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ASSESSMENT ON SEAGRASS COVER AND DENSITY AT MAGYI (SHWETHAUNGYAN) COASTAL AREA, AYEYARWADY REGION

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Abstract

In the present study, analysis of seagrass cover and density have been carried out at MaGyi (Lat. 17° 04' 25" N, Long. 094° 27' 55" E), October, 2019. Three 100m-transect are laid perpendicular to the shoreline and each transect is at a distance of 50m from each other. A total of three transects is generally enough in a given area, thus seagrass cover and density are recorded from a total of 33 quadrats and 12 quadrats respectively. 20.06 % of seagrass are covered in this study area. Average shoot density in a site was 107 and 1280 total shoot density in a site.

Keywords: seagrass cover and density

Introduction

Seagrasses are flowering plants that are fully adapted to live submerged in the marine environment (Short 2001). Seagrasses are commonly found in shallow waters, tidal areas, and estuaries in the tropical and subtropical region (Hemminga and Duarte 2000). Unlike seaweeds, seagrasses have stems, leaves and rhizomes and produce flowers, fruits and seeds for their propagation (Duarte et al., 1996). Seagrass distributes all along the three coastal Regions of Myanmar, namely the Rakhine Coastal Region, the Ayeyarwady Delta and the Gulf of Mottama (Martaban) Coastal Region and the Thanintharyi Coastal Region. Their ability to accumulate and store organic carbon enables seagrass habitat to contribute to15% of the total carbon deposited in the ocean. This is due to high production, particularly in large species, high capacity to store organic matter in the sediment, and the ability for long-term accumulation and storage (IPCC. 2017). With their tremendous ability to absorb and store carbon, seagrass habitats can significantly contribute to climate change mitigation (Laffoley and Grimsditch 2009).

Seagrass often grow in dense meadows, with relatively uniform patches over the seafloor, although patchy mosaics of seagrass, sand and other habitats is also common. The seagrass canopy forms a structurally complex system, providing habitat for other organisms and facilitating complex ecological interactions among seagrass species. The habitat provision and ecological interactions within the meadows are unique features of the seagrass ecosystem and distinguish them from neighboring habitats such as bare sand, coral reefs, and macroalgae stands.

To determine seagrass community structure, we perform several measurements and extrapolate the results into a single value for the entire seagrass beds; therefore, the sampling techniques must be adequate for community level. For the site selection, minimum requirement for seagrass coverage to take the data is 10% coverage from the overall or total area. Some information is essential to establish an appropriate sampling area such as the homogenous seagrass area, seagrass bed extent, and safety and accessibility. Line transects and quadrats were used to determine community structure of seagrass in the intertidal area.

After the sampling site is selected, permanent transect can be established and its Global Navigation Satellite System (GNSS) position should be recorded using a standard Grid system (e.g. WGS84) and a standard unit format (e.g. decimal degrees).

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Materials and Methods

Site Selection and Sampling Considerations

Analysis of seagrass cover and density have been carried out at MaGyi (Lat. 17° 04' 25" N, Long. 094° 27' 55" E), October, 2019 (Fig.1). The assessment is focused on intertidal area of seagrass ecosystems, because: 1) seagrass meadows generally occur in the intertidal area, and 2) sampling in intertidal area is simpler and requires less equipment and logistic support compared to one in subtidal area or in deeper water. If intertidal seagrass ecosystem is not present, then subtidal seagrasses could be considered, but boat and diving equipment would be necessary. Larger species, like *Enhalus acoroides* may best sampled in subtidal area, as they are fully submerged allowing the full extension of their canopy.

We employ line transect and quadrat to determine community structure of seagrass in the intertidal area. If the seagrass meadows are large or extend seaward, three 100m-transect are laid perpendicular to the shoreline and each transect is at a distance of 50m from each other (Fig.2). Narrow meadows might also justify the transects to not be fully extended to 100m, as the meadows already reach its edge before 100m.

A total of three transects is generally enough in a given area, thus seagrass cover and density are recorded from a total of 33 quadrats and 12 quadrats respectively.

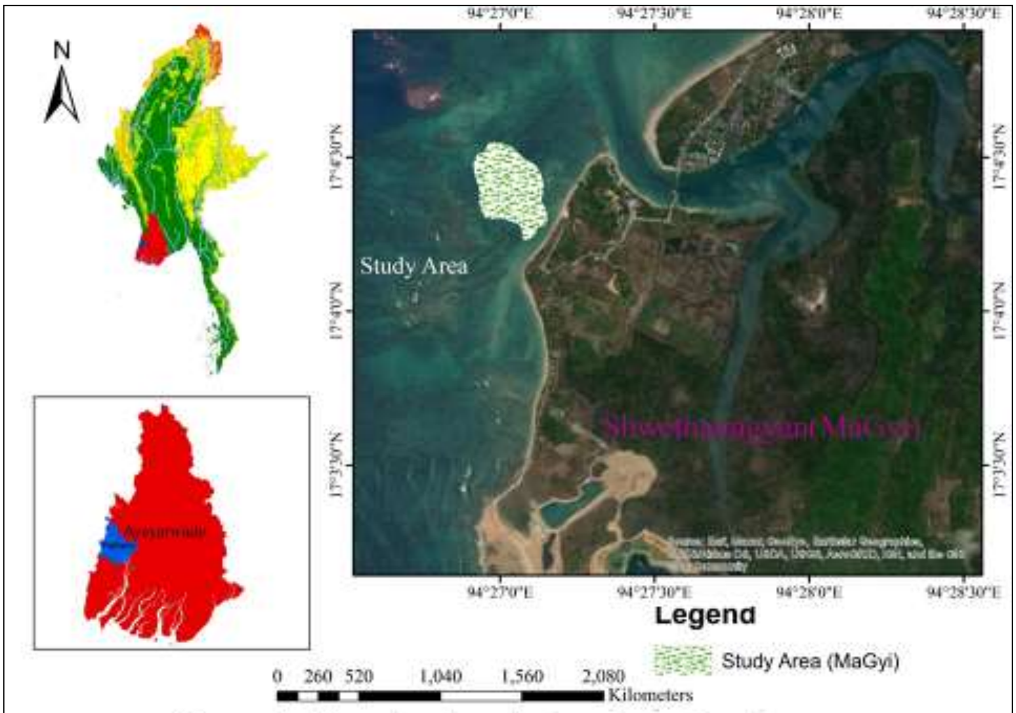

Figure 1. Map showing the location of study area

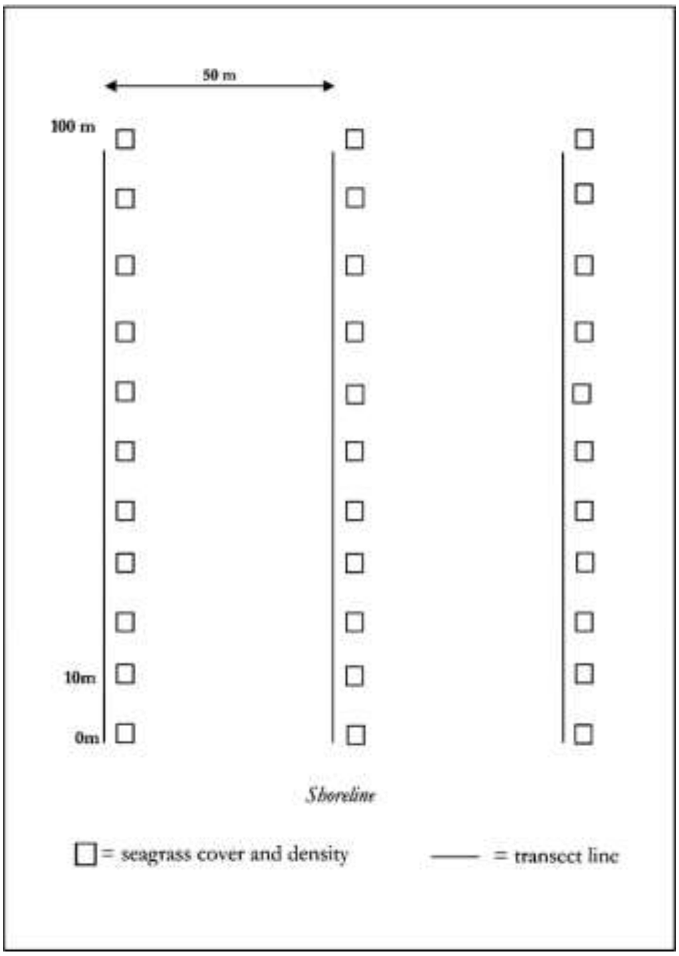

Figure 2 Basic sampling design to collect seagrass communities' structure The transect is modified from Seagrass-Watch (McKenzie and Campbell, S. J., 2002).

Site Description and Additional Data

Before samples are collected, it is recommended to take a general overview (e.g. by snorkeling) about the meadows and its surrounding. The following background information should be recorded:

1. sediment characteristic (mud, sand, etc)
2. presence of potential disturbances (e.g. pollution, fishing activities, human settlement, etc.)
3. presence of epiphyte or algae
4. general description about the sampling site (extent of meadows, etc.)

When resources are available, environmental data should be collected, for example temperature, pH, DO, salinity, turbidity, suspended particulate matter, conductivity, and nutrient level. These data would be of significance when more detailed analysis is needed.

