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Seagrass assessment along the vicinity of Bangaan Island Marine Sanctuary, Tungawan, Zamboanga Sibugay

Jay Ann T. Dagalea*

Western Mindanao State University, College of Forestry and Environmental Studies, San Ramon Campus, Talisayan Zamboanga City, Philippines

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Abstract

Seagrass, despite the remarkable ecosystem services it offered were still in the grave threat due to lack of protection and climate change. Seagrasses located outside the vicinity of Bangaan Island Marine Sanctuary, were in subtidal zone where the water depth at low tide in most shallow is at 0.5 meters and a deepest is 2 meters. These serves as an ideal place for shell gleaning and tourist exploration due to patches of corals found in the area. This study was conducted to assess the seagrass along the vicinity of Bangaan Island Marine Sanctuary. Specifically, this was conducted to document the extent of seagrass area and to assess the diversity, distribution and abundance of seagrass species. Seagrass coverage for two sites was about 1.6 hectares (Site 1, 1 hectare and Site 2, 0.6 hectare). Using line intercept method a 1 meter x 1 meter quadrat was used in the study to determine seagrass cover percentage. There were 4 seagrasses species found in Site 1, and 5 seagrass species in Site 2. The overall average of seagrass cover in identified two sites in Bangaan Island is 11.5% (site 1 = 13%; site 2 = 10%). In terms of diversity index of seagrass species in quadrats 1 to 3, results shows that quadrat 3, located at the deepest station of the study area has the more diverse seagrass species for both site 1 and 2. However, diversity level of seagrass for quadrat 1, 2 and 3 were low for both site 1 and site 2. One way analysis of Variance (ANOVA) results show that there were no significant difference of seagrass percentage cover in increasing water depth in quadrats 1,2, and 3 for both Site 1 and Site 2. Moreover, the sparse distribution and low percent cover of seagrass along the vicinity of Bangaan Island Marine Sanctuary can be influence by natural factors (e.g., climate change, soil type and waves), or anthropogenic factors (e.g., tourism, resource utilization and waste disposal). Thus, seagrass restoration and management should be carried out in Bangaan Island.

***Corresponding Author:** Jay Ann T. Dagalea ✉ jayanntambac@gmail.com

Introduction

Seagrasses are known as the "lungs of the sea" (Reynolds *et al.*, 2018). It helps to mitigate climate change through large organic carbon sinks (Stankovic *et al.*, 2021) and has strong potential to help alleviate ocean acidification (Luan *et al.*, 2023) within their ecosystems. Seagrass and macroalgae provides food, shelter, protection from predators and serves as a nursery ground of fisheries juvenile stages of development (Macreadie *et al.*, 2017).

Though seagrass meadows provide essential structure, functions and services, they are also the most impacted by human activities and in urgent need of better management and protection (Murphy *et al.*, 2021). Study of DA-BFAR on seagrasses in the Philippines showed that anthropogenic impacts are the primary cause for most of seagrass losses and these are increasing as human population increases (Fortes and Santos 2004). Eutrophication of marine waters along with habitat loss is a major long-term threat to seagrass ecosystems (Fortes, 2013).

The Southeast Asia lacks basic information on seagrass habitats despite the highest diversity of seagrass species and habitat types (Fortes *et al.*, 2018). In the Philippines, the status and uses of seagrass beds and identification of other related environmental problems were moderately studied (Fortes and Santos, 2004).

Changes in vertical light attenuation coefficient in water column (Livingston *et al.*, 1998), primarily caused by suspended inorganic solids, increasing water depth (Samper-Villarreal *et al.*, 2016), and water turbidity (Halim *et al.*, 2020) are important factors that could influence seagrass growth and performance.

Moreover, the municipality of Tungawan in the province of Zamboanga Sibugay is where the Bangaan Island Marine Sanctuary is located (PhilAtlas, 2020). It is accessible through barangay Tigbucay which is 15km away, about 45 minutes ride from the town. It was established in 2004 through General Ordinance No. 30-04. This comprises 880 hectares of coral reef, seagrass beds, and mangrove with 247 hectares buffer zone and 633 hectares core zone. Within its sanctuary lies the 17-hectare hilly forested area with unique rock formation and white sandy beaches ideal for eco-tourism. Valuable resources on the island were commercially valuable fishes (Lapu-lapu, Mantis, Talakitok, and Maming), Corals (*Montipora, Acropora, Porites,* and *Fungia*), endangered species of whales, sea turtles, and manta rays were also observed, and rich algae of different species and seagrass beds. Bangaan Island is also the nesting site of marine turtles, Tabon birds, and other wildlife (MSN 2020, *unpublished*).

