Article

Species composition, diversity, and distribution of marine macroalgae around Mapun Island, Tawi-Tawi, The Philippines

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Abstract

Seaweeds are found in mild temperate and tropical waters across the globe, where they thrive in a diverse array of habitats and are affixed to a variety of substrates, including rocks, sediment, and seagrass beds. The Philippines' periphery islands, situated in the expansive Sulu Sea basin, may contain a wealth of seaweed resources that have yet to be thoroughly explored and investigated with regard to their complete composition. For the first time, a macroalgae survey was carried out in five sampling areas located on Mapun Island, Tawi-Tawi. The research investigated the constitution of seaweeds and ascertained the diversity of species. A total of fifty-seven (57) macroalgae species were identified and organized into three main algal divisions: Chlorophyta, Rhodophyta, and Phaeophyta. Among these species, 27 were green algae, 18 were red algae, and 12 were brown algae. The green algae accounted for the most significant proportion of species diversity (47%), followed by the red algae (32%), and finally the brown algae (21%). The diversity index for Sikub is the highest among the five sampling areas, measuring 3.17. Based on species distribution, the Sorensen similarity index revealed that Sikub, Umus Mataha, and Duhul Bato have comparable Sorensen index values (37%). The results of this research would offer valuable insights for informing the development of more effective policies pertaining to the conservation of biodiversity and the management of resources.

Keywords diversity; distribution; Mapun Island; seaweeds; species composition.

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1 Introduction

The Philippines is home to an extensive inventory of 1,065 seaweed taxa, which presents a substantial opportunity to further our comprehension of these marine resources. The ongoing importance of this exhaustive dataset, which Lastimosa and Santiañez reported in 2020 and includes information on 193 brown seaweed taxa, 272 green seaweed taxa, and 600 red seaweed taxa, is highlighted. It is imperative to maintain consistent endeavors to provide up-to-date information regarding the biodiversity of seaweed in the nation. This is in recognition of the manifold advantages that may aid in the possible rejuvenation of the local economy, the resolution of food security issues, and the progression of sustainable development initiatives.

Seaweeds hold significant economic value in the Philippines, as they are deeply ingrained in the way of life and cultural customs, especially in the recently formed Bangsamoro region's island provinces of Basilan, Sulu, and Tawi-Tawi. Throughout history, coastal communities in these regions have heavily depended on seaweeds for a multitude of functions—from sustenance for humans and animals to utilization as verdant manure and medicinal substances. The evidence that does exist, however, is anecdotal. In contrast to Agngarayngay and Llaguno (2012) and Dumilag and Javier (2022), who have exhaustively documented the various uses of seaweeds in the Ilocos region in the north of the Philippines, the comprehensive documentation of seaweed applications in the island province of Tawi-Tawi remains incomplete. In order to completely comprehend the potential of these species for sustainable development and biodiversity, their taxonomic classifications have yet to be determined. The notable prevalence of seaweed utilization in the Ilocos region can be attributed to factors such as the challenging topography and limited agricultural land, which, to some degree, resemble the circumstances on the islands of Tawi-Tawi. Particular ethnic groups residing in Tawi-Tawi have cultivated unique cultural customs pertaining to seaweeds, as expounded upon by Dumilag in 2019. These practices necessitate additional elucidation through the inclusion of accurate taxonomic classifications of species that hold cultural significance.

In addition, Tawi-Tawi comprises a multitude of islands, including the comparatively uncharted Mapun Island in the southwestern Sulu Sea, and is among the most diminutive and secluded island provinces in the Bangsamoro analogous region of Muslim Mindanao. Acknowledging a substantial knowledge deficit regarding the variety of benthic marine phytoplankton inhabiting the island of Mapun, this research endeavors to fill that void. By establishing a correlation between observed environmental parameters and marine phytoplankton species, determining species composition and distribution, and quantifying species diversity, this study can fill in crucial knowledge gaps. Significant contributions to future biodiversity literature evaluations are anticipated from the results of this study, particularly in terms of a greater comprehension of macroalgae in the island provinces.

2 Study Area and Methodology

2.1 Study site

Mapun Island, located in the province of Tawi-Tawi, is a municipality comprised of fifteen barangays. It is situated in the southeastern region of the Sulu Sea, with the nearest landmass being Sabah, Malaysia. The study was conducted in five (5) selected intertidal areas around Mapun Island namely; Liyubud (6°58′27.62″N, 118°31′12.21″ E), Sikub (7°1′20.27″ N, 118°25′20.33″ E), Umus Mataha (7°2′4.82″ N, 118°27′47.58″ E), Duhul Bato (7°2′45.97″ N, 118°29′41.87″ E), and Guppah (7°1′15.26″ N, 118°31′29.18″ E) as shown in Fig. 1.