Seagrass Cover

Seagrass cover is defined as the proportion of area covered by perpendicular projection of seagrasses' canopy within a given quadrat (Brower et al. 1998). This will clearly vary if the meadow is exposed at low tide when the leaves lie flat on the ground, or when the meadow is submerged and the leaves float more vertically in the water column. Therefore, if sampling is planned to be repeated over time, and the site is intertidal, it should be carried out at low tide to ensure comparable measures over time.

In any case record whether the cover was estimated at low tide or sub tidally, when the meadow was submerged.

At each point along the transect indicated in Fig. 2 the cover of seagrass is estimated. A photo reference is provided in Appendix A as a standard to estimate seagrass cover (% cover). Estimate cover to the nearest 5%, with the exception of low cover areas where smaller increments are recommended.

Sampling Procedures

1. Materials needed:
   a. Measuring tapes (100m Roll meter)
   b. Quadrat 50cm x 50cm (divided into four grids)
   c. Data sheet (waterproof paper), slate and pencils
   d. Photo guide for cover estimates
2. Place the quadrat at the first plot (0m on the line transect).
3. Record coordinate position with a GNSS receiver.
4. Identify species present at each plot.
5. Estimate seagrass cover based on photo standard
6. Record all the data (total seagrass percent cover and cover by species) on the data sheet
7. Move to the next sampling plot (10m forward along the transect).
8. Repeat step 3 - 6.
9. Repeat the measurement for the rest of plots in a site. The number of plots in a site may vary depending on the extent of seagrass. In extensive meadows, the maximum number of plots is 33, because there are 3 transect lines and each line contains 11 plots.
10. To determine total seagrass cover in a site, calculate the average of all plots in a transect (n=11 quadrats or possibly less), then the average per site (n=3transects), see Formula 1.

Seagrass cover

$$Seagrass\ cover\ (\%) = \frac{\%\ cover\ plot\ \ (1 + 2 + \cdots + N)}{N}$$

N = number of plots

Seagrass Density

Seagrass density is represented by the number of shoots per unit area. Shoots are the above-ground, predominantly leafy parts of the plant (Dennison 1990). In this guideline, shoot density is determined by manually counting the shoots without uprooting the plants. Most seagrass species have shoots which are long, linear and strap- like that are encased by a sheath at the bottom of the shoot (e.g. *Thalassia*) and each shoot can have multiple leaves. Some seagrass species have vertical stems with clusters of leaves (e.g. *Halophila beccari*) and others have leaves arranged in pairs that are attached directly to the rhizome by petioles (e.g. *Halophila ovalis*). For species with stems, we recommend that the leaf clusters are counted. For species with leaf pairs, we recommend that the total number of leaves are counted. Clearly, the appearance of a shoot or what needs to be counted, can vary depending on the species. Therefore, to ensure that shoots, not leaves are counted, and the shoot is identified correctly, refer to Fig. 5. In all cases, clearly record the part of the plant that you count for the shoot density component. For smaller seagrass species it may be too time consuming to count all the leaves in the recommended quadrat size, if this is the case, a smaller quadrat such as 10 x 10 cm for species like *Halophila* can be used, but ensure that the size of the quadrat you use is recorded.

Seagrass density can also be used to calculate Leaf Area Index (LAI), which is a useful indicator of standing stock. Leaf area index (LAI) defined as the single-sided leaf area per unit ground area is one of the most important factors for characterising plant canopy structure and process.

Sampling Procedures

1. Materials needed:
   a. Small quadrat (25cm x 25cm, can be a division in the larger 50 x 50 cm quadrat, or smaller quadrat e.g. 10 x 10 cm if you are only targeting small species like *Halophila* and it is too time consuming to use a 25cm x 25cm).
   b. Data sheet (waterproof paper), slate and pencils.
2. Place the small quadrat in the first plot (the 0m in the transect line)
3. Count the number of shoots of each species in a small quadrat (25cm x 25cm).
4. Total shoot density in a quadrat is the sum of all species present.
5. Repeat this at four quadrats, at 0m, 30m, 60m and 90m along each of the three transects (Total of 12 shoot density measures).

6. To estimate average total seagrass density at a site, average the total seagrass density across all quadrats and to estimate average density per species at a site, repeat this but for each species separately. Follow the Formula 2 below.

Seagrass Density

$$Dsx\ (shoot\ m^{-2}) = number\ of\ shoots\ of\ Sp\ X\ per\ small\ quadrat * 16$$

Note: 16 is a factor to convert to per square meter if the quadrat is 25 x 25 cm. A different multiplication factor is required if a different sized quadrat is used.

