Seagrass community at tawang coast pacitan in rainy and dry season

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Abstract. Ecologically, the presence of seagrass contributes to an ecosystem offering for human need. This research was conducted to study the seagrass appearance at Tawang Coast Pacitan, East Java, Indonesia during rainy and dry season using a percentage of the covered area and physico chemical factors. The method used was transect-plot. The physical and chemical factors measured included temperature, light penetration, rapidity flow, high water rate, salinity, wave level, sediment texture, pH, dissolved oxygen, and nutrients such as ammonium, nitrate, C-organic and phosphorus pentoxide. The result showed that seagrass bed in Tawang Coast was formed by three seagrass: Cymodocea rotundata, Thalassia hemprichii, and Halophila ovalis. The average percentage of seagrass cover was 37.66 % in rainy season and 32.49% in dry season. According to decree of the Minister of Environment No. 200 in 2004, the seagrass bed conditions in Tawang Coast in the rainy season and dry season were categorized into less rich/less healthy. The decline in the seagrass covering percentage in the dry season was caused by light and temperature factors. Seagrasses in Tawang Coast were associated with different types of organisms.

1. Introduction
Seagrass meadow is one of the most productive communities, living in submerged underwater, covering the shallow coastal area, forming seagrass ecosystems, taking the crucial elements of tropical coastal ecosystems, other than coral reefs and mangroves [1], and has wide worldwide distribution [2]. In comparison with the both, the seagrass ecosystem received less attention from academic researchers, while this seagrass ecosystem contributed significantly to the utilization of its potential. [3].

The presence of seagrass contributes to an ecosystem offering [4]–[6] as natural processes and components that immediately or incidental meet the human needs [7]. Seagrass meadows offer a number of ecosystem products which include food, natural place, refreshment, and others [8]. For marine life forms, these habitats are utilized for spawning, foraging, rearing place and as natural shelter [9].
Based on anthropogenic influences, seagrass is not only found at the underwater but also situated near the mainland [10].

The components such as nutrients, sediment, light, salinity and temperature control the distribution and balance of seagrass communities [9], [11]–[13]. In a coastal environment, fluctuation frequently occurs due to seasonal variation and daily tidal cycle. It regulates the character and zonation of intertidal and shallow water organisms [14]. Sea tidal events cause the quality and intensity of light attaining the seabed to assist seagrass photosynthesis vary widely. It also regulates the growth and production of marine plants [9]. Such environmental elements have been presented to steer substantially growth and recruitment rate of the large seagrass species *Enhalus acoroides*. [15]. Heavy sediment load can affect the percentage of biomass, cover, and species composition of seagrass, which reduce the intensity of subsurface light [16].

Indonesia has two seasons throughout the year, namely dry and rainy seasons. The two seasons did not take place simultaneously in the Indonesian archipelago. Generally, the dry season occurs in April continuing until about September-October, and the wet season occurring in October-November continues March-May. The islands of Java and Nusa Tenggara experienced a dry season in April-October and a rainy season in November-March. We characterized the seagrass at Tawang Coast, which is located in Pacitan, East Java. Information about seagrass in Pacitan is limited.

2. Methodology
This research was conducted to study the condition of seagrass at Tawang Coast Pacitan, East Java, Indonesia during rainy and dry season using a percentage of the covered area and physico chemical factors. The method used was transect-plot. We used four transect (each transect 50 m) perpendicular to the shoreline. The distance between transect is 25 m. Data was collected at each transect using the quadrate plot, 0.5 m x 0.5 m, the distance between plot 5 m. The total number of plots is 44. Species identification is carried out on each plot by noting the organism found and measuring the percentage of the covered area. The determination of a percentage of the covered area follows percent cover standards from seagrasswatch.org. The physical and chemical factors measured included temperature, light penetration, rapidity flow, high water rate, salinity, wave level, sediment texture, pH, dissolved oxygen, and nutrients such as ammonium, nitrate, C-organic and phosphorus pentoxide. Identification of seagrass based on [17], a guide to tropical seagrasses of the Indo-West Pacific. There is no statistical analysis was used in this study.

3. Result and Discussion
The results showed that there were three of seagrass species in Tawang Coast, with species composition in Table 1. Based on the seagrass species that were more than one species, the seagrass community in Tawang Coast was mixed vegetation.

| No. | Familia          | Sub Familia     | Genus  | Species         |
|-----|------------------|-----------------|--------|-----------------|
| 1.  | Potamogetonaceae | Cymodoceoideae  | Cymodocea | C. rotundata  |
| 2.  | Hydrocharitaceae | Thalassioideae  | Thalassia | T. hemprichii |
|     |                   | Halophiloideae  | Halophila | H. ovalis    |

The types of seagrass found were classified into two families, namely Potamogetonaceae and Hydrocharitaceae. *Cymodocea* and *Halophila* are genera commonly found in Indonesian coastal waters [18], while *Thalassia hemprichii* is a type that is almost always found in Indonesian waters.

