalis*           | -           | +                 | +             | +             |
| *Potamogetonaceae*           |             |                   |               |               |
| *Cymodocea rotundata*        | +           | +                 | +             | +             |
| *Halodule pinifolia*         | +           | +                 | +             | +             |

Note: * (name of family), + (found), - (not found)

3.2 Density of Seagrass Species

The density of seagrass species in each observational location is different (Figure 2). *E.acoroides* and *H.pinifolia* are the mostly found along the coastal areas of Natal. *E.acoroides* is the seagrass species which still survives in the turbid waters, with muddy substrate, and forms single vegetation [14, 15, 16].

![Figure 2. Graph of seagrass density](image)

Figure 2 shows the highest density of the seagrass species in the four observational locations *E.acoroides* and *H.pinifolia*. The density of the seagrass species is influenced by several factors such
as temperature, salinity, brightness, basic substrate, and availability of nutrients; besides that, seagrass physiology and metabolism can also influence the density of seagrass species [5, 17-21].

The condition of the coastal area of Natal is highly supporting for the growth of seagrass plant (Table 2). The distribution of seagrass depends upon some factors such as brightness (in the depth of < 10 m), temperature (28°C-30°C), salinity (10%-40%), substrate (40% of coarse and fine muddy sediment), and current velocity 0.5 m/sec [16, 22].

### Table 2. Value of Water Quality Parameter during the Research

| No | Parameter                | Unit | Lokasi Pengamatan |
|----|--------------------------|------|-------------------|
|    |                          |      | Galon Beach       | Sikara-kara Beach | Buburan Beach | Bintuas Beach |
| 1. | Temperature              | °C   | 31                | 29                | 28            | 30            |
| 2. | Salinity                 | ppt  | 32                | 35                | 36            | 34            |
| 3. | pH                       |      | 7,6               | 7,9               | 8,1           | 7,9           |
| 4. | Dissolve Oxygen          | mg/l | 7,7               | 8,6               | 9,1           | 8,9           |
| 5. | Light Penetration        | cm   | 90                | 160               | 160           | 150           |
| 6. | Kecepatan Arus           | m/sec| 0,147             | 0,053             | 0,027         | 0,093         |

The result of the measurement indicated that the temperature is about 28°C-31°C; this condition was above the optimum condition for the growth of seagrass. According to Campbell [23], some tropical seagrass species, Cymodocea rotundata, C. serrulata, Halodule uninervis, and Thalassia hemprichii are more tolerant of extreme temperature; they are even reasonably tolerant of the temperature of 40°C. Each of seagrass species has different capacity to adapt to extreme salinity. Seagrass can grow in a wide range of salinity, 10-65 ppt [5, 19, 20] which indicates that salinity in the entire research locations was at the range of seagrass tolerance.

The level of acidity (pH) is one of the important factors for the survival of water organisms. Dewi and Prabowo [24] found seagrass grew well in an alkaline condition between 7.79-11.8 which indicated that the pH condition in the whole research location could support seagrass optimal survival.

Dissolved Oxygen (DO) is the amount of dissolved oxygen in an area of waters. The dissolved content is closely related to the brightness and the temperature of waters. Low light penetration can hamper the entrance of sunlight into the waters so that the photosynthetic process of the growth of seagrass will eventually be hampered. Low oxygen content dissolved in the waters of Pantai Galon is caused by the level of light penetration in that location. Intensity of certain light is important for seagrass to do photosynthetic process [25]. Low light penetration to the seagrass waters is not only caused by eutrophication but also caused by the increase in sedimentary content [26, 25, 27]. Low light penetration in Pantai Galon is caused by the high human activity in that location.

The velocity of current in that location is in the range of 0.027 - 0.147 m/s. Low current is favored by seagrass because in the condition of stagnant waters seagrass roots will easily pierce into the base of waters. On the other hand, in the waters with fast current, it is difficult for seagrass to pierce its roots into the base of waters and to grow and develop.

#### 3.3 Percentage of Seagrass Cover

The percentage of seagrass cover can be indicated as a condition of seagrass ecosystem in a certain location and time. The result of the research showed that there was the difference in the percentage of seagrass cover in each coastal area of the research location. The (Figure 3). Percentage of seagrass was in the neighborhood of 51.2%-89%. The lowest percentage of seagrass cover was found in the location of Pantai Galon (51.2%) while the highest on was in the location of Pantai Buburan (89%).
Figure 3. Percentage of seagrass cover on each locations

It was also found that the condition of seagrass in the four coastal areas was in good and very good categories. According to Blanquet [28] the scale of seagrass condition was divided into 5 categories: highly damaged (<5%), damaged (5%-25%), moderately good (25%-50%), good (50%-75%), and very good (>75%). However, when it is categorized according to the Degree of the Minister of State for Environment Republic of Indonesia [29] No. 200/2004, the condition of the four coastal areas in Natal are categorized as not healthy (30%-59.9%) and healthy (≥60%).

The percentage of seagrass cover is closely related to the density of its species; the higher the density of the seagrass, the higher the percentage of its cover in that location. The factor which causes the low percentage of seagrass cover at the coastal areas of Pantai Galon and Pantai Bintuas is the high velocity of current so that it is difficult for seagrass to grow and develop. Besides that, another factor which can cause the low percentage of seagrass cover is the high activity of human beings in those locations. High activity at Pantai Galon has caused seagrass to get pressure of high turbidity at that location.

4. Conclusions
The result of the research shows that there are four seagrass species which grow along the coastal area of Natal. *Enhalus acoroides* is seagrass species which can be found at the whole research area. The highest percentage of seagrass cover is at the coastal area of Pantai Buburan and the lowest one is at the coastal area of Pantai Galon. The condition of seagrass field at the waters of Natal coastal area is in the scale of unhealthy and healthy according to the Minister of State for Environment Republic of Indonesia No. 200/2004[29]. Factors that affect the percentage of seagrass cover are temperature, salinity, pH, dissolved oxygen, light penetration, turbidity and human activity.

Acknowledgments
We would like to express our sincere gratitude to Kemeristekdikti (Ministry of Research, Technology and Higher Education of the Republic of Indonesia) that has financed this research through the Program Hibah Kompetitif Nasional Skim Penelitian Dosen Pemula (the National Competitive Grand Program for Novice Instructors’ Research Schemes), financing in 2017.

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