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Research Article

Species Composition, Abundance, Distribution and Diversity of Seagrass at Provinces of Sulu and Basilan, Philippines

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Abstract: Seagrass plays a vital role in coastal ecosystems by supporting biodiversity, fisheries, and local economies. However, security concerns have limited research on seagrass in Sulu and Basilan, Philippines. This study assessed the seagrass status across 12 coastal municipalities in the provinces of Sulu and Basilan, Philippines, using the line transect-quadrat method, covering 580 transects and 5,600 plots. Six seagrass species from the family Cymodoceaceae (*Cymodocea rotundata, Halodule uninervis* and *Syringodium isoetifolium*) and the family Hydrocharitaceae (*Enhalus acoroides, Halophila ovalis* and *Thalassia hemprichii*) were identified. Seagrass cover was fair in Omar (41.83%), Pangutaran (33.18%), Tabuan Lasa (31.96%), Luuk (29.73%), and Banguingui (28.89%), while it was poor in Sumisip (21.75%), Hadji Muhtamad (18.78%), Hadji Panglima Tahil (18.43%), Patikul (15.98%), Lantawan (15.10%), Maluso (14.25%) and Panamao (9.60%). *T. hemprichii* (45.97%) and *C. rotundata* (35.44%) dominated, collectively comprising 81% of the total cover. *E. acoroides* contributed 18.76%, while the remaining species had low coverage (7.85%–11.74%). Diversity indices indicated low diversity with an overall Shannon-Weiner diversity index (H = 1.3367), Pielou's evenness (e = 0.13566), and Margalef's index (Sm = 0.4807). Associated flora included Chlorophyta, Rhodophyta, and Phaeophyta, while fauna was dominated by Asteroidea, Anthozoa, Gastropoda, and Echinodea. Thus, the degraded seagrass beds in the eastern part of the Sulu Sea highlight the need for immediate conservation efforts, monitoring, and management strategies. Protecting these habitats is crucial for biodiversity and sustaining local livelihoods dependent on the Sulu Sea's resources.

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1. Introduction

The Philippine archipelago, a unique and diverse ecosystem, is a haven for marine biodiversity. With 7641 islands and 2 200 000 km^2 of total territorial water, including an exclusive economic zone (EEZ) (BFAR, 2019; Tahiluddin and Terzi, 2021), it is the original home of tropical seagrasses (Carpenter and Springer, 2005; Malanguis et al., 2024). Seagrasses, highly specialized flowering plants in temperate and tropical locations, thrive in brackish and marine waters, serving as crucial marine habitats and nursery areas for commercially important marine organisms (Fortes, 2012; Jumawan et al., 2015). They also provide protection against strong typhoons and wave attenuation (Hansen and Reidenbach, 2017), improve water transparency, and reduce the amount of suspended particles in the water. Moreover, seagrasses act as a vital global carbon sink, enhancing community diversity, biomass, and primary and secondary production. Despite their immense ecological value, seagrasses are among the most vulnerable ecosystems (Duarte, 2002; Waycott et al., 2009; Unsworth et al., 2022).

Around 60% of seagrass species globally belong to 13 genera and five families (Mckenzie, 2007; Short et al., 2007). Additionally, the Philippines is home to an astounding 21 seagrass species in nine genera and four families, making up 29% of the world's seagrass species. It boasts the highest seagrass species diversity, with 19 species recorded in the Philippines (Lamit et al., 2017), and is regarded as the world's second-largest number of seagrass with species next to Australia (Carruthers et al., 2007). The distribution of seagrass is affected by physicochemical factors (Brazas and Lagat, 2022), and its survival and growth are affected by nutrients. Other factors that threaten the seagrass meadows, particularly in the Philippines, for instance, is port development, which has caused the eutrophication of marine waters, a significant long-term threat to seagrass ecosystems (Fortes and Santos, 2004). Furthermore, coastal recreational activities, overexploitation (Lagud et al., 2020), aquaculture operations, destructive fishing techniques, and sedimentation can also lead to the degradation of seagrass meadows (Unsworth and Cullen, 2010; Asmus et al., 2022). These threats underline the vulnerability of seagrasses, emphasizing the need for immediate and effective conservation measures.

The Sulu archipelago, which includes the provinces of Tawi-Tawi, Sulu, and Basilan, is located in the southern Philippines (Muallil et al., 2020). This archipelago is of immense importance as a key marine biodiversity area due to its potentially rich marine resources (Ong et al., 2002; Muallil et al., 2024). Seagrasses provide various ecosystem services to coastal residents in the provinces of Sulu and Basilan, including recreation and livelihood activities such as gleaning and subsistence fishing. However, despite its importance, few studies have assessed the status of seagrass in the region due to local instability over the past few decades. While the province's security risks have helped prevent overexploitation, they have also hindered local awareness of the conservation status of marine organisms in the area (Tabugo et al., 2013). Therefore, this study aims to assess the status of the seagrass by determining the species composition, abundance, distribution, and diversity of seagrass beds as well as their associated flora and fauna in the coastal provinces of Sulu and Basilan, Philippines. The findings of this study will not only contribute to our understanding of marine biodiversity but also guide conservation efforts in these areas.

2. Material and Methods

2.1. Study site and duration

This study was conducted in 140 barangays across 12 island municipalities in the provinces of Basilan and Sulu, Philippines, from October 2020 to March 2021. Seven municipalities were investigated in Sulu province: Hadji Panglima Tahil (6°07'5" N, 120°54'44" E), Luuk (6º016’51” N 121º31’52” E), Omar (6º03’0” N 121º22’38” E), Panamao (6º01’45” N 121º19’39” E), Patikul (6º08’63” N 121º08’03” E), Pangutaran (6º28’68” N 120º52’45” E), and Banguingui (6º14’84” N 121º82’98” E). In Basilan Province, five municipalities were assessed: Maluso (6º31’06” N 121º51”54” E), Hadji Muhtamad (6º39’30.2” N 121º35’21.8” E), Lantawan (6º39’50.8” N 121º54’01.6” E), Sumisip (6º24’41” N 122º01’55” E) and Tabuan Lasa (6º18’30” N 121º55’52” E) (Figure 1).

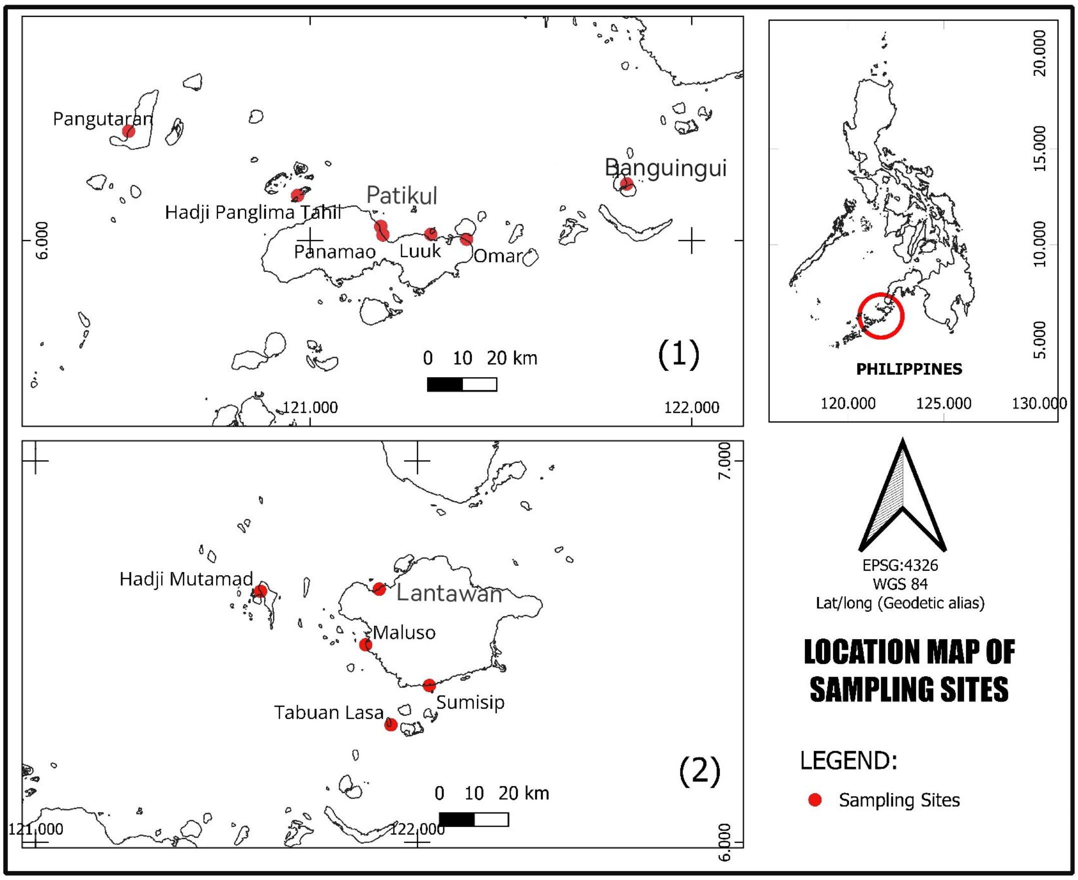

Figure 1. Map of the study sites (red dots) showing the Sulu province (1) and Basilan province (2), Philippines.

2.2. Line transect-quadrat method

The composition, distribution, abundance, and percentage cover of seagrass were evaluated using the line transect-quadrat method by Deguit et al. (2004) (Figure 2). Four transects, each with ten quadrats, were laid and recorded at each sampling site. A 50 m transect was laid from the seashore towards the sea; a 1 x 1 m quadrat with 25 grids was placed along the line at an interval of 5 m from each other. Once the first transect was thoroughly investigated, a 50 m interval from the first transect was established before the second transect was laid. The same procedure was applied for the third and fourth transects. The occurrence of seagrass species was then counted and recorded. The percentage cover was also estimated (McKenzie, 2003), and the number of grids in the quadrat where seagrass species were found was tallied.

Figure 2. Line transect-quadrat method.

2.3. Seagrass identification

Seagrass identification was done morphologically using the available field guides (Meñez et al., 1983; McKenzie, 2003; Ohba et al., 2007; Fortes, MD, 2015). Each species was documented, and the complete names of the species were based on the World Register of Marine Species (WoRMS, 2024).

2.4. Seagrass percentage cover

For the percent cover computation of each species per quadrat, the formula of Saito and Atobe (1970), as adopted by English et al. (1994), was used. The average percentage cover was calculated using the steps adopted from Deguit et al. (2004). The average cover of every transect was taken by dividing the total per transect by the number of quadrats. The average of each transect was taken, which was divided by the number of transects established in the survey. The condition of the seagrass beds was determined using the criteria set by Fortes (1989) as stated: excellent (76-100% coverage), good (51-75% coverage), fair (26-50% coverage), and poor (0-25% coverage).

A. Seagrass Percentage Cover

$$C = \frac{\sum(\mathrm{M}i \ x \ Fi)}{\sum \mathrm{f}} \tag{1}$$

Where:

C = Coverage
Mi = midpoint percentage of class i
Fi = frequency
∑= sum from total cover for each species

2.5. Diversity indices

The Shannon-Wiener Diversity Index (H), Pielou's Evenness Index (e), and Margalef's Index (Sm) were employed to assess the biodiversity of seagrass communities in various aspects (diversity, evenness, and richness) across different assessment areas. These indices were computed using specific equations (Equations 1, 2, and 3) as outlined by Shannon (1948), Pielou (1966), and Margalef (1958). The calculations were performed using Paleontological Statistical Software Package (PAST) version 4.03. A value of 1 signifies maximum evenness (Pielou, 1966). Margalef's Index (Sm) was categorized as high species richness/integrated (> 4), medium species richness/semi-disturbed (2.5-4), and low species richness/disturbed (< 2.5).

A. Shannon-Weinner Diversity Index

$$H = \sum_{i=0}^{S} -(Pi * InPi) \tag{2}$$

Where:

H' = Shannon-Wiener Diversity Index
Pi = fraction of the entire population made up of species
S = numbers of species encountered/species richness
∑ = sum from species 1 to species

B. Pielou’s Evenness Index

$$e = \frac{\mathrm{H}}{\mathrm{Ins}} \tag{3}$$

Where:

e = Pielou’s Index of Evenness
H’ = Shannon’s Diversity Index

ln = natural logarithm
S =Total number of genera in the sample

C. Margalef's index

$$Sm = (S - 1)/lnN \qquad (4)$$

Where:
S = Number of species in a sample
ln = natural logarithm
N = Total individual

3. Results

3.1. Seagrass species composition

Different species of seagrass composition have been observed across the 140 sampling sites both in the provinces of Sulu and Basilan, Philippines (Table 1 and Figure 3) During the assessment, there were only six species of seagrass from two families namely Cymodoceaceae (*Cymodocea rotundata, Halodule uninervis,* and *Syringodium isoetifolium*) and Hydrocharitaceae (*Enhalus acoroides, Halophila ovalis,* and *Thalassia hemprichii*) were recorded in both provinces.

Table 1. Species composition of seagrass in the province of Sulu and Basilan

Family Cymodoceaceae	**Species**
	Cymodocea rotundata Ascherson & Schweinfurth, 1870
	Halodule uninervis (Forskal) Ascherson, 1882
	Syringodium isoetifolium Ascherson (Dandy), 1939
Family Hydrocharitaceae	*Enhalus acoroides (*Linnaeus f.) Royle, 1839
	Halophila ovalis (R.Brown) J.D.Hooker, 1858
	Thalassia hemprichii (Ehrenberg) Ascherson, 1871

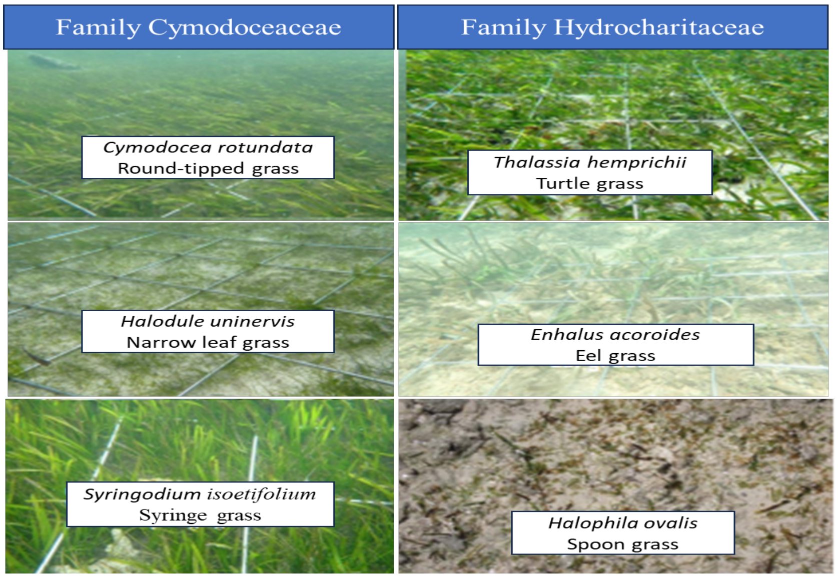

Figure 3. Actual species of seagrass in its natural habitat.

3.2. Species distribution

The species distribution of seagrass in the provinces of Sulu and Basilan, Philippines, is presented in Table 2 and Figure 4. In the Sulu province, a total of six species, namely, *E. acoroides, H. ovalis, T. hemprichii, H. uninervis, C. rotundata,* and *S. isoetifolium,* were recorded in the municipalities of Omar and Patikul. However, *E. acoroides* was absent in Hadji Panglima Tahil municipality, and *S. isoetifolium* in the municipalities of Panamao, Pangutaran, and Banguingui. Furthermore, all six species of seagrass were present in the five municipalities of Basilan province, namely, Hadji Muhtamad, Maluso, Lantawan, Sumisip, and Tabuan lasa.

Table 2. Composition and distribution of seagrass species in the study areas

Municipalities	Species						Total Number of species
	E. acoroides	*H. ovalis*	*T. hemprichii*	*H. uninervis*	*C. rotundata*	*S. isoetifolium*	
Sulu Province							
Hadji Panglima Tahil	X	√	√	√	√	√	5
Luuk	√	√	√	X	√	X	4
Omar	√	√	√	√	√	√	6
Panamao	√	√	√	√	√	X	5
Patikul	√	√	√	√	√	√	6
Pangutaran	√	√	√	√	√	X	5
Banguingui	√	√	√	√	√	X	5
Basilan Province							
Hadji Muhtamad	√	√	√	√	√	√	6
Maluso	√	√	√	√	√	√	6
Lantawan	√	√	√	√	√	√	6
Sumisip	√	√	√	√	√	√	6
Tabuan Lasa	√	√	√	√	√	√	6

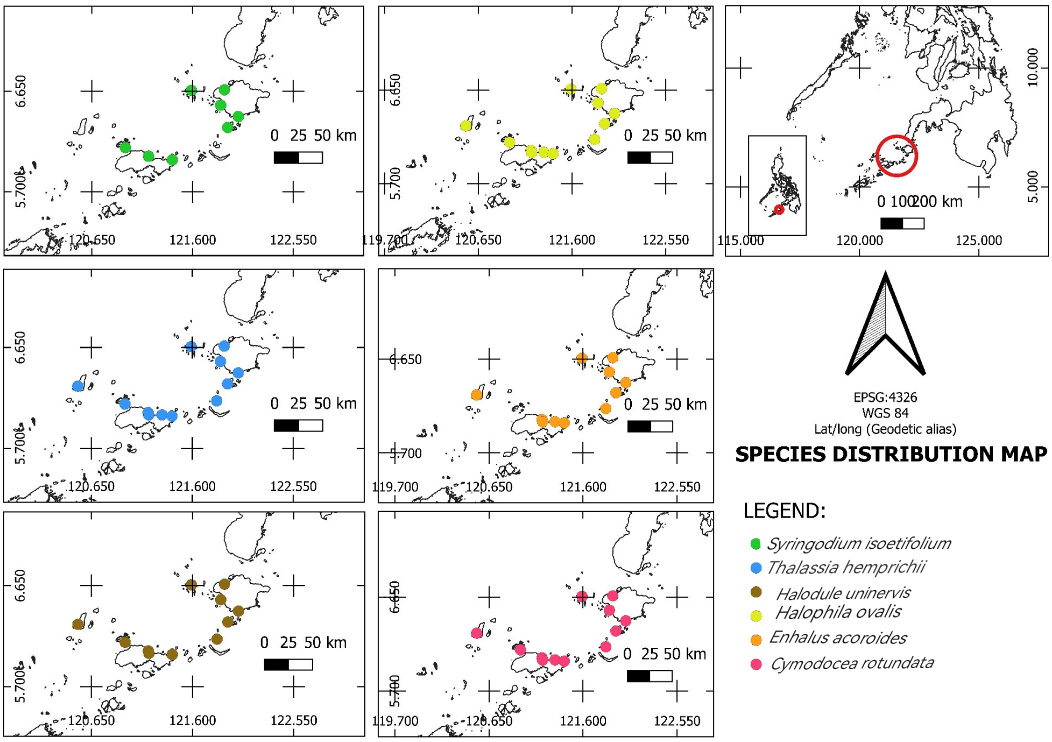

Figure 4. Species Distribution of Seagrass Species in Sulu and Basilan, Philippines (Green dots: *Syringodium isoetifolium*, Blue dots: *Thalassia hemprichii*, Brown dots: *Halodule uninervis*, Yellow dots: *Halophila ovalis* and *Enhalus acoroides*, Orange dots: *Cymodocea rotundata*).

3.3. Relative abundance

Figure 5 shows the relative abundance of each seagrass species recorded in the sampling areas. Among the six species, *T. hemprichii* obtained the highest percent relative abundance with 39.1 ± 5.26 %, followed by *C. rotundata* (28.3 ± 5.43 %) and *E. acoroides* (14.3 ± 6.67 %). On the other hand, *H. uninervis, H. ovalis,* and *S. isoetifolium* were recorded as the lowest value of relative abundance of 9.0 ± 2.22 %, 5.7 ± 2.14 %, and 3.7 ± 1.72 %, respectively.

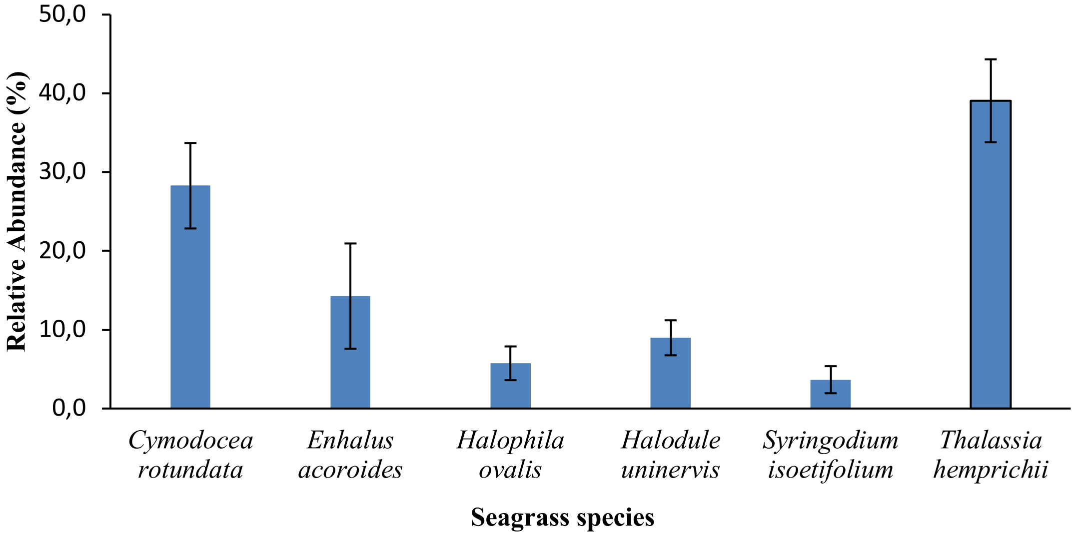

Figure 5. Mean Percentage Relative abundance of seagrass species in the Sulu and Basilan, Philippines.

3.4. Mean percentage cover

The seagrass mean percentage cover of twelve (12) coastal municipalities in the provinces of Sulu and Basilan, Philippines, is shown in Figure 6. The *T. hemprichii* (45.97 ± 5.87 %), of family Hydrocharitaceae dominates the highest percentage cover of seagrass, followed by *C. rotundata* (35.44 ± 5.43 %), *E. acoroides* (18.76 ± 6.23 %), *H. uninervis* (11.74 ± 2.17 %), *H.ovalis* (11.35 ± 4.99 %), and *S. isoetifolium* (7.85 ± 1.72 %) respectively.

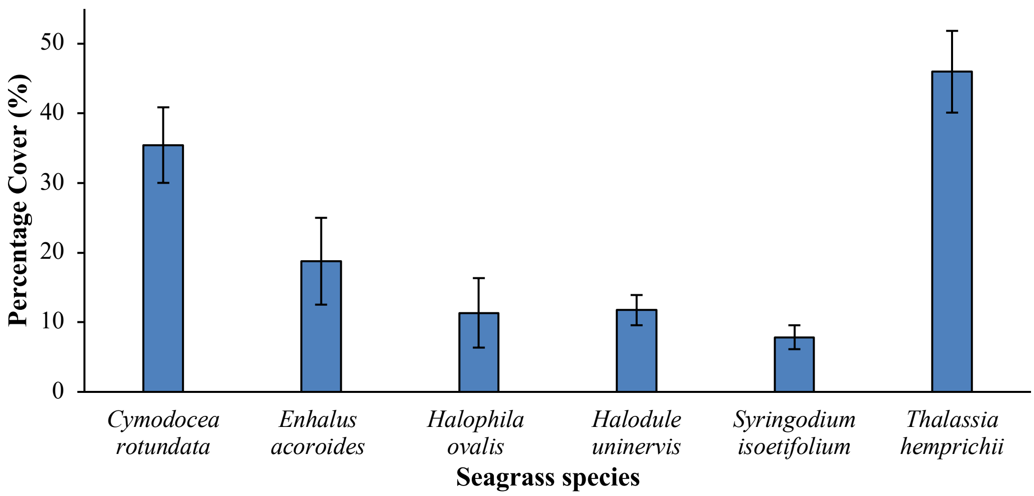

Figure 6. Mean percentage cover of seagrass species in the Provinces of Basilan and Sulu, Philippines.

3.5. Percentage cover of seagrass per study area

The percentage cover of seagrass per study area is presented in Figure 7. In the province of Sulu, the municipality of Omar has the highest percentage cover of 41.83 ± 12.63 %, followed by the municipalities of Panguturan (33.18 ± 13.12 %) and Luuk (29.73 ± 8.74 %), which are classified under the status of "fair" seagrass bed, while, the municipalities of Hadji Panglima Tahil (18.43 ± 8.46 %), Patikul (15.98 ± 6.27 %) and Panamao (9.6 ± 3.60 %) were categorized as "poor" status. In the Basilan province, the highest percentage was recorded in the municipalities of Tabuan Lasa (31.96 ± 11.28 %) and Banguingui (28.89 ± 13.75 %), which were classified as having "fair" seagrass beds. Additionally, Sumisip (21.75 ± 9.07 %), Hadji Muhtamad (18.78 ± 8.98 %), Maluso (14.25 ± 4.99 %), and Lantawan (15.10 ± 6.63 %) were classified as having "poor" status of seagrass bed.

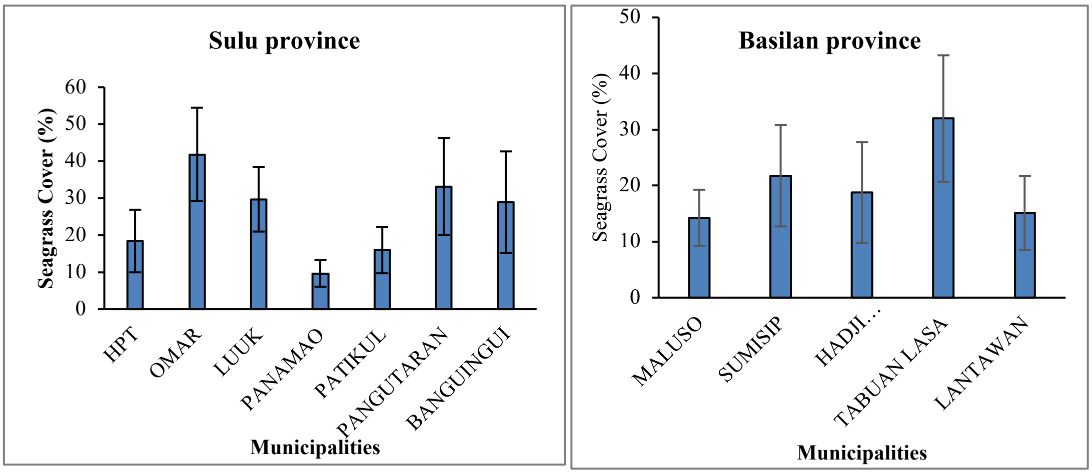

Figure 7. Mean percentage cover (%) of seagrass along municipalities of Sulu and Basilan, Philippines.

3.6. Species diversity

The seagrass diversity of the 12 target municipalities in Sulu and Basilan provinces was computed using the three diversity indices: the Shannon-Weinner diversity index (H), Simpson Dominance Index (D), and Margalef's index value (*Sm*) (Figures 8, 9, and 10). The results revealed that all study areas were categorized as "very low" diversity, with computed values below 1. Similarly, the computed values of the target municipalities were <2.5 and categorized under "Low Species richness/Disturbed. In terms of Evenness, all municipalities recorded > 0.5, which was considered as "high," indicating a more evenly distributed number of individual sizes between species.

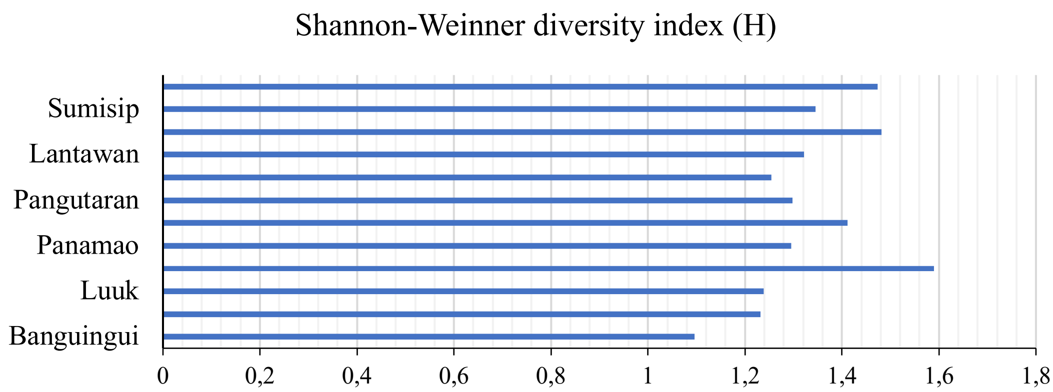

Figure 8. Shannon-Weinner diversity index (H) of 12 municipalities in the provinces of Sulu and Basilan, Philippines. H category: Very low=1.99 and below; Low=2.0-2.49; Moderate=2.50-2.99; High=3.00 – 3.49; Very high= 3.50 and above.

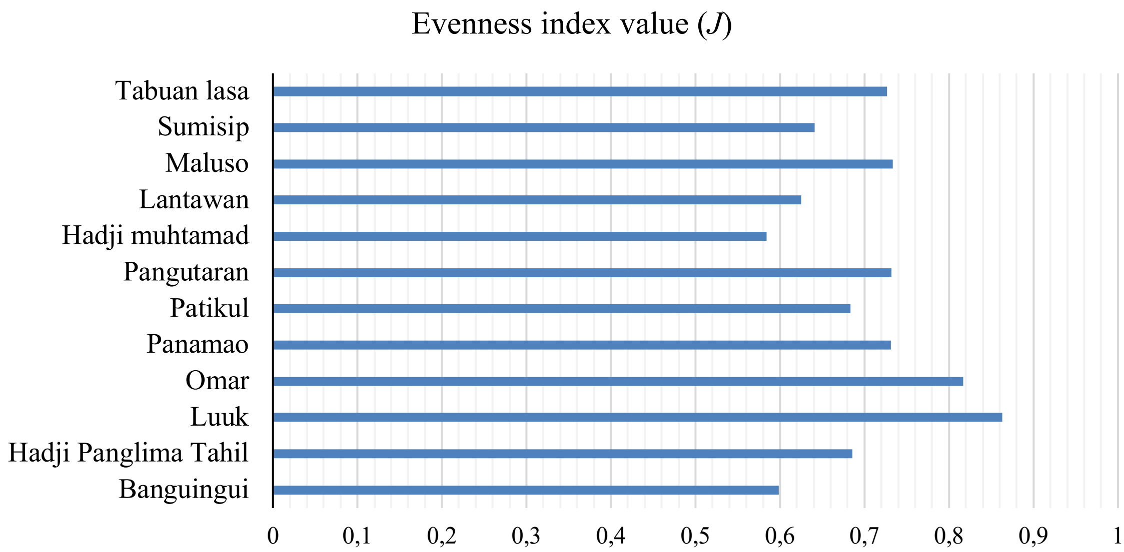

Figure 9. Evenness index value (*J*) of 12 municipalities in the provinces of Sulu and Basilan, Philippines. The value of *J* ranges from 0 to 1. Higher values indicate higher levels of evenness. At maximum evenness, *J* = 1.

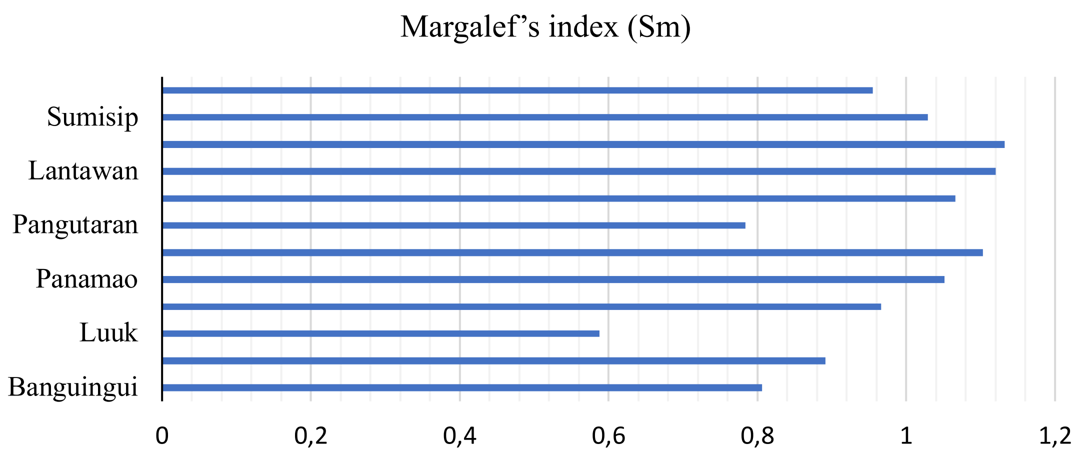

Figure 10. Margalef's index value (*Sm*) of 12 municipalities in the provinces of Sulu and Basilan, Philippines. Margalef's index value category: High Species richness/Integrated = >4, Medium species richness/Semi disturbed = >2.5 - <4 and Low Species richness/ Disturbed = <2.5.

3.7. Associated flora and fauna in the seagrass bed

The associated flora and fauna in the seagrass bed in the study areas were also observed and recorded during the assessment of seagrass. There were seven classes of associated fauna recorded in the 12 municipalities of the Sulu and Basilan provinces (Figure 11). The class Gastropoda was recorded as the highest (38%) number of fauna associated with seagrass in Pangutaran, Sulu. In Basilan, the class Asteroidea was recorded as the highest number of fauna associated with seagrass in Tubuan Lasa (45%) and Maluso (38%). Moreover, the associated flora within the seagrass bed was also recorded during the assessment. There were three divisions of macroalgae, such as Chlorophyta, Rhodophyta, and Phaeophyta, observed along the transect line and quadrats method in the 12 municipalities of Sulu and Basilan provinces, as listed in Table 3.

