**Enhalus acoroides** coverage and density in Jago Jago Coastal, Central Tapanuli

Z A Harahap*, I E Susetya, Khairunnisa, R F Siregar, J S Hasibuan and V R Manurung

Department of Aquatic Resources Management, Universitas Sumatera Utara, Medan, Indonesia.

E-mail: *zulham.apandy@usu.ac.id

**Abstract.** Research about seagrass in Central Tapanuli is still very limited. This study aimed to assess *E. acoroides* density and coverage in Jago Jago coastal area, Central Tapanuli. The seagrass beds in Jago Jago coastal area are monospecific beds that formed by *Enhalus acoroides*, a species that has bigger morphological size than other species. Seagrass sampling was conducted in July 2020 in three observation stations. The assessment of seagrass coverage and density was conducted using line transect method and placing 50 cm x 50 cm quadrats every 10 m along the transect. The lowest coverage and density were found in Station I which was 26.06% and 39 shoots/m². Meanwhile, the highest coverage and density were found in Station II which was 42.12% and 80 shoots/m². This research outcome is expected to be basic data for future seagrass management in Central Tapanuli.

1. **Introduction**

Seagrass is a flowering plant (Angiosperms) which can grow and live submerged in marine environments [1]. Seagrass beds can be formed by single species (monospecific) or more than one species (mixed vegetation). Seagrass has many significant roles such as feeding ground for dugong, manatee, sea turtles and waterfowl, spawning and nursery ground for fish and invertebrates, maintaining fisheries production, and even binding sediments and protecting mainland from coastal erosion [2].

Seagrass can be found all over the world. Globally, there are about 60 species that grouped into 13 Genera and 5 Families [3]. There are 15 species that grouped into 2 families and 7 genera in Indonesia. They are *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serulata*, *Halodule pinifolia*, *Halodule uninervis*, *Halophila decipiens*, *Halophila ovalis*, *Halophila minor*, *Halophila spinulosa*, *Syringodium isoetifolium*, and *Thalassodendron ciliatum* [4]. Unfortunately, many countries including Indonesia is facing seagrass degradation (lost about 30 – 40%) not only because natural causes but also anthropogenic pressures [5].

Jago Jago is a village in Central Tapanuli district and located in coastal area. The seagrass beds in Jago Jago coastal area are dominated by *Enhalus acoroides*, a common species in tropical coastal ecosystems that easily recognized because of its size and widely distributed along the coast of Indian Ocean. Compared to mangrove and coral reef, research about seagrass in Central Tapanuli is still very limited, so there’s an urgency to start it. It can be started from collect and asses the seagrass status and
distribution. This research aimed to assess *Enhalus acoroides* coverage and density in Jago Jago and was expected to become basic data for future seagrass management in Central Tapanuli.

2. Materials and methods

2.1 Research site

This research was conducted in Jago Jago, Central Tapanuli District, North Sumatera in July 2020 (figure 1). There were 3 observation stations where the seagrass beds are formed by *Enhalus acoroides*.

![Figure 1. Research location.](image)

2.2 Seagrass sampling method

The assessment of seagrass coverage and density was conducted using line transect method and placing 50 cm x 50 cm quadrats every 10 m along the transect. Each observation station was consisted of 3 line transects with 50 m distance between each line, so in total there was 9 line transects. This transect method was modified from Seagrass Watch [6]. Seagrass coverage is defined as the percentage area covered by seagrasses canopy in a transect quadrat [7]. The assessment of the seagrass coverage was based on visual observation. Meanwhile, the seagrass density is defined as the number of shoots per unit area and the assessment was calculated by this equation [8]:

\[
\text{Density (shoot/m}^2\text{)} = \text{number of shoots of Sp X per small quadrat} \times 16
\]

where: in this research, the 25 x 25 cm quadrat was used for measuring the seagrass density, so 16 is a factor to convert to per square meter

2.3 Water quality sampling method

Water quality sampling was conducted to know the physical and chemical characteristics of water in each station. The parameters are temperature, salinity, pH, current, dissolved oxygen, and total suspended solid (TSS). These data parameters was measured directly in the sampling location using
water quality checker and conjecture ball except for TSS. The laboratory work for TSS was done in Institute for Research and Standardization of Industry, Medan.

3. Results and discussion

3.1 Water quality
Seagrass in Jago Jago coastal area grows on muddy sand substrate and is adjacent to mangrove forest so the water clarity is relatively low, but in general the water quality was good for seagrass habitat (table 1).

| Station | Salinity (‰) | DO (mg/l) | pH | Temperature (°C) | Current (m/s) | TSS (mg/l) |
|---------|--------------|-----------|----|------------------|---------------|-------------|
| I       | 35           | 5.3       | 7.4 | 32               | 0.131         | 22          |
| II      | 36           | 5.9       | 7.9 | 29.5             | 0.262         | 23          |
| III     | 36           | 4.7       | 7.3 | 30.7             | 0.189         | 26          |

The salinity ranged between 35 - 36‰. Salinity is one of the main limiting factors affecting the growth and lifespan of seagrass because it lives and grows submerged in marine environment. The ability of seagrass to tolerance salinity varies between species. According to [9] salinity is affected by evaporation, freshwater input from land, groundwater sources, and tides.

The results for dissolved oxygen measurements in all observation stations ranged between 4.7 - 5.9 mg/l which indicates that the DO value can support seagrass to grow. Based on the Decree of the Minister of Environment No. 51/2004 about sea water quality, the standard value for dissolved oxygen is greater than 5 mg/l.

The pH value ranged between 7.4 - 7.9. For seawater, pH is slightly more alkaline and generally varies between 7.5 - 8.4. Meanwhile the water temperature ranged between 29.5 - 32 °C. According to [10] the optimal temperature for seagrass growth in tropical/subtropical areas ranges between 23 °C to 32 °C but in temperate areas the water temperatures are usually lower so the seagrass has adapted to low temperatures but has limited tolerance to high temperatures. Temperatures that more or less than the optimum range can lead to stress and even death. Beside that, high temperature can change and damage seagrass anatomy and morphology [11].

Current has major influence on sediment transport and nutrient cycling. The current measurement for this research ranged between 0.131 – 0.262 m/s. Meanwhile for the total suspended solid (TSS), the measurement in all observation stations ranged between 22 – 26 mg/l. Based on the Decree of the Minister of Environment No. 51/2004, the TSS standard for seagrass habitat must be lesser than 20 mg/l. The TSS results slightly exceeded the quality standard. The high level of turbidity or total suspended solids in seawater can reduce the sunlight penetration into the water and it will affect the seagrass photosynthesis and respiration in a bad way.

3.2 Seagrass coverage and density

| Coverage | Status            |
|----------|-------------------|
| >60 %    | Rich/Healthy      |
| 30 – 59.9| Less rich/less healthy |
| < 29.9   | Poor              |

Seagrass coverage is described as the percentage area covered by seagrass canopy. Based on the results and refer to the Decree of Minister of Environment No. 200/2004 on the status of seagrass beds.
(table 2), the percentage shows that seagrass in Jago Jago coastal area is in poor and less rich/less healthy condition. The average coverage of *E. acoroides* varied between 26.06 - 42.12% with the highest value observed in Station II and the lowest value in Station I (table 3). Meanwhile, the average density varied between 39 – 80 shoots/m² (table 4). Same as coverage, the highest value for density observed in Station II and the lowest value in Station I (figure 2).