2.2 Data collection and preservation of seaweeds

2.2.1 The samples were gathered in accordance with the transect-quadrat method described by Handayani et al., 2023. Parallel to the shore, three replicates of a 50-meter transect line were positioned, with a 20-meter separation between transects. In order to conduct observations, a squared transect with dimensions of 1 m x 1 m was positioned 5 m away from the coastline. Following that, the square plot was set 10 meters away from the initial placement, and so on until it was 50 meters away. Every macroalga present within the quadrat was identified and documented.

2.2.2 To preserve the inherent hues of the collected samples, they were sealed in Ziplock® polyethylene bags or plastic vials containing a 4% solution of buffered formalin and seawater. The containers were then sealed in the dark (Tahil and Liao, 2019). Recently acquired herbarium specimens were photographed to illustrate their three-dimensional characteristics prior to preservation (Coppejans et al., 2010).

2.2.3 The research was executed twice between the third week of April and the last week of June 2023, during the period when macroalgae were exposed due to the transition from the arid (November-May) to rainy (June-October) seasons.

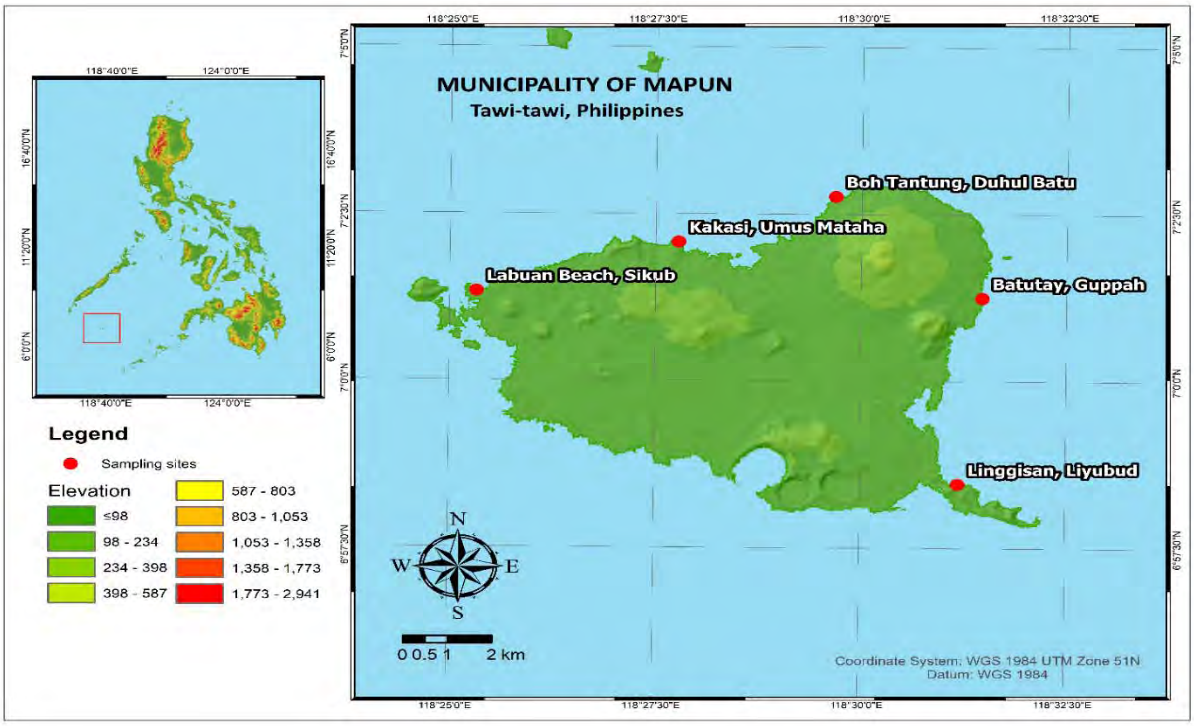

Fig. 1 Map of Mapun Island, Tawi-Tawi and the location of sampling sites.

2.3 Species identification

Specimens were identified with the aid of pictorial field guides and recent taxonomic references such as Hurtado-Ponce et al., 1992; Calumpong and Meñez, 1997; Trono, 1997; and other seaweed taxonomic references. The validity and synonymy of each name were verified by referring to AlgaeBase (Guiry and Guiry, 2022).

2.4 Physico-chemical parameters determination

In all sampling locations, environmental parameters, including water temperature, salinity, and water current, were measured. In situ, the measurements were documented. Salinity and water temperature were measured with a digital thermometer and salinometer, respectively. The water flow at each identified site was quantified utilizing the Clod Card method. The construction of clod cards followed the general guidelines outlined in Doty's 1971 manual.