The island of Bangaan is one of the major tourist attraction in municipalities of Tungawan, Zamboanga Sibugay. It attracts tourist not only from the province itself but also from other places who wants to experience its beauty. It is a great place for relaxation and enjoyment. It offers tourists fine white sandy beaches, pristine environment and a perfect area whenever they want a solemn place to experience peace and solitude – a great escape from the crowded town in just a few kilometers. Tourists in Bangaan Island can enjoy swimming in its long white sand beach or experience the floating cottage, banana boat ride, and around-the-island tour. However, being one of the major tourist attractions, the coastal environment of the island became vulnerable to disturbances and damages, including seagrass resources.

This study was conducted to assess seagrass along the vicinity of Bangaan Island Marine Sanctuary. Specifically, this sought to: identify seagrass species present in along the vicinity of Bangaan Island Marine Sanctuary; determine the distribution and abundance of seagrass species; and document the seagrasses along the vicinity of Bangaan Island Marine Sanctuary using Geographic Positioning System (GPS).

Materials and methods

With the use of Global Positioning System (GPS), ground survey was conducted to document and to

calculate the extent of seagrass along the vicinity of Bangaan Island Marine Sanctuary.

There were two sites identified along the vicinity of Bangaan Marine Sanctuary for seagrass assessment. Assessment of seagrass cover was conducted using the line intercept method set by Seagrass-Watch, for seagrass monitoring data collection. Three 50 meters transect will be laid out perpendicular to the shore with an interval of 25 meters heading out to the sea from the shore. For every 50 meters transect, a sampling point was established at every 25 meters interval thus creates 3 sampling points for each transect. A 1m x 1m quadrat (divided into 100 squares at 10cmx10cm) was randomly tossed for not more than 5 meter radius in every sampling points and was replicated thrice to ensure the validity and accuracy of the data collected.The number of squares that seagrass has filled in the quadrat, represents the percentage of the seagrass cover per quadrat. Every quadrats location was documented using GPS. Through snorkelling, seagrass inside each quadrat was identified using and its percentage cover and epiphytic cover was recorded. Seagrass species will be identified using the Guidelines for the Rapid Assessment and Mapping of Seagrass Tropical Habitats (McKenzie 2003).

Paleontological Statistics Software Package (PAST version 4.3) was used to analyze seagrass species diversity index and One way Analysis of Variance to determine the significant difference of seagrass percent cover in an increasing water depth in Site 1,2 and 3.

Results and discussion

Seagrass species identification

Seagrasses were located in the subtidal zone where the water depth at low tide in most shallow is at 0.5 meters and a deepest is 2 meters. From quadrat 1, located at the most shallow of the sampling area, a transect was laid out perpendicular to the shore at 25 meters interval. There were two sites identified for seagrass assessment in Bangaan Island (Fig. 1).

The overall average of seagrass cover identified in these two sites are 11.5% (site 1 = 13%; site 2 = 10%).

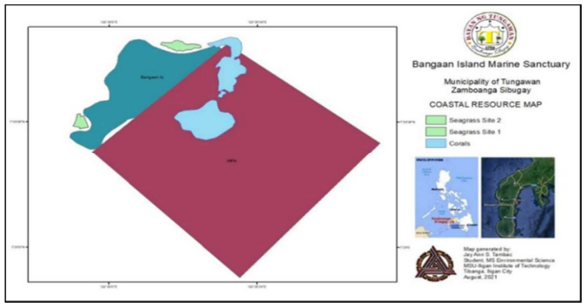

Fig. 1. Seagrass location in Bangaan Island marine sanctuary

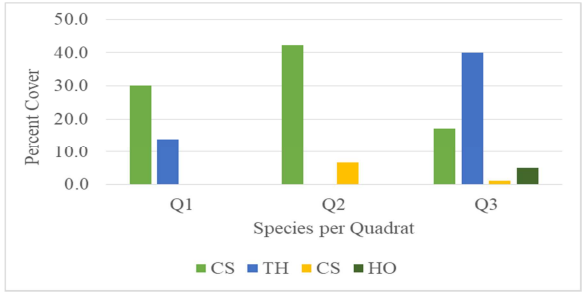

Fig. 2. Bangaan seagrass site 1.

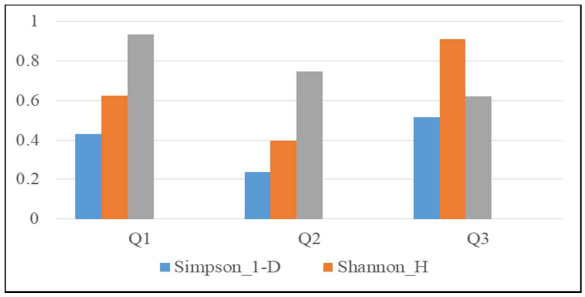

Fig. 3. Bangaan seagrass site 1.

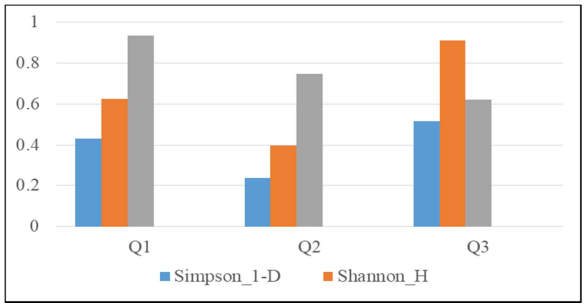

Fig. 4. Bangaan seagrass site 1 diversity indices

Fig. 2 shows seagrass species present in Site 1, which were *Enhalus acoroides, Thalassia hemprichii, Cymodocea serrulata* (CS) and *Halophila ovalis* (HO).

In quadrat 1, two seagrass species were observed and these were *Enhalus acoroides* (30%), and *Thalassia hemperichii* (13.9%). For the quadrat 2, which was 25 meters away from the first quadrat, two seagrass species were also observed which *Enhalus acoroides* were (42.22%) and *Cymodocea serrulata* (6.67%). Moreover, there were 4 seagrass species that was observed in quadrat 3 and these were *Thalassia hemprichii* (40%), *Enhalus acoroides* (17%), *Cymodocea serrulata* (1%) and *Halophila ovalis* (5%). In quadrats 1 and 2, *Enhalus acoroides* (EA) has the highest percentage (Q1-30%; Q2-42.22%) cover in 3 transects and in quadrat 3 *Thalassia hemprichii* (40%). The highest percent of *Enhalus acoroides* (EA) in quadrat 1 and 2 could indicate that this seagrass species can survive severe environmental conditions (Ogawa and Nanba, 2002) such as waves (Ambo-Rappe, 2022) and siltation (Terrados *et al.*, 1998).

Fig. 3 shows that based on the assessment conducted, there were 5 seagrass species identified in site 2 along the vicinity of Bangaan Island Marine Sanctuary, and these are: *Enhalus acoroides* (EA), *Thalassia hemprichii* (TH), *Cymodocea serrulata* (CS), *Cymodocea rotundata* (CR) and *Halophila ovalis* (HO). In quadrat 1, species identified were *Enhalus acoroides* (21%), *Thalassia hemprichii* (3%), *Cymodocea serrulata* (10%), *Cymodocea rotundata* (5%). Quadrat 2 present species were *Enhalus acoroides* (14%), *Cymodocea serrulata* (18%), *Cymodocea rotundata* (9%), *Halophila ovalis* (8%) and *Thalassia hemperichii* (3%). For quadrat 3 *Thalassia hemprichii* (39%), *Enhalus acoroides* (16%), *Cymodocea rotundata* (9%), *Halophila ovalis* (8%) and *Cymodocea serrulata* (6%), were the species present in the area.

Seagrass species such as *Enhalus acoroides, Thalassia hemprichii*, *Cymodocea serrulata* (CS) and *Halophila ovalis* (HO) were both common in two sites along the vicinity of Bangaan Island Marine Sanctuary. Except for *C. rotundata,* which was only found in Site 2, this species was also considered as one of the Southeast Asian seagrass species most sensitive to siltation (Halun *et al.*, 2002).

Species diversity

This assess the species diversity of seagrass species in 3 quadrats in increasing water depth, from seagrasses located at most shallow in quadrat 1 to seagrass species located at more deeper in 50 meters which is quadrat 3. In the 50m x 50 m transect in Site 1, analysis shows that Quadrat 3 has the highest diversity index (H= 0.9087) compared to other two quadrats (Q1: H=0.6243 and Q2: H=0.3984) as shown in Fig. 4. Among 3 quadrats, quadrat 1 has the highest Evenness value (Evenness=0.9335) thus, has most evenly distributed species compared to Quadrat 2 (Evenness=0.7447) and Quadrat 3 (Evenness=0.6203). This means that quadrat 1 has the most consistent distributed species with an almost equal number of species in each transect as compared to the other two quadrats. Dominating species in the area such as *E. acoroides, T. hemprichii and C. serrulata* means low diversity level in seagrass community. Since all of the quadrats in Site 1 has a diversity index of less than two (H<2.0), the species diversity of seagrass along the vicinity of Bangaan Island Marine Sanctuary is low, based on the Biodiversity Index Category of Odum, 1983**.**

Based on the analysis conducted to determine the significant difference in three quadrats in Site 1, One-way Analysis of Variance (ANOVA) results revealed that *p* value is 0.9239. Using at α=0.05 (at 95% confidence level), the result of the analysis showed that *p* value is greater than the alpha (α=0.05) thus, there is no significant difference in terms of percentage cover of seagrass species in 3 quadrats of Site 1 even at an increasing water depth.