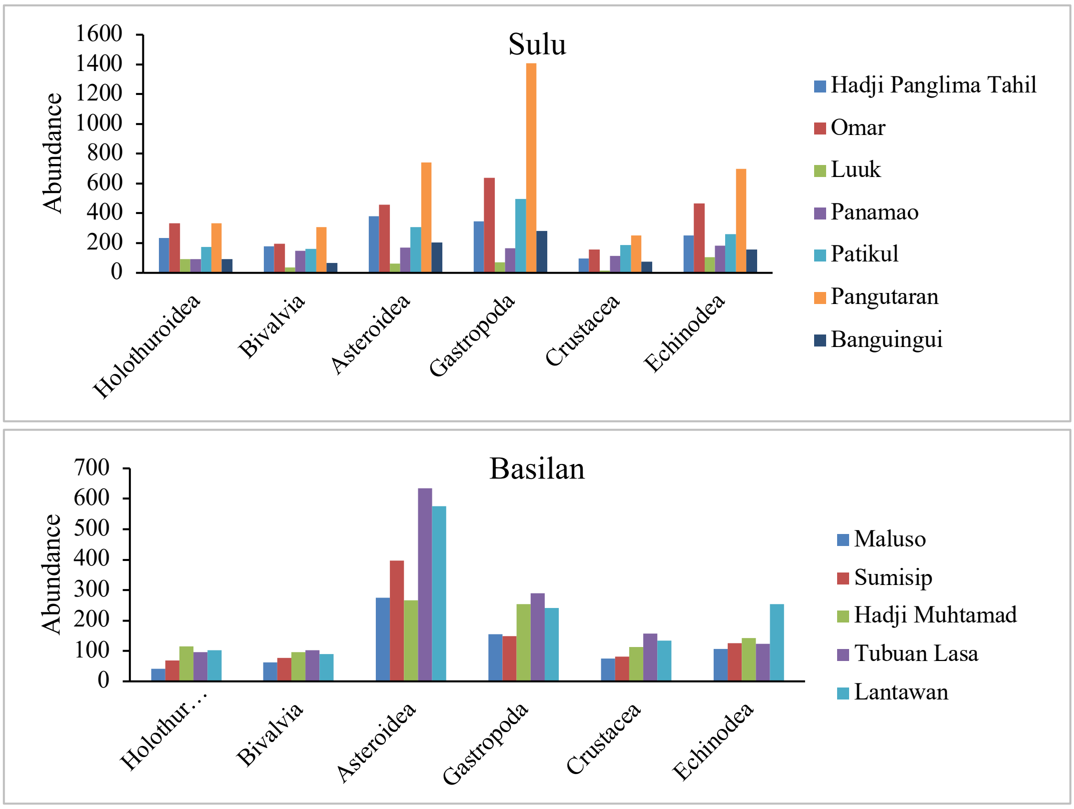

Figure 11. Fauna associated with seagrass observed in the study areas.

Table 3. List of seaweeds/algae associated with seagrass that occurred in the transect locations during sampling activity

Seaweeds Group/Division	**Species**
Green algae/Chlorophyta	1. *Caulerpa* sp. 2. *Chaetomorpha crassa* 3. *Halimeda* sp. 4. *Neomeris* sp. 5. *Valonia ventricose*
Red algae/Rhodophyta	1. *Gelidium* sp. 2. *Gracilaria arcoata* 3. *Gracilaria salicornia* 4. *Hypnea* sp.
Brown algae/Phaeophyta	1. *Padina* sp. 2. *Sargassum* sp. 3. *Turbinaria ornata*

4. Discussion

Seagrasses contribute significantly to the sustainable development of fisheries resources, which ensures food security. It plays a crucial role in the marine ecosystem, as its high levels of biological activity and growth support and benefits every organism within that environment, contributing to the overall health and balance of marine life (Lagud et al., 2020). The purpose of the present study was to determine the status of seagrass by determining the species composition, abundance, distribution, diversity, and the associated flora and fauna in seagrass beds in the coastal water of 12 municipalities of Sulu and Basilan, Philippines. The results of the study determined that there were six seagrass species representing two families: *C. rotundata*, *H. uninervis*, and *S. isoetifolium* of Family Cymodoceaceae;

and *E. acoroides*, *H. ovalis,* and *T. hemprichii* of Family Hydrocharitaceae found in the study areas. Generally, 18 seagrass species were reported in the Philippines (Fortes, 2013). In the northern Philippines, six seagrass species were recorded by Ame and Ayson (2009). Payo et al. (2018) listed four seagrass species along the coast of Tacloban, Philippines. In addition, Mascariñas and Otadoy (2022) identified seven seagrass species in Bohol, Philippines. In the southern Philippines, seven species of seagrasses were identified in Kauswagan, Lanao del Norte, and Lopez Jaena, Misamis Occidental (Arriesgado et al., 2024). Additionally, seven species of seagrasses were also identified in Hagonoy, Davao del Sur (Jumawan et al., 2015), and Bongao, Tawi Tawi (Abubakar et al., 2018), southern Philippines. Although Lagud et al. (2020) documented three seagrass species in another area of Cabucan Island, Hadji Panglima Tahil, Sulu, our study identified six seagrass species across both Basilan and Sulu provinces, including additional areas of Hadji Panglima Tahil Island, Sulu. This higher number of species aligns with those commonly observed in various studies conducted throughout the Philippine archipelago. Moreover, a previous study reported that *E. acoroides* was the most dominant seagrass species in Cabucan Island, Hadji Panglima Tahil, Sulu Lagud et al. (2020). However, in our study, *E. acoroides* was not found in Hadji Panglima Tahil, Sulu. Although the two locations are relatively close, differences in seagrass cover may still arise. Our sampling areas are more heavily impacted by human activities such as fishing, boat traffic, and coastal development, which likely contribute to the reduced seagrass cover due to physical disturbances. Additionally, in this study, the sampling coverage was limited to only a 50-meter distance from the shore, which may not fully capture the typical habitat range of *E. acoroides*. This species is known to prefer deeper and more stable environments where wave action and physical disturbances are less pronounced (Gole et al., 2023). The absence of *E. acoroides* in our sampling area could be attributed to the shallow waters near the shore, which are more susceptible to anthropogenic disturbances such as boat traffic, fishing activities, and coastal development. These disturbances likely hinder the growth and establishment of *E. acoroides* in the immediate coastal zone.

The present study revealed that *T. hemprichii* was the most dominant species compared to the other species. The seagrass bed covers about 7.85 % to 45.97 % of *T. hemprichii,* which has a "fair" percentage cover. On the other hand, *H. uninervis, H. ovalis,* and *S. isoetifolium* were noted as having the lowest values of 9.0 %, 5.7 %, and 3.7 %, respectively. Similar findings have been reported that *T. hemprichii* is the most abundant, having a "fair" percentage cover in the Southwest Coast of Davao Oriental, Philippines (Capin et al., 2020). In addition, *H. ovalis*, *T. hemprichii*, and *C. rotundata* were observed to dominate the seagrass beds of Davao Gulf (Noel et al., 2012), as well as in Bohol (Mascariñas and Otadoy, 2022). The same species was also found dominating at Lamongan, Indonesia, and was classified as poor (< 30 %) to healthy (> 60 %) by Dewi et al. (2020). Gaiballa and Mohammad Ali (2023) stressed that *T. hemprichii* was the most prevalent and widely dispersed species along the coast of the Red Sea, with a percentage cover of 36.56 %. Furthermore, in Kapoposang Island, South Sulawesi, Indonesia, the percentage cover ranges from 48.3 % to 95.8 % (Arti et al., 2012), and 43.60 % in Panggang Island, Jakarta, Indonesia (Wahab et al., 2017). In North Sulawesi Province, Indonesia's percentage cover was 19.32 % "fair" to 34.29 % "good' (William et al., 2020). As reported in the present study, four municipalities from Basilan province, including Hadji Muhtamad, Maluso, Lantawan, and Sumisip were categorized as being in “poor” condition. The physico-chemical factors, siltation, rocky substrate, and seasonal fluctuations in water level may be the cause of this, as they have a significant impact on seagrass cover and abundance. Furthermore, as seagrass near the shoreline is likely impacted by water pollution, the municipality of Maluso, which is populated by rural coastal settlements and sees a significant quantity of small-scale fishing, is probably affected.

The seagrass beds in the present study were associated with a diverse range of fauna, primarily including species from the classes Asteroidea, Anthozoa, Gastropoda, and Echinodea. This is consistent with the findings of Arriesgado et al. (2024), who also reported that seagrass habitats in various provinces of the southern Philippines were predominantly associated with these same faunal groups. Moreover, the present study also recorded associated flora within the seagrass beds, primarily from the groups Chlorophyta, Rhodophyta, and Phaeophyta. Tahiluddin et al. (2023) noted that in Sulu province, farmed seaweeds such as *Kappaphycus* sp. and *Eucheuma* sp. are often found in areas dominated by seagrass, particularly *Thalassia* sp. and *Enhalus* sp. However, in contrast, our study found no association between seagrass cover and *Kappaphycus* sp. or *Eucheuma* sp., likely due to the fact that the sampling sites were located far from seaweed farming areas. This distance could have contributed to the lack of interaction between the farmed seaweeds and the natural seagrass beds in our study.

The diversity analysis showed that the Sulu and Basilan provinces revealed low diversity with an overall Shannon-Weinner diversity index, H'= 1.3367, Pielou's evenness = 0.13566, and Margalef's index = 0.4807. In some parts of the Philippines, the seagrass diversity was recorded in the "Moderate" diversity index at Calatagan, Batangas, with H'=2.08, respectively (Brazas and Lagat 2022). In addition, Mascariñas and Otadoy (2022) revealed the highest diversity index of seagrass in Panglao (H'=1.33), Maribojoc (H'=1.21), and Tagbilaran (H'=1.15) in Bohol. The seagrass diversity index in Hagonoy, Davao del Sur, was recorded as H= 0.6861 (Jumawan, 2015). The observed decline in seagrass species within the 12 coastal municipalities of Sulu and Basilan provinces may be attributed to a confluence of factors. Physical disturbances, such as dynamite fishing and the use of destructive fishing gear, are prevalent in the region and pose a significant threat to seagrass meadows. Furthermore, previous research has identified several environmental stressors that can negatively impact seagrass health and diversity. These include increasing water temperatures, reduced light availability due to sedimentation and algal blooms, and the presence of stressors such as elevated nutrient levels and epiphyte infestations (Burkholder et al., 1992; Aboud and Kannah, 2017). The cumulative effect of these stressors likely contributes to the observed low seagrass diversity within the study sites.

Conclusion

The seagrass community is a vital and productive ecosystem of global importance, serving as a lifeline for vertebrates and various life forms essential for our survival. In this study, we employed the line transect-quadrat method to assess the current status of seagrass in the provinces of Sulu and Basilan, Philippines. Our findings indicate that the seagrass conditions across twelve coastal municipalities in these areas are classified as "fair" to "poor" conditions. The low diversity of seagrass within the study area may be attributed to a combination of anthropogenic activities, such as destructive fishing and natural processes. Consequently, it is imperative to implement more effective conservation measures to protect the seagrass beds in Sulu and Basilan. These results highlight the urgent need for immediate conservation efforts, such as establishing protected area management and conducting long-term monitoring to assess species status and enhance public awareness. Government entities and other organizations must enact well-structured programs aimed at safeguarding seagrass meadows. Given the critical role of the seagrass ecosystem in our existence, it requires immediate attention for interventions, management, and conservation efforts to prevent further degradation of coastal resources in the eastern Sulu Sea.

Ethical Statement

The authors declare that there were no animal or human studies were carried out in this study.

Conflict of Interest

The authors declare that there is no conflict of interest exists in this study.

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Author Contributions

Abduhasad, A. K. conceptualized and wrote the original draft. Nando, A. T. and Paradji Jr, S. M. gathered and consolidated the data. Sailadjan, S. J. and Imbuk, E. S. conceptualized, validated, and finalized the manuscript. Marsuki P. T. analyzed the data and editing of the manuscript. Julpatiri, A. I. and Muktadir, N. T. conceptualized and proofread the manuscript. Arsad L. H. coordinated and assisted in data gathering. Sarri, J. H. review and editing of the manuscript.

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