2.5 Data analysis

2.5.1 The species diversity indices such as Shannon diversity (H'), Dominance (DI), Simpson richness (R), and Evenness (J') were calculated using the Paleontological Statistics Software Package for Education and Data Analysis (PAST) (version 4.03) (Hammer et al., 2001).
2.5.2 The relationship between environmental parameters and species composition were examined using Canonical Correspondence Analysis (CCA).
2.5.3 To compare the marine algal floristic composition among sampling areas, Sorensen Similarity Index alternatively referred to as the Czekanowski index (Ludwig and Reynolds, 1988; Clarke and Warwick, 1994; Krebs, 1999; Krebs, 2002; Bakus, 2007) was used. This index quantifies the degree of similarity between the vegetation in all sample units.

$$Ss = \frac{2a}{2a+b+c}$$

where S = Sorensen Similarity Index
A= number of the same species within sample units I and II
B= number of species found within sample unit I only
C= number of species found within sample unit II only

3 Results and Discussion

3.1 Species composition and distribution of seaweeds around Mapun Island

A total of 57 species of the three main algal divisions—Chlorophyta (green algae), Phaeophyta (brown algae), and Rhodophyta (red algae)—were identified during a survey of marine macroalgae collected from five sites along Mapun Island, Tawi-Tawi. Table 1 contains a distributional inventory of the species procured in the vicinity of the island.

Chlorophyta were represented by 27 species as shown in Fig. 2, the 32% species richness of Phaeophyta covers 12 species as shown in Fig. 3. Lastly, Rhodophyta (21%) consists of 18 species as presented in Fig. 4.

Table 1 Distribution of seaweeds species recorded around Mapun Island, Tawi-Tawi.

List of Species	**Mapun Site**				
Chlorophyceae	**LB**	**SB**	**UM**	**DB**	**GH**
Chaetomorpha spiralis Okamura		+			
Chaetomorpha philippinensis Leliaert				+	
Dictyosphaeria cavernosa (Forsskål) Børgesen	+	+	+		
Dictyosphaeria versluysii Weber Bosse	+				
Valonia ventricosa J. Agardh	+	+	+		+
Valonia aegagropila C. Agardh			+		
Caulerpa cupressoides (Vahl) C. Agardh			+	+	
Caulerpa racemosa (Forsskål) J. Agardh	+				
Caulerpa racemosa var laetevirens (Montagne) Weber Bosse	+	+	+	+	+
Caulerpa serrulata (Forsskål) J.Agardh	+	+			+

Caulerpa sertularioides (S. G. Gmelin) M. Howe	+	+		+	
Codium arabicum Kützing		+	+	+	
Codium edule P. C. Silva		+			
Codium geppiorum O. C. Schmidt		+	+		+
Avrainvillea erecta (Berkeley) A. Gepp & E. S. Gepp	+				
Avrainvillea obscura (C. Agardh) J.Agardh			+		
Halimeda borneensis W. R. Taylor	+		+		
Halimeda discoidea Decaisne	+	+			+
Halimeda macroloba Decaisne	+	+	+	+	+
Halimeda opuntia (Linnaeus) J. V. Lamouroux	+	+	+	+	+
Halimeda tuna (J. Ellis & Solander) J. V. Lamouroux		+	+		
Halimeda velasquezii W. R. Taylor		+	+	+	
Udotea orientalis A. Gepp & E. S. Gepp		+	+		
Bornetella oligospora Solms-Laubach	+	+	+	+	
Neomeris vanbosseae M. Howe	+				
Acetabularia dentata Solms-Laubach				+	
Acetabularia major G. Martens	+				
Phaeophyceae					
Dictyota bartayresii J. V. Lamouroux			+	+	
Dictyota ciliolata Sonder ex Kützing	+	+			
Canistrocarpus cervicornis (Kützing) De Paula & De Clerck	+	+	+	+	+
Padina australis	+	+	+	+	+
Padina minor	+	+	+	+	+
Colpomenia sinuosa (Mertens ex Roth) Derbès & Solier	+		+		
Hydroclathrus clathratus (C. Agardh) M. Howe	+		+	+	+
Hormophysa cuneiformis (J. F. Gmelin) P. C. Silva	+	+	+	+	+
Turbinaria conoides (J. Agardh) Kützing	+				
Turbinaria luzonensis W. R. Taylor	+				+

LB: Liyubud, SB: Sikub, UM: Umus Mataha, DB: Duhul Bato, GH: Guppah.

"+" presence of species.

Table 1 Distribution of seaweed species recorded around Mapun Island, Tawi-Tawi (cont.).

List of Species	Mapun Site				
Phaeophyceae	**LB**	**SB**	**UM**	**DB**	**GH**
Turbinaria ornata (Turner) J. Agardh					+
Sargassum polycystum C.Agardh	+	+	+	+	+
Rhodophyceae					
Zellera tawallina G. Martens			+		
Acanthophora spicifera (M. Vahl) Børgesen		+		+	
Amansia glomerata C. Agardh	+				
Laurencia nidifica C. Agardh		+			+
Palisada perforata (Bory) K. W. Nam				+	
Amphiroa fragilissima (Linnaeus) J. V. Lamouroux	+	+		+	+
Mastophora rosea (C. Agardh) Setchell	+	+	+	+	+
Hypnea musciformis (Wulfen) J. V. Lamouroux				+	+
Portieria hornemannii (Lyngbye) P. C. Silva	+			+	+
Kappaphycopsis cottonii (Weber Bosse) Dumilag & Zuccarello	+				
Hydropuntia edulis (S. G. Gmelin) Gurgel & *Fredericq*			+	+	
Halymenia durvillaei Bory		+			
Halymenia maculata J. Agardh		+			
Cryptonemia denticulata J. Agardh			+		
Actinotrichia fragilis (Forsskål) Børgesen		+	+	+	
Galaxaura rugosa (J. Ellis & Solander) J. V. Lamouroux	+				
Tricleocarpa cylindrica (J. Ellis & Solander) Huisman & Borowitzka	+	+	+	+	
Tricleocarpa fragilis (Linnaeus) Huisman & R. A. Townsend	+	+	+	+	

LB: Liyubud, SB: Sikub, UM: Umus Mataha, DB: Duhul Bato, GH: Guppah.

"+" presence of species.

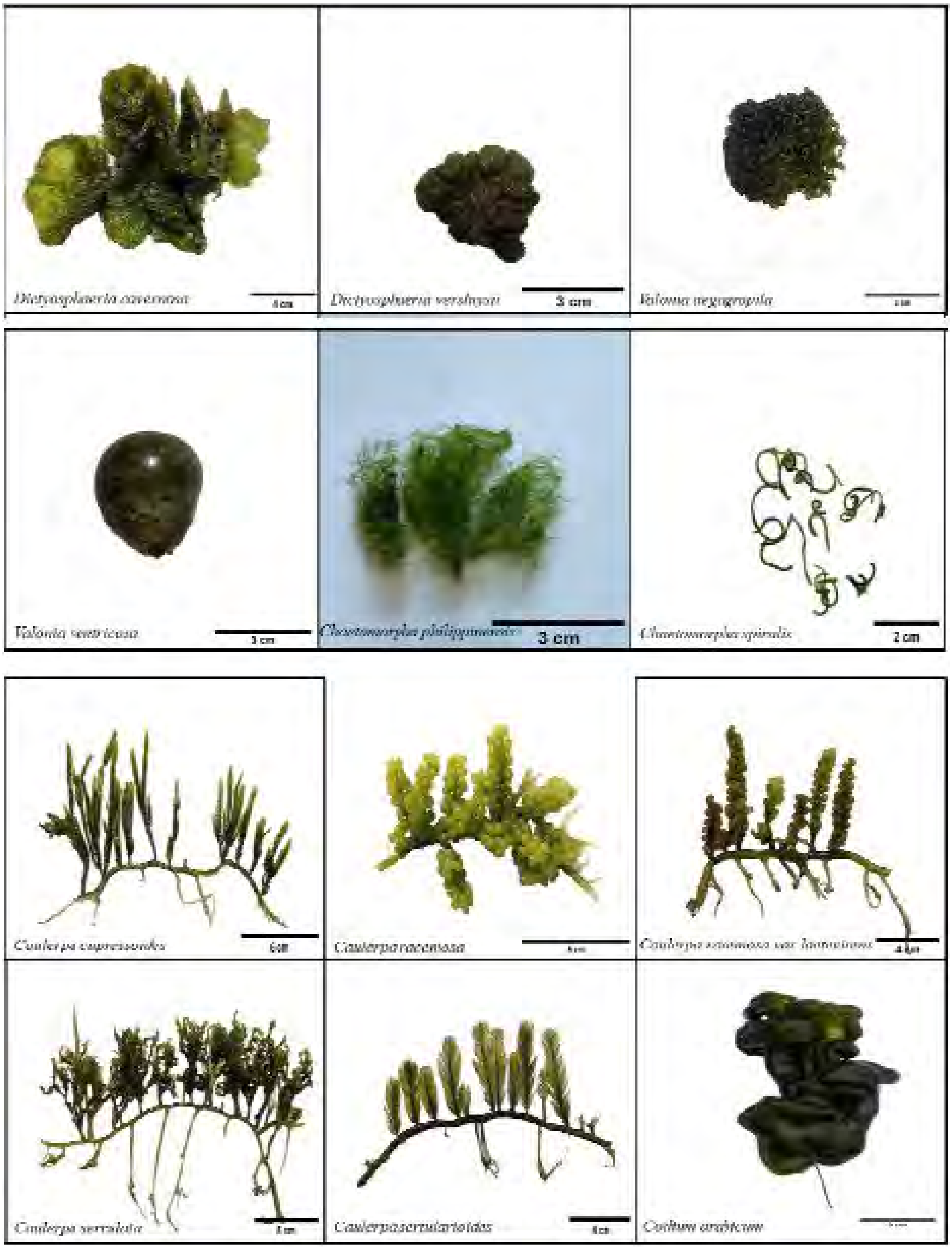

Fig. 2 Green seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 2 (cont.) Green seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 2 (cont.) Green seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 3 Brown seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 3 (cont.) Brown seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 4 Red seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

Fig. 4 (cont.) Red seaweeds collected in all sampling areas around Mapun Island, Tawi-Tawi.

This report represents the inaugural survey undertaken to comprehensively assess the marine macroalgal diversity in the vicinity of Mapun Island, Tawi-Tawi. With regard to species composition, green algae comprise the most significant proportion on the island, followed by red algae and brown algae in that order. It is noteworthy that nine species were identified at every sampling location on the island. *Halimeda macroloba*, *Caulerpa racemosa var laetevirens*, and *Halimeda opuntia* dominated the chlorophyta community. The Phaeophyta were predominately composed of *Canistrocarpus cervicornis* and *Padina* species, including *Padina australis* and *Padina minor*. Additionally, it was observed that masses of *Sargassum polycystum* and

Hormophysa cuneiformis were present in every sampling area. Undermining the red algae was a species of *Mastophora rosea*.

3.2 Species richness and diversity of macroalgae around Mapun Island

The taxonomic group with the greatest species diversity was green algae, comprising 47% of the total number of species. Notably, Sikub was where these algae made their greatest contribution, accounting for 53%. As depicted in Fig. 5, red algae ranked second (32%), contributing the most in Duhul Bato (37%), whereas brown algae ranked third (21%), contributing the most in Guppah (38%).

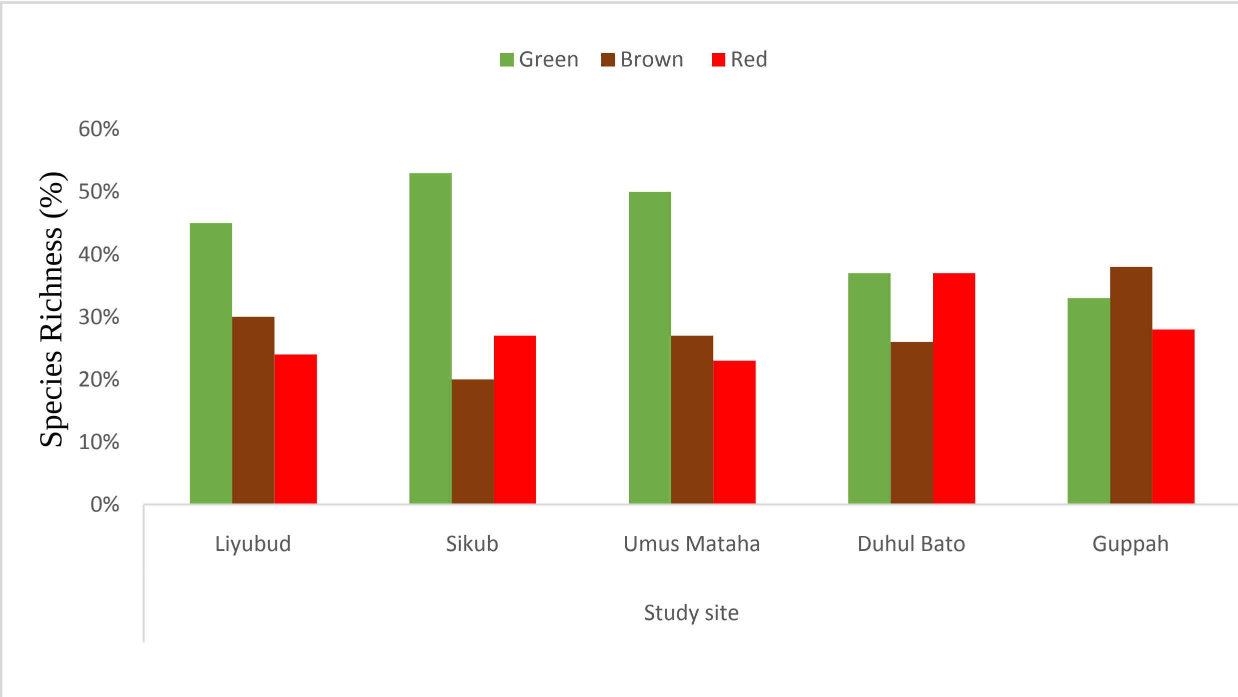

Fig. 5 The species richness of different algal groups in five (5) sampling areas of Mapun Island.

An essential metric for determining the diversity of organisms in an ecosystem is the diversity index. Two fundamental statistical techniques utilized by ecologists to quantify species diversity are Shannon-Wiener and Simpson's diversity indices (Omayio and Mzungu, 2019; Sharashy, 2022). The diversity indices of the sampling locations in the vicinity of Mapun Island are displayed in Table 2. According to the diversity scale (Fernando, 1998), the Shannon-Wiener (H') diversity index for the various sampling locations surrounding Mapun Island was high in Sikub and Liyubud. In contrast to Guppah, Umus Mataha and Duhul Bato exhibited a moderate level of diversity.

Table 2 Diversity profile of macroalgae in five (5) sampling sites of Mapun Island.

Diversity indices	Sampling area				
	Liyubud (LB)	Sikub (SB)	Umus Mataha (UM)	Duhul Bato (DB)	Guppah (GH)
Dominance index (DI)	0.06	0.05	0.08	0.09	0.11
Diversity index (H’)	3.02	3.17	2.78	2.66	2.45
Richness index (R)	5.69	5.86	4.60	4.20	3.53
Evenness index (J')	0.62	0.70	0.64	0.62	0.64

The island is home to a diverse array of habitats characterized by high light intensity, including tidal pools, intertidal flats, granite surfaces, and granular substratum. This may have influenced the island's high species richness of green algae. Green algae, in addition to its current distribution across subtidal substrates such as dead seagrass layers, sand, mud, and gravel (ranging in depth from 0 to 50 meters), possesses the capability of expanding its range along the littoral (Mushlihah et al., 2021). Furthermore, an increase in species diversity in the rugged intertidal habitat may be an adaptation to withstand extreme environmental conditions (Denny and Gaines, 2007). Beds of *S. polycystum* and clusters of *Padina* species, including *P. australis* and *P. minor*, were observed at every surveyed location on Mapun Island. *Sargassum*, a class of predominating elements, is prevalent along the margins of coral reefs and tropical rocky shores. They exhibit remarkable diversity in subtropical and tropical areas, with a particular emphasis on the Indo-West Pacific region (Chan et al., 2013; Guiry and Guiry, 2022; Yoshida, 1983). In addition to *Sargassum*, numerous species of the marine brown algal genus *Padina* inhabit the tropics. They are readily identifiable in the field, especially *P. australis*, which is frequently observed affixed to stony substrata in intertidal to shallow subtidal regions. Primarily found in tropical and subtropical waters, there are no documented occurrences of this species in temperate waters. The genus *Padina* of brown algae possesses unique characteristics and may be more resistant to the elements of most tropical regions (Trono and Ganzon-Fortes, 1988). Their ability to assimilate heavy metals from seawater is a distinguishing characteristic (Dulymamode et al., 2001), which could demonstrate their utility as ecological bioindicators. Red algae, specifically *Mastophora rosea*, were observed in every surveyed location due to their predilection for coral reefs, tide pools, and intertidal stony substrates (Karthick et al., 2015).

The Shannon-Wiener (H') diversity index, as determined by the diversity scale (Fernando, 1998), indicated that Sikub and Liyubud had the highest diversity index among the various sampling locations surrounding Mapun Island. In contrast to Guppah, Umus Mataha, and Duhul Bato they exhibited a moderate level of diversity (Table 2). Sikub shows a substantial degree of diversity, as evidenced by the maximum species richness (R) of thirty (30) in this sampling area. A high evenness index (J) was also observed in Sikub, suggesting that the macroalgae were distributed uniformly throughout the study site. Conversely, Duhul Bato and Liyubud exhibit diminished evenness, indicating an asymmetrical or skewed distribution of species. In addition, Guppah has the highest dominance index, suggesting that one or two species dominate the macroalgal community. *Padina* species was the predominant species in this location. Particularly prevalent in the Philippines is the species *Padina australis*, which is the most frequently encountered specimen (Modelo and Umezaki, 1984).

3.3 Environmental parameters among sampling sites in Mapun Island

Physico-chemical parameters of the area affect the diversity and distribution of seaweeds. The results of the water temperature, salinity, and water flow of the different sampling areas are provided in Table 3.

Table 3 Mean table of environmental parameters among sampling sites in Mapun Island.

Environmental Parameters	Sampling Area				
	Liyubud	Sikub	Umus Mataha	Duhul Bato	Guppah
Temperature (^{0}C)	29.03±2.74	29.71±1.31	29.64±1.34	29.70±2.08	29.90±2.69
Salinity (ppt)	26.56±0.91	27.01±1.22	27.69±0.97	26.45±1.10	27.13±0.09
Water flow (m/s)	0.31±0.03	0.09±0.17	0.24±0.03	0.28±0.04	0.24±0.05

An assessment was also conducted on the impact of environmental factors on the macroalgal assemblages in the vicinity of the sampling sites. Temperature regulates the metabolism and distribution of macroalgae significantly. Macroalgae and other marine organisms have adapted to survive and proliferate within a limited temperature range of 0–40°C (Nyabakken, 1992). Furthermore, it was determined that the ideal temperature range for the proliferation of macroalgae is between 28 and 30°C (Charan, 2017). The temperature fluctuations observed in the surveyed region adjacent to the waters of Mapun Island are consistent with the specified growth temperature range of 29.03-29.90°C. Due to the fact that the growth threshold for macroalgae is 34.50°C, an increase in water temperature may inhibit macroalgae development (Hutagalung, 1988; Mushlihah, 2021; Handayani, 2023).