Fig. 4 this shows the results of diversity analysis of seagrass species among the three quadrats in Site 2 located along the vicinity of Bangaan Island Marine Sanctuary. As shown in figure 1.6, this study reveals that quadrat 3 has the most diverse seagrass community (H=1.552) among the other 2 quadrat (Q1: H=1.143 and Q2: H=1.477). In terms of species evenness, seagrass species were evenly distributed among three quadrats in Site 2. However, the seagrass species diversity area was still categorized as

low as its diversity value is below 2.0 (H>2.0), based on the Biodiversity Index Category of Odum, 1983.

Based on the, One-way Analysis of Variance (ANOVA) to determine significant difference of seagrass percentage cover in 3 quadrats for Site 2, results revealed that *p* value is 0.4611. Using at α=0.05 (at 95% confidence level), the result of the analysis showed that *p* value is greater than the alpha (α=0.05) thus, there is no significant difference in terms of cover percentage of seagrass species in 3 quadrats of Site 2 even at an increasing water depth.

Fig. 5 This results of this study revealed that among the three quadrats in the 50m x 50m transect line which was used to assess seagrass species along the vicinity of Bangaan Island Marine Sanctuary, quadrat 3 has the highest diversity index compared to the other two quadrats (quadrat 1 and quadrat 2). Water depth for quadrat 1 ranges up to 0.2 to 0.5 meters, quadrat 2 ranges up to 0.5 to 1 meter and quadrat 3 ranges up to 0.9 to 1.5 meters. These results show that there were more seagrass species found in the deeper areas of the sea as compared to the shallow areas along the vicinity of Bangaan Island Marine Sanctuary. The resistance of these seagrass species to the increasing depth, especially *for E. acoroides, T. hemprichii and C. serrulata* species (Bach and Borum *et al.*, 1998**)** might be some factors that help these species survive in these areas. Also the presence of dominating species such as *E. acoroides, T. hemprichii* and *C. serrulata* could also be an indicator that the diversity of seagrass species in the area is low.

The low percent cover and sparse distribution of seagrass in Bangaan Island could be due to some anthropogenic factors or natural cause. Recreation activities offered such as floating cottage in Bangaan Island and the passenger boats that transport tourists from the mainland to the island could lead to seagrass damage as some of it (especially *E. acoroides* was known to possess long ribbon - like leaves) may cling to boat propeller. During peak season, summer and holidays, both islands became overloaded with tourists which its activities endanger not only the seagrass but also the other resources in the area. Other natural factors that affect the seagrass abundance in both islands are the soil type, waves and sediments.

Conclusion

Based on the seagrass assessment conducted along the vicinity of Bangaan Island Marine Sanctuary, data shows that there were 4 species identified in Site 1 for the 3 quadrats and, *E. acoroides* has the highest percent cover (42.22%) in quadrat 2 among the four species. For site 2, there were 5 seagrass species identified in the 3 quadrants and among these 5, dominating species is *T. hemprichii* (39% cover) in quadrat 3. In terms of diversity index of seagrass species in quadrats 1 to 3, results shows that quadrat 3, located at the deepest station of the study area, has the most diverse seagrass species among the three quadrats for both site 1 and 2. However, diversity level of seagrass for quadrat 1, 2 and 3 were still low for both site 1 and site 2. One way analysis of Variance (ANOVA) results show that there were no significant difference of seagrass percentage cover in increasing water depth in quadrats 1,2, and 3 for both Site 1 and Site 2. Low species diversity level of seagrasses could also indicate low stability of the community which might affect seagrass mechanism to combat and to cope up against threats and environmental stress brought by either natural or anthropological. Aside from having a Marine Sanctuary, Bangaan Island is a tourism site and its accessed areas are open for community activities use such as fishing, snorkelling, diving and shell gleaning. These activities poses threats to seagrasses in the area. Thus, seagrass restoration and management should be carried out in Bangaan Island.

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