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Macrobenthic Invertebrates in the Seagrass Bed of Matarinao Bay, Southeast Samar, Central Philippines

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Abstract

The area has been known as the major source of macrobenthic invertebrates in the southeastern most region of Eastern Samar. Gleaning has been the source of alternative livelihood for the locals. However, no regulation on the harvest of these resources is observed which could degrade its status. Survey was conducted using a 50 sqm belt transect method. The 7011 total samples were composed of 42 observed species distributed to echinoderms (81.46), sponges (11.27), mollusks (7.07), and arthropods (0.2) based on relative abundance. Species with higher economic value, *i.e.* mollusks and crustaceans were least abundant. Margalef index revealed species richness of 5.3, while Shannon diversity index was low (H' = 1.26). The low status of macrobenthic invertebrates in the area can be attributed to severe or moderate exploitation/harvest pressure or environmental pollution due to active gleaning activities coupled with non-existing regulations specifically on harvesting, zoning and resource management in general.

Keywords

Macrobenthic Invertebrates, Matarinao Bay, Species Diversity, Seagrass Bed

1. Introduction

Seagrasses provide several ecological services which support the macrobenthic invertebrates and fishes [1], and were observed to have higher biodiversity over mangrove habitats [2]. Seagrass beds can be found in Matarinao bay has an approximate area of 500 hectares seagrass bed, where little bear conch, *Strombus urceus*, locally known as "*busikad*" and other species with economic value are harvested, *i.e.* cowry, sea cucumber, and conch. In the same area, [3] reported a mean density of Strombus was 77 ind/m^2 over Borongan and Dolores, Eastern Samar. Species diversity is one of the indicators on the status of an ecosystem. A population of macrobenthic invertebrates could be over exploited [4] [5] for food and commercial trade for food ingredients and shellcraft; and change of seagrass habitats due to human impacts [6] [7], while other factors could be attributed to multiple factors, including sediment pattern, seagrass structure and temporal changes [8]; and particle size [9].

Gleaning of macrobenthic invertebrates support subsistence to fishing families [10] [11] hence harvest should be regulated for sustainable use. Seagrass density and catch-per-unit effort (CPUE) is significant and positively correlated with invertebrate gleaning, which highlights the importance of conserving these threatened habitats [12]. Though the area is one of the sites in the initial assessment of Strombus species [3], and despite being the fishing ground of four surrounding municipalities, the area has limited studies. Hence, information on the resources in the area should the studied for various purposes, specifically on resource management. The study was conducted to describe the species diversity of the macrobenthic invertebrates specifically on the species composition, abundance and status of diversity. However, the study was limited in the seagrasses of the intertidal area due to limited resources.

2. Materials and Methods

Matarinao Bay is along the geographical coordinates of 11.2˚N; 125.5˚E facing the Philippine Sea. It is enclosed with four municipalities Salcedo, Quinapondan, Hernani and General McArthur with a declared fish sanctuary at Diyo Island. The bay is margined with mangrove forest, seagrasses and other benthic communities. The intertidal area is covered with approximately 15 km^2 seagrasses (**Figure 1**) in a combination of patchy and continuous meadows with an average cover of 65%. A lot of mangrove reforestation projects have been implemented in the area to enhance the protection of the shoreline. Fish corrals fringes the water channel from the Philippine Sea, where hawksbill, sharks and rays are sometimes caught. The seagrass dependent products of this bay are dried siganids ("*danggit*"), deshelled Strombus species, *i.e.* spider conch ("*ganga*"), and little pitcher conch ("*busikad*"). Other, along with other products are of fresh Caulerpa ("*lato*"), fishes and other invertebrates.

An ocular survey was conducted after the courtesy protocol to establish the transect sites using the belt-transect method [14]. The study was conducted from February to August 2023. Data were collected in 12 transect points with not less than 100 m apart. Each 50 m belt-transect has an area of 100 sqm laid in seaward direction. All invertebrates found within the belt were identified and counted including the bivalve species which were spotted through their exhalant and inhalant siphons. Still photos of the fragile samples were taken on site, while others were collected for identification based on the morphological characters observed from the species with reference to the various on-line databases available [15] [16]

[17] [18]. Characters of echinoderms were based on presence or color of patches and patterns, bands, spines, tests, and other special features like secretion of red color when rubbed and ejection of the Cuvierian tubules in holothurians. Mollusks were identified based on bands/markings, shape of shells, and presence of riblets/grooves/notch/whorls/folds/tubercles; while texture, shape, color, size of the ostia for sponges; and carapace texture, markings, presence/number of teeth for the arthropods. An experienced gleaner was hired to guide in data collection specifically for the burrowing species. Species were classified and counts per species in each transect were pulled together to summarize the data of the whole area. Species diversity was described using the Shannon, Margalef; and Simpson diversity indices [19]-[21].

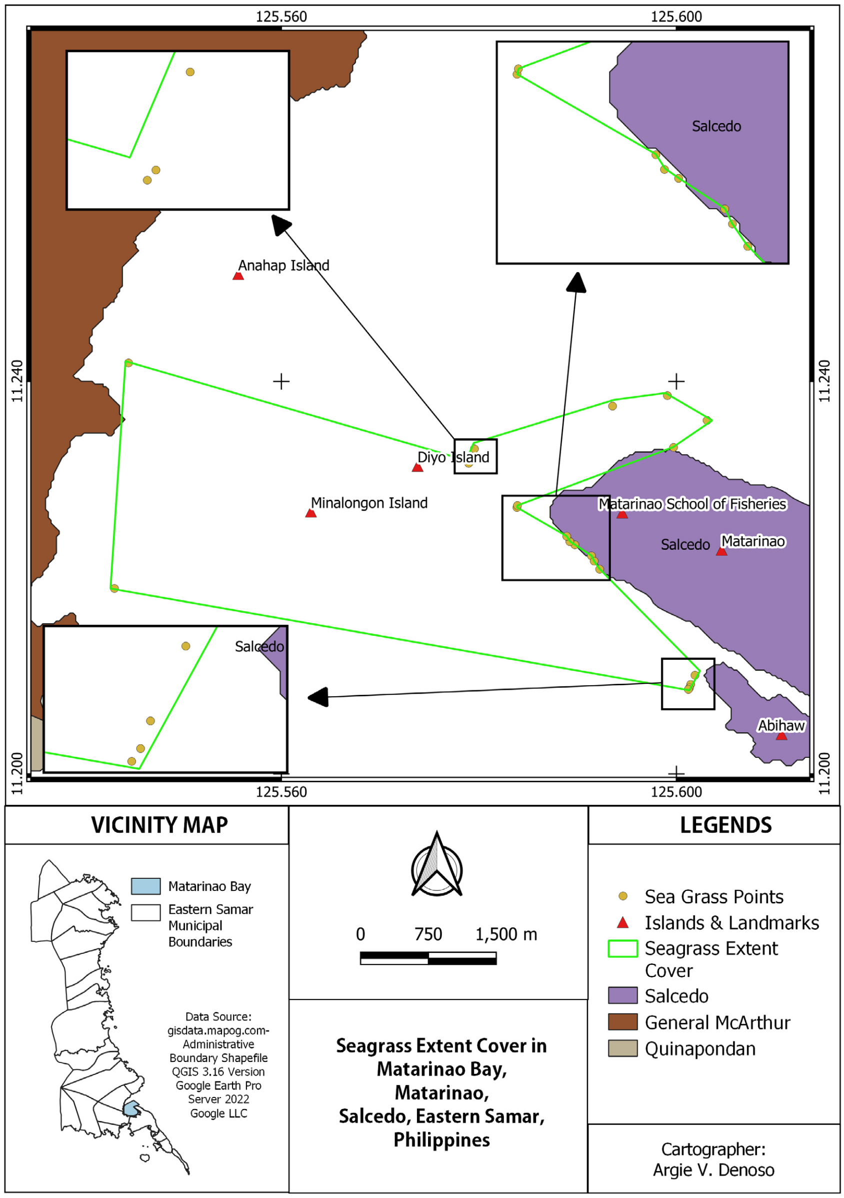

Figure 1. The seagrass area of Matarinao Bay [13].