The salinity of seawater is an additional environmental parameter that significantly influences the distribution, abundance, and proliferation of macroalgae. The results of seawater salinity measurements near Mapun Island range from 26.45 to 27.69 parts per million (ppt). Consequently, the surveyed regions surrounding the waters of Mapun Island meet the necessary conditions for macroalgae growth, and the optimal salinity range for macroalgae development is between 26 and 41 ppt (Duran et al., 2018).

In addition to water temperature and salinity, water velocity or current is a significant factor in nutrient transport and water agitation, both of which are critical for macroalgae growth (Ayhuan et al., 2017). The water flow or current measurements in the waters surrounding the surveyed areas of Mapun Island vary between 0.09 and 0.31 meters per second. Furthermore, according to Widyastuti (2008), the optimal current velocity range for macroalgae growth is between 0.10 and 0.50 meters per second. Therefore, the current measurement of the waters off Mapun Island satisfies the conditions that are conducive to macroalgae growth. The presence of current facilitates the development of macroalgae by preventing the accumulation of detritus and the attachment of epiphytes to the thallus, both of which are detrimental to macroalgae growth (Ayhuan et al., 2017).

3.4 Sorensen index between sampling sites around Mapun Island

The similarity index values as shown in table 4 between sampling sites, calculated using the Czekanowski index or Sorensen Similarity Index, which varied between 32% and 44%. The Sorensen similarity index (Clarke and Warwick, 1994; Krebs, 1999; Bakus, 2007) employs binary data (presence and absence) of a species within a sampling unit; its values range from 0 (indicating no similarity) to 1 (indicating the utmost similarity) (Table 4).

Table 4 Sorensen index between sampling sites around Mapun Island.

Sites	Liyubud	Sikub	Umus Mataha	Duhul Bato	Guppah
Guppah	0.361	0.438	0.320	0.385	
Duhul Bato	0.337	**0.374**	**0.374**		
Umus Mataha	0.326	0.388			
Sikub	0.380				
Liyubud					

The data presented in Table 4 indicates that Guppah and Umus Mataha exhibited the lowest similarity value of 32%. In contrast, Sikub and Guppah shared the maximum similarity index, measuring 44%. In general, the degree of similarity among the sampling sites surrounding Mapun Island is inadequate, as determined by

Krebs' (2002) criteria for the similarity of vegetation among sampling sites. High similarity is indicated by similarity values between 50 and 70%, whereas values below 50% denote poor similarity. However, this index does not compute species abundance and only utilizes binary data (presence or absence) of species. As a result, the actual ecological pattern within the data remains uninformed by this index (Balmer, 2002). Notably, sample areas situated between Duhul Bato-Sikub and Duhul Bato-Umus Mataha exhibit comparable Sorensen index values, both standing at 37%. The similarity coefficient observed among these three sampling areas can be attributed to their mixed sandy-rocky substratum at the base, which is consistent with observations made during field sampling. An additional factor contributing to the similarity coefficient among these three sampling areas is the presence of fifteen species of macroalgae in each of the aforementioned areas. *C. racemosa* var laetevirens, *C. arabicum*, *H. macroloba*, *H. opuntia*, *H. velasquezii*, *B. oligospora*, *C. cervicornis*, *P. australis*, *P. minor*, *H. cuneiformis*, *S. polycystum*, *M. rosea*, *A. fragilis*, *T. cylindrica*, and *T. fragilis* are among the 15 species found between these three sampling areas. This may represent an additional factor that contributes to the similarity coefficient among these three locations in conjunction with their underlying structure. Table 1 presents the distributional data pertaining to the 57 species of macroalgae that were gathered in the vicinity of Mapun Island, Tawi-Tawi.

3.5 Canonical Correspondence Analysis between the environmental parameters and species composition

Fig. 6 illustrates the CCA plot pertaining to the environmental parameters and macroalgae species. ter Braak and Verdonschot (1995) assert that in order to gain a more comprehensive understanding of the correlation between biological assemblages of species and their environments, Canonical Correspondence Analysis, a type of multivariate analysis, is employed. By utilizing this statistical instrument, synthetic environmental gradients are extracted from ecological data sets