**Table 3. Seagrass coverage in Jago Jago.**

| Station | Transect | *E. acoroides* average coverage per transect (%) | *E. acoroides* average coverage per station (%) | Status   |
|---------|----------|--------------------------------------------|---------------------------------------------|---------|
| I       | I        | 30.91                                      | 26.06                                       | Poor    |
|         | II       | 29.09                                      |                                             |         |
|         | III      | 18.18                                      |                                             |         |
| II      | I        | 25.45                                      |                                             |         |
|         | II       | 56.36                                      | 42.12                                       | Less rich |
|         | III      | 44.44                                      |                                             |         |
| III     | II       | 24.55                                      |                                             |         |
|         | II       | 39.08                                      | 31.82                                       | Less rich |
|         | II       | 31.83                                      |                                             |         |

**Table 4. Seagrass density in Jago Jago.**

| Station | Transect | *E. acoroides* average density per transect (shoots/m²) | *E.acoroides* average density per station (shoots/m²) |
|---------|----------|---------------------------------------------------------|-----------------------------------------------------|
| I       | I        | 33                                                      | 39                                                  |
|         | II       | 48                                                      |                                                     |
|         | III      | 36                                                      |                                                     |
|         | I        | 45                                                      |                                                     |
| II      | II       | 106                                                     | 80                                                  |
|         | III      | 90                                                      |                                                     |
|         | I        | 63                                                      |                                                     |
| III     | II       | 64                                                      | 58                                                  |
|         | III      | 47                                                      |                                                     |

**Figure 2.** Comparison of seagrass density and coverage in Jago Jago.
The seagrass density is related to the percentage cover where the higher seagrass density, the higher percentage cover and vice versa (figure 2). According to [12], clean environment help seagrass to live and optimally reproduce which in turn will affect the density and maintain the population. Although *E. acoroides* is known as a species that can live on wide variety substrates and adapt well, the low density and percentage cover are most likely caused by the total suspended solid and its coexistence with mangrove. The high TSS level will block sunlight penetration into the water and fatally affect the photosynthesis process and seagrass growth. In addition, competition for living space is likely unavoidable because of their coexistence with mangroves. This assumption is supported by [13] research about mangrove and seagrass interaction where the lower seagrass percentage cover was most likely because of mangroves that were planted over the seagrass so they were competing for growing space.

*E. acoroides* has the chance to become dominant species and survive longer than other species because of its size. The sturdy rhizome leads *E. acroides* to live on various types of substrates such as muddy, sand, muddy sand, gravel, and rubber. Usually, small species (such as *H. pinifolia*, *H. uninervis*, etc) tends to live among larger species, however, in this observation, no smaller species than *E. acoroides* were found. This is most likely because of the muddy sand substrate (labile substrate). According to [14], a stable substrate such as sand allows small species (which has small roots and rhizomes) to live and survive, meanwhile on the labile substrate, it will be carried away easily by the current because of its small size. In addition, the small species’ ability to live among the larger species is the way of defending itself from currents. Compared to condition in other locations [15-18], *E. acoroides* lived with smaller species such as *T. hemprichii*, *C. rotundata*, *S. isoetifolium*, *H. ovalis*, and *H. uninervis* in varied substrate.

4. Conclusions
The seagrass bed in Sijago-jago coastal area is formed by *E. acoroides* monospecific beds. The lowest coverage and density was found in Station I which was 26.06% and 39 shoots/m². Meanwhile the highest coverage and density was found in Station II which was 42.12% and 80 shoots/m². The low density and percentage cover are most likely caused by the total suspended solid and its coexistence with mangrove.