3. Results and Discussion

The study recorded 42 species of macrobenthic invertebrates distributed to four taxonomic groups. Based on relative abundance, majority of the total population were echinoderms, while the least were the arthropods (Figure 2). Mollusks have the highest number of families and species despite having the second least population to arthropods which was composed of crustaceans (Figure 3).

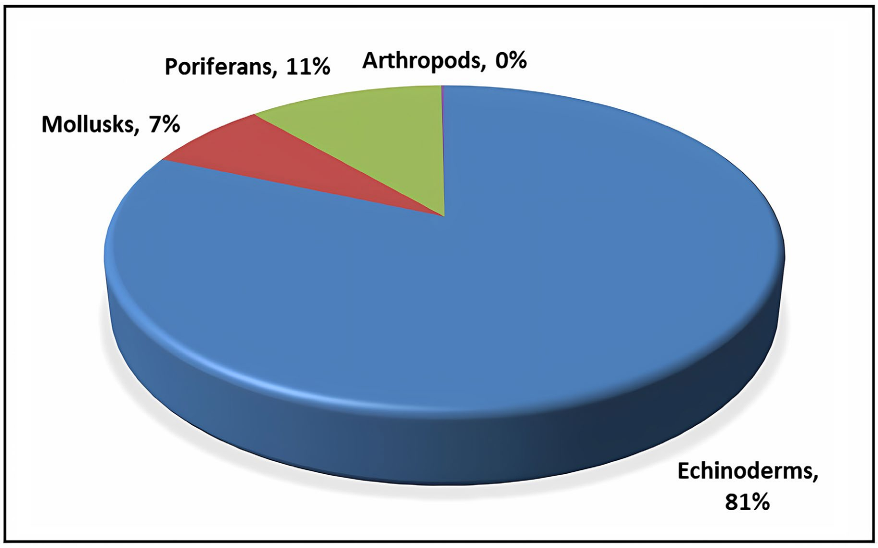

Figure 2. Distribution of macrobenthic invertebrates per taxonomic group based on relative abundance.

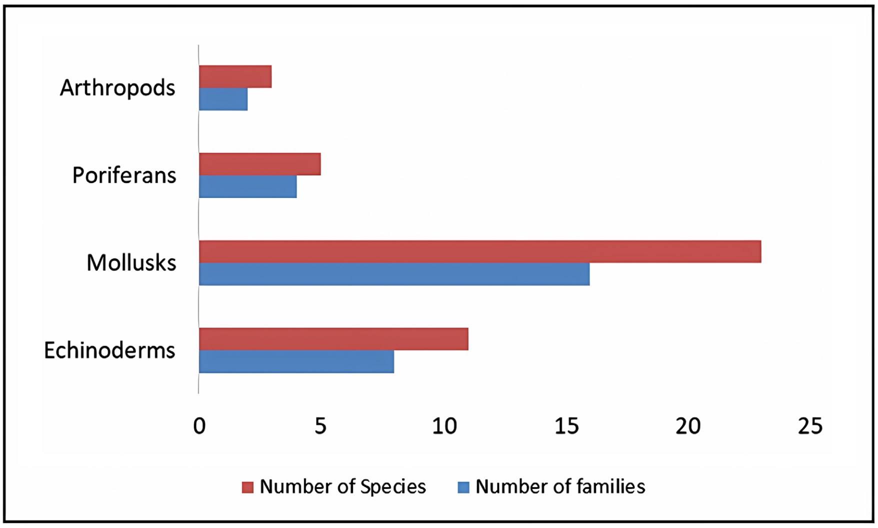

Figure 3. Distribution of observed macrobenthic invertebrates according to species and families.

Distribution of the representative taxonomic groups based on relative abundance revealed that Clypeasteridae (echinoderms), Strombidae (mollusks), Chalinidae (sponges), and Portunidae (arthropods) were the highest (Figure 4).

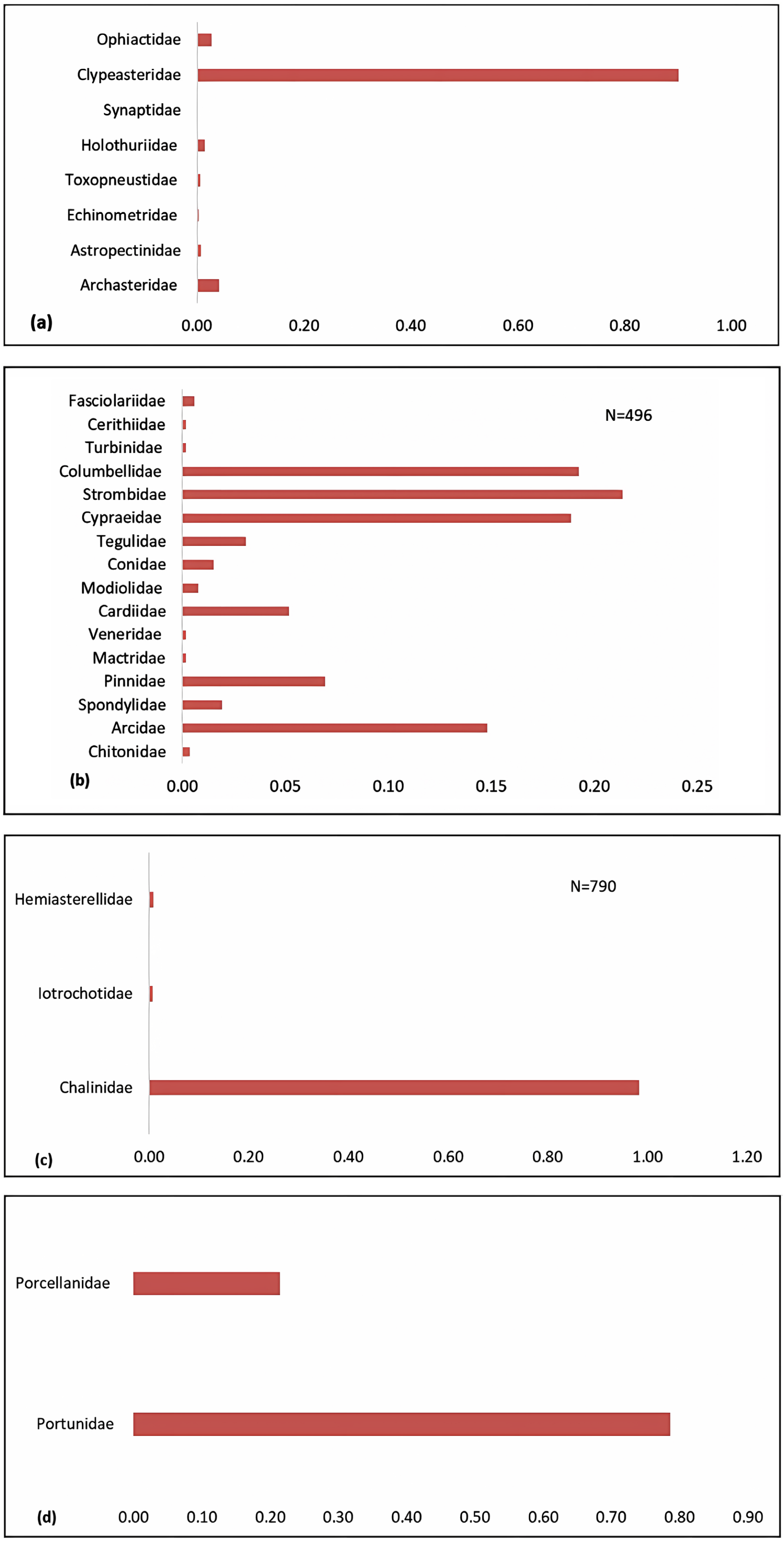

Figure 4. Relative abundance of representatives groups among echinoderms (a); mollusks (b); poriferans (c); and arthropods (d).

The high species richness of mollusks was attributed to the various niches provided by the seagrass bed with the various substrates, the canopy area [22], and food sources [1]. On the other hand, the highest relative abundance of echinoderms, specifically *C. humilis,* and the Poriferans can be attributed to its non-economic value, hence they are not harvested. The water depth and exposure to water currents along the water channel supports the requirement of poriferans and echinoderms. Moreover, sandy substrate favors the species to escape from predators by burying themselves during low tide, while rocky-sandy substrate provide attachment and crevices for sponges and mollusks. Gastropod favors sand, pebbles, rock and boulder substrate [23]. In addition, the submerged area is favorable for Strombus, Holothuria and Cyprea species. Strombus are known to be specialized grazers [24] and their preference within the seagrass bed is associated with their feeding, and intra-specific interactions among individuals, such as in the case of *Strombus canarium* [25].

Sand dollar *C. humilis* was the most abundant as revealed by Simpson index D = 0.73, which can be attributed to the sandy substrate and the weak water current in the leeward region of the site. While adhering to the ground, the weak current supports the planktotrophic larvae (echinopluteus) of the species for several months before sinking using their spines, to metamorphose into young individuals [26] [27].

The species diversity is low as revealed by the Shannon diversity indices (H' = 1.26; EHmax = 3.9). The status is far below than that in Pulau Indah, Klang, Malaysia [28]. However, in the Philippines, the status is higher than in Igang Bay, Guimaras, (H' = 0.608; 0.513) [29], but lower than in Bohol (H' = 1.68) with 19 taxa [14]. Though 42 species were observed, the species were unevenly distributed as revealed by species evenness of EH = 0.33. The species richness is 5.3 based on Margalef index (1958).

Results of the study revealed higher species composition of mollusks over other groups, similar to that in Penang, Malaysia [9] and in Misamis Occidental, Philippines [30]. However, the prevalence of gastropods among the mollusks were common observations among the studies. The low species diversity as revealed by the Margalef and Shannon indices qualitatively attributes to moderate pollution or exploitation. Less number of species and environmental degradation due to anthropogenic pressures has an impact on species diversity, besides other biotic factors [31]. Sedimentation could be brought by the run-off from adjacent sources, while overexploitation for various utilization could be the greatest factor [32] of low abundance [4] [5]. Gleaning for alternative livelihood was observed in the area, in addition to no regulatory measures implemented on the harvest and marketing of the resources. The structural benefits of seagrass have less importance than their biological contributions for supporting macrofaunal biodiversity [33], where the natural occurrence of drifting algae trapped in the aboveground complexity of the seagrass meadows benefits seagrass macrofauna [34]. This theory supports the macrofaunal abundance in stations with dense seagrasses, while, biodiversity loss due to environmental changes, yield less productive seagrass ecosystems [35]. However, taxonomic diversity alone cannot be predicted from species loss for ecosystem functioning [36]. Disturbance of the seagrass by boat dragging, mangrove planting withing the seagrass bed, and sedimentation caused by wharf construction and reclamation structures which prevents the natural flow of the water current.

4. Conclusions and Recommendations

The seagrass bed supports a wide range of macrobenthic invertebrates. However, based on relative abundance and species diversity, exploitation is high. Anthropogenic disturbances and less recognition of seagrass ecological contribution further promote low productivity.

Based on the results, conservation efforts on the coastal habitat should be taken into consideration by the local planners specifically on the seagrasses to enhance macrbenthic communities to provide several ecosystem benefits. Gleaning regulations, zoning and coastal restoration are only few of the measures that could be considered.

Acknowledgements

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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