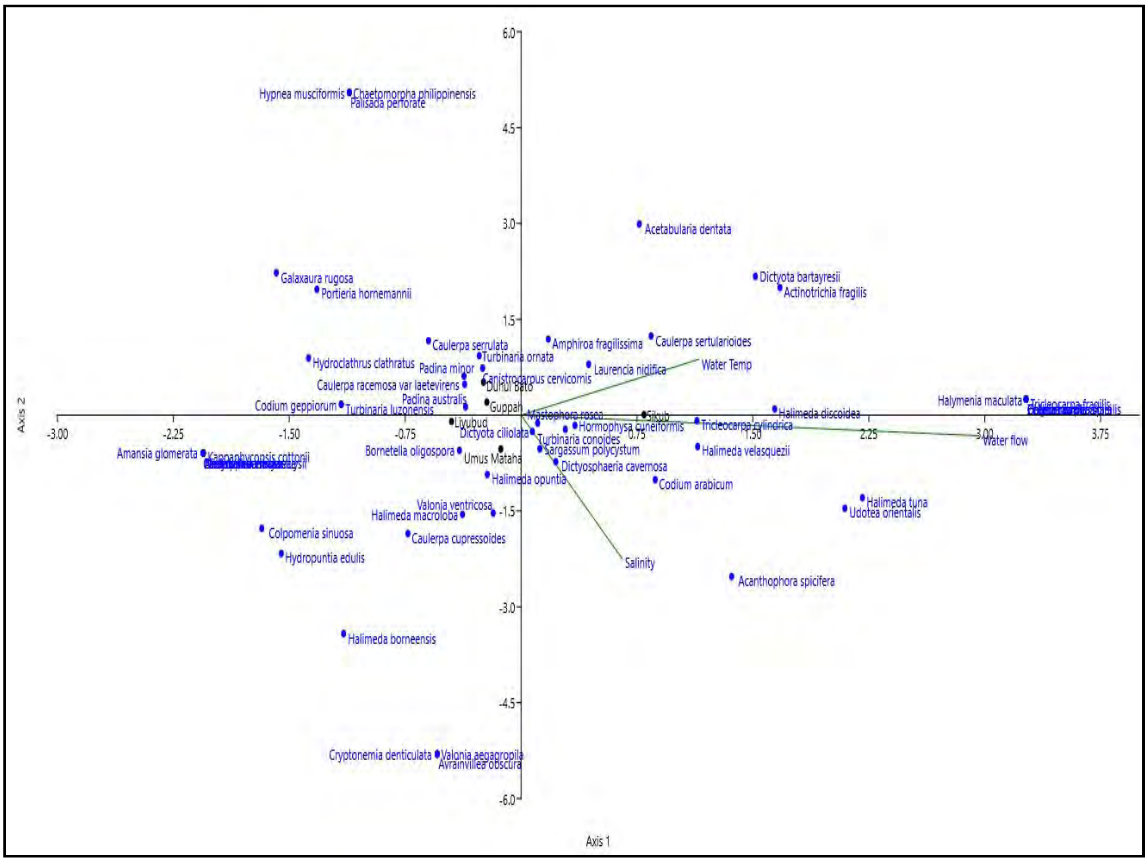

Fig. 6 A CCA plot showing the relationship of environmental parameters and species composition in the sampling sites.

Species including *M. rosea*, *T. conoides*, *S. polycystum*, and *D. cavernosa* exhibit a faint positive correlation with salinity and water velocity or current, as indicated by the CCA plot. Conversely, water temperature showed an unclear positive correlation exclusively with *M. rosea*. Furthermore, certain species of macroalgae have been observed to be associated with increased concentrations of these environmental factors: salinity, water velocity, and water temperature. *H. maculata, A. fragilis, T. fragilis, A. spicifera, H. tuna, D. bartayresii*, and *U. orientalis* are among these taxa. While the CCA findings indicate the presence of correlations, albeit feeble ones, certain macroalgae exhibit no discernible correlation with the environmental parameters. *H. clathratus, P. minor, P. australis, C. racemose var laetevirens, C. geppiorum, T. luzonensis, D. ciliolata, B. oligospora, H. opuntia, V. ventricosa, H.musciformis*, and *C. sinuosa* are among these species. The results obtained from the CCA provided further support for the claims put forth by Potts et al. (2020) and Nurhasballah et al. (2019), which stated that organisms and physicochemical parameters, including salinity and water temperature, have a substantial impact on the distribution and composition of species.

4 Conclusions

The identification and documentation of fifty-seven (57) species of marine macroalgae in the five sampling areas surrounding Mapun Island, Tawi-Tawi, constitutes a substantial accomplishment of this study. Chlorophyta has the greatest species diversity, comprising 47% of the total, according to the taxonomic distribution; Rhodophyta follows at 32%, and Phaeophyta at 21%. It is worth mentioning that the Shannon-Weiner Index reveals that Sikub and Liyubud harbour a heterogeneous macroalgal community, whereas Guppah exhibits a relatively restricted quantity of diversity.

The aforementioned discoveries provide an essential foundation for comprehending the present condition of the island's varied nature resources. The data provided is of the utmost importance in driving policy development and species conservation initiatives that seek to safeguard the distinctive marine ecosystem surrounding Mapun Island, Tawi-Tawi. These findings provide a myriad of information that is vital for biodiversity assessments of alternative food sources and the identification of basic materials essential for the revitalization of the local economy, within the broader context of local development planning. The implementation of such initiatives may potentially convert these seaweeds into enduring revenue streams, thereby fostering economic expansion and aiding in the reduction of destitution among the residents of the island.

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