References
[1] Kawaroe M, Nugraha AJ, Juraij and Tasabaramo I A 2016 Seagrass biodiversity at three marine ecoregions of Indonesia: Sunda Shelf. Sulawesi Sea, and Banda Sea *Biodiversitas* 17 pp 585-90
[2] Spalding MD, Taylor M, Ravilious C, Short FT and Green E 2003 *Global overview: the distribution and status of seagrass* (Berkeley: University of California Press) p 13
[3] Short FT, and Coles RG 2001 *Global Seagrass Research Method* (Amsterdam: Elsevier) p 5
[4] Sjafrie NDM, Hernawan UE, Prayudha B, Supriyadi IH, Iswari MY, Rahmat, Angraini K, Rahmawati S and Suyarso 2018 *Status Padang Lamun Indonesia (Seagrass Meadows Status in Indonesia)* (Jakarta: Puslit Oseanografi LIPI) p 8
[5] Naidiarti, Riani E, Djuwita I, Budiharsono S, Purbayani A and Asmus H 2012 Challengging for seagrass management in Indonesia *J. Coast. Dev.* 15 pp 234-242
[6] McKenzie LJ and Campble SJ 2001 *Seagrass-Watch: Manual for Community (Citizen) Monitoring of Seagrass Habitat. Western Pasific Edition* (Cairns: NFC) p 20
[7] Brower JE, Zar JH and von Ende CN 1998 *Field and Laboratory Methods for General Ecology.* (Boston: McGraw-Hill)
[8] Rahmawati S, Hernawan UE, McMahon K, Prayudha B, Prayitno HB, Wahyudi AJ and Vanderklift M 2019 *Blue carbon in Seagrass Ecosystem: Guideline for Assesment of Carbon Stock and Sequestration in Southeast Asia* (Yogyakarta: UGM Press) p 19
[9] Lirman D and Cropper W P 2003 The influence of salinity on seagrass growth, survivorship, and distribution within Biscayne Bay, Florida: field, experimental, and modeling studies. *J Est.* 26 pp 131-141
[10] Lee KS, Park SR and Kim YK 2007 Effect of irradiance, temperature, and nutrients on growth dynamics of seagrasses. *J. Exp. Mar. Bio. and Ecol.* **350** pp 144-175

[11] Purnama PR, Purnama ER, Manuhara YSW, Hariyanto S and Purnobasuki H 2018 Effect of high temperature stress on changes in morphology, anatomy, and chlorophyll content in tropical seagrass *Thalassia hemprichii* *AACL Bioflux* **11** 6 pp 1825-33

[12] Yunitha A, Wardianto Y and Yulianda F 2019 Substrates diameter and seagrasses species in Bahoi Coastal North Minahasa: a correlation analysis. *JIPI* **19** pp 130-135

[13] Mendoza ARR, Patalinghung JMR and Divinagracia J Y 2019 The benefit of one cannot replace the other: seagrass and mangrove ecosystems at Santa Fe, Bantayan Island. *J. Ecol. Environ.* **19** pp 30-35

[14] Takaendengan K and Azkab MH 2010 Struktur komunitas lamun di Pulau Talise, Sulawesi Utara [Seagrass community structure in Talise Island, Sulawesi Utara] *J. OLDI* **36** pp 85-89

[15] Fahruddin M, Yulianda F and Setyobudiani I 2017 Kerapatan dan penutupan ekosistem lamun di pesisir Desa Bahoi, Sulawesi Utara [Density and coverage of seagrass ecosystem in Bahoi Village, North Sulawesi] *JIKT* **9** pp 375-383

[16] Khairunnisa, Setyobudianti I and Boer M 2018 Estimasi cadangan karbon pada lamun di pesisir timur Kabupaten Bintan [The estimation of seagrass carbon stocks in the east coast of Bintan Regency] *JIKT* **10** 3 pp 639-50

[17] Soedari T, Hariyanto S, Wedayanti A, Rahmawati D, Safitri P, Alifcia I and Suwono 2017 Biodiversity of seagrass bed in Balanan Resort – Baluran National Park *AIP Conf. Proc.* **1888** 020051

[18] Soedarti T, Fadila AF, Hariyanto S, Safitri DP and Suwono 2019 Mapping seagrass beds diversity distribution in substrates on Sirondo Beach – Baluran National Park using GIS *Ecol. Environ. Conserv.* **25** pp 10-13

**Acknowledgements**

This study is supported by a research grant of TALENTA USU 2020 (No. 399/UN5.2.3.1/PPM/SPP-TALENTA USU/2020). The authors also want to thank Department of Fisheries and Maritime Affairs of Tapanuli Tengah as partner in this research.