Seagrass beds at a certain location within a certain time can be assessed by using a percentage area of cover. Based on the measurement results at the research location, the following data is obtained:
Table 2. The average percentage of seagrass cover

| Transect | C (percentage of the covered area) in rainy season | C (percentage of the covered area) in dry season |
|----------|-------------------------------------------------|-------------------------------------------------|
| I        | 15 %                                            | 14.33 %                                         |
| II       | 28.33 %                                         | 20 %                                           |
| III      | 50.63 %                                         | 45 %                                           |
| IV       | 56.67 %                                         | 50.63 %                                         |
| Average  | 37.66 %                                         | 32.49 %                                         |

The average percentage of seagrass cover varies between transects (Table 2). This is because dispersion and condition of chemical physico factors also differ between transects. The average percentage of seagrass cover in the rainy season is higher than in the dry season. According to decree of the Minister of Environment No. 200 in 2004, the seagrass bed conditions in Tawang Coast in the rainy season and dry season were categorized into less rich/less healthy.

Comparisons performed at the Flores Sea and South Lombok (East Indonesia) show a small seagrass closure. However, when compared to several locations in Java (for example, Sowan Coast, Tuban) the value is ideal. The percentage of seagrass closure in Tawang Coast is the factor causing less wealth. In addition to natural factors, also due to the expanding human activity and the excessive of fishing boat activity, thus turbidity is difficult to avoid. The fishermen sell their sea catches to Tawang TPI.

The frequent activities of fishing boats stimulate the turbulence above sea which causes turbidity. Photosynthesis process becomes less optimal because the penetration of sunlight inhibited due to high turbidity. This has a direct impact on decreasing the amount of seagrass growth. The osmoregulation system also experiences interference due to high turbidity [19].

Chemical physics factors in the rainy and dry seasons show no significant difference, except the temperature as shown in Table 3. All the chemical physics and nutrient factors measured are still within the tolerance range of the seagrass. The need for certain light intensity of seagrass is necessary for photosynthesis [11]. Reduced light penetration into seagrass is caused by eutrophication and the sediment load [11], [20] which increase by fishing boat activities in Tawang Coast. Without human activities, seagrasses can develop in the deeper spot since they obtain the high light intensity.

The decline of seagrass coverage percentage in the dry season (Table 3) was implied by light and temperature factors which causes dieback of seagrass. The high photosynthesis rate and seagrass growth range from thermal optima 15 to 33°C and generally representing the geographic distribution in specific

Table 3. Physico chemical factors at Tawang Coast

| No. | Parameter         | Unit | Rainy  | Dry    |
|-----|-------------------|------|--------|--------|
| 1   | Light penetration | m    | 1.5    | 2      |
| 2   | Air temperature   | °C   | 24     | 34     |
| 3   | Water temperature | °C   | 28     | 36     |
| 4   | Salinity          | °/oo | 35     | 39.05  |
| 5   | DO                |      | 7.9    | 7.5    |
| 6   | pH                |      | 11.8   | 10.2   |
| 7   | Current velocity  | m/s  | 0.06   | 0.1    |
| 8   | NH$_4$            | me/l | 0.130  | 0.135  |
| 9   | NO$_3$            | me/l | 0.109  | 0.101  |
| 10  | P$_2$O$_5$        | ppm  | 4.11   | 4.25   |
| 11  | Organic C         | %    | 0.167  | 0.155  |
| 12  | Organic matter    | %    | 0.288  | 0.350  |
temperature [21]. In shallow water habitat, the thermal optima are probably exceeded during the low tide and have been linked to seagrass disappearance [22]–[23]. Despite the fact that coastal water temperatures are nonetheless inside the range of seagrass tolerance, seagrass has been shown to replace in morphological character and the covered area percentage.

Stress conditions can affect seagrass metabolism in several ways, including an unbalanced water temperature that impress photosynthesis and respiration processes. The photosynthetic apparatus is terribly sensitive to temperature. Cyclic change in temperature effect fixation and reduction process, also transport and distribution of electron and photosynthetic products during the photosynthetic pathways [24]. Afterward, the temperature exceeds the threshold then photosynthetic efficiency will decrease [13]. Each species has a different level of sensitivity to elevated temperatures. Tropical species have a proportion at high temperatures compared to subtopic species and temperate species [13], [21]. Extreme temperature stress implies seagrasses mortality. Unfortunately, in situ observation of seagrass mortality is commonly applied after a thermal stress process, making it difficult to straightforwardly connect the physiological changes with mortality [22]–[23], [25].

Numerous grazers and other fauna inhabits seagrass meadows at Tawang Coast. Macroinvertebrates were found in the plots are eight species namely Archaster typicus, Echinometra mathaei, Holothuria atra, Nerita chamaeleon, Trochus maculates, Conus textile, Cypraea eglantina, and Turbo argyrostomus. There are also three species of macroalgae were found in the plots namely: Padina sp., Ulva sp., and Halimeda sp.

4. Conclusion
Seagrass meadow in Tawang Coast was formed by three of seagrass species: Cymodocea rotundata, Thalassia hemprichii, and Halophila ovalis. The average percentage of seagrass cover was 37.66% in the rainy season and 32.49% in the dry season. According to decree of the Minister of Environment No. 200 in 2004, the seagrass bed conditions in Tawang Coast in the rainy season and dry season were categorized into less rich/less healthy. The decline in the seagrass covering percentage in the dry season was caused by light and temperature factors. Seagrasses in Tawang Coast were associated with different types of organisms.

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