Average shoot density in a site:

$$Average\ Dsx\ (shoot\ m^{-2}) = \frac{Dsx\ (plot\ 1 + plot\ 2 + \cdots + plot\ N)}{N}$$

Total shoot density in a site:

$$Ds\ (shoot\ m^{-2}) = Average\ Ds\ (Sp\ 1 + Sp\ 2 + \cdots + Sp\ X)$$

Note:

Dsx = Shoot density per species
Ds = Total shoot density
N = Number of plots
X = Number of species

Results

Table 1. Seagrass Cover and Density of Transect A

Country: Observer: _ FIELD WORK DATA SHEET:
Province/ District: Date/ Time: -
Site_ID / Site_Name: Transect No. : _____ (A)

Plot		Coordinate		Cover (%)	Density (25x25 cm^2)						
		Latitude	Longitude		*Cymodocea rotundata*	*Cymodocea serrulata*	*Thalassia hemprichii*	*Halodule uninervis*	*Halodule pinifolia*	*Halophila major*	*Syringodium isoetifolium*
1	0 m	17° 04' 08"N	094° 26' 55"E	5	3						
2	10 m			10	1	4					
3	20 m			10		5		2			
4	30 m			70		13					12
5	40 m			50		10			1		6
6	50 m			10	2	5					
7	60 m			50		5					
8	70 m			20		7				2	
9	80 m			5		2					
10	90 m			-	-	-	-	-	-	-	-
11	100 m			-	-	-	-	-	-	-	-

Table 2 Seagrass Cover and Density of Transect B

Country: Observer: _ FIELD WORK DATA SHEET:
Province/ District: Date/ Time: _
Site_ID / Site_Name: Transect No. : _____ (B)

Plot		Coordinate		Cover (%)	Density (25x25 cm^2)						
		Latitude	Longitude		*Cymodocea rotundata*	*Cymodocea serrulata*	*Thalassia hemprichii*	*Halodule uninervis*	*Halodule pinifolia*	*Halophila major*	*Syringodium isoetifolium*
1	0 m	17° 04' 09"N	094° 26' 59"E	2		2					
2	10 m			10		5					
3	20 m			20		3					
4	30 m			50		7			8		5
5	40 m			20	2	10					
6	50 m			-	-	-	-	-	-	-	-
7	60 m			5		2					
8	70 m			20	3	5		2		1	
9	80 m			5		2					
10	90 m			5					2		4
11	100 m			-	-	-	-	-	-	-	-

Table 3 Seagrass Cover and Density of Transect C

Country: Observer: _ FIELD WORK DATA SHEET:
Province/ District: Date/ Time: _
Site_ID / Site_Name: Transect No. : _____ (C)

Plot		Coordinate		Cover (%)	Density (25x25 cm^2)						
		Latitude	Longitude		*Cymodocea rotundata*	*Cymodocea serrulata*	*Thalassia hemprichi*	*Halodule uninervis*	*Halodule pinifolia*	*Halophila major*	*Syringodium isoetifolium*
1	0 m	17° 04' 10"N	094° 27' 00"E	5		5					
2	10 m			80	2	15		1			
3	20 m			70	1	10				3	
4	30 m			50		1					6
5	40 m			25		4		3		2	
6	50 m			20		3	2		1		
7	60 m			20		5					
8	70 m			20							
9	80 m			-	-	-	-	-	-	-	-
10	90 m			-	-	-	-	-	-	-	-
11	100 m			5			5				

According to the result, the study area was approximately covered with 20.06 % of seagrass. Among them *Cymodocea serrulata* is dominant species and *Thalassia hemprichii* is the least. In shoot density, *Cymodocea serrulata* is also larger than other species and second is *Syringodiun isoetifolium.*

Discussion and Conclusion

This study revealed that the total seven species belonging to five genera of two families of seagrasses in MaGyi namely, *Cymodocea rotundata, Cymodocea serrulata, Thalassia hemprichii, Halodule uninervis, Halodule pinifolia, Halophila major, Syringodium isoetifolium. Cymodocea serrulata* was dominant species along the MaGyi because *Cymodocea serrulata* is a runner and possess more root density and also drop-off all it leaves during the seasonal changes (especially during monsoon wind wave action) (Minikandan et al. 2011). *Syringodium isoetifolium* was the second most dominant and *Thalassia hemprichii* was the least abundant in study area.

The cover of seagrass was large in transect line between 30 m and 70 m. This range was nearly submerged zone. Above and below this range, the seagrass cover was low in percentage. Seagrass density is also related with seagrass cover.

From the data analysis, we can also predict the cover and density of seagrass at study area. We are mainly intended how to calculate the cover and density of seagrass using with ASEAN standard methods. For further study, we will be also carried out biomass and organic carbon content in seagrass.

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APPENDIX

Percent cover standards