Macrobenthic Composition of Sea Water Associated with Seagrass in East and West Portions of the Igang Bay, Nueva Valencia, Guimaras

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Abstract - The study investigates the macrofauna composition associated with seagrass communities in west and east portions of Igang Bay Nueva Valencia, Guimaras. The study aims to determine the faunal composition of the macrobenthos in east and west Igang Bay seagrass communities and the physical factors like the substrate type, temperature, salinity, and water depth. The study found that West Igang had a relatively higher diversity index (0.608) than East Igang (0.513), while the index of similarity between the two sites was relatively high (0.667). The physico-chemical parameters were observed to be variable between the two sites, with higher salinity recorded in West Igang and variable temperatures. The type of substrates was relatively similar between sites, with occasional rocky bottoms in West Igang. The study highlights the importance of monitoring and understanding the macrofauna composition associated with seagrass communities as an indicator of the environmental health of marine ecosystems.

Keywords - Benthic communities, macrobenthos, seagrass communities, physico-chemical parameters, diversity index, similarity index, marine ecosystems.

INTRODUCTION

Macrofauna or macrobenthos are the largest benthic animals associated with the marine water bottom sediment. Benthic animals are classified into three ecological categorie, viz., infauna and epifauna, based on where they thrive relative to the substrate. The infauna are those that live wholly or partly within the substrate which includes many clams and worms polychaetes as well as other invertebrates which usually dominate communities in soft substrates and are most diverse and abundant in subtidal regions. Few are found in hard substrate communities with rock-boring clams being one example. The epifauna are those animals living on or attached to the seafloor which encompass about 80% of the larger zoobenthos. Epifauna include corals, barnacles, mussels, many starfish and sponges. These animals are present on all substrate types but are particularly richly developed on hard substrates and are most abundant and diverse in rocky intertidal areas and coral reefs. A third category include animals hat live in association with the seafloor but also swim temporarily above it and include prawns and crabs and flatfish such as sole (Parsons and Lally, 1997).

The macrobenthic composition of a particular area traditionally gives baseline information along with valuable insights on the interaction between the biotic and abiotic components of a benthic community. As concerns on the consequences of effluent discharges heighten, the benths are now looked upon as probable indicators of environmental changes (Rees et. al. 1991).

The balanced ecological conditions with a diverse flora and fauna characterize a pristine environment. In such an environment of stable condition, conservative species are traditionally regarded as the competitive dominant and are usually the first ones affected by perturbation. Benthic community assemblages are composed of organisms with diverse functional groups defined by feeding types, mobility and method of food capture, reproductive modes, life history patterns and physiological adaptations to environmental conditions (Kennish, 1994). This diversity along with limited mobility, close association with the sediment substrate and ease of quantitative sampling all good indicators of healthy habitat to benthic organisms.

Information from macrobenthic studies, i.e., shifts in population and community parameters has a history of use in monitoring programs (Kemp et. al., 2005), assessment of water quality (Che and Morton, 1991) and pollution effects (Grizzle and Penniman, 1991 provide baseline information on impacts of human associated activities such as fishing activities (Thrush and Dayton, 2002), dumping of sewage sludge (Lopez Gappa et al., 1990 and recovery after cessation of dumping (Moore and Rodger, 1991).

Studies on benthos in the Philippines are expanding in scope, these studies focus on associated fish and/or characteristics of certain islands or reefs (Estacion et al., 1993) to taxonomy (Palpal-Latoc 1996), community assemblages (Mequila et al., 2004) and oil spill impacts.

The present study aims to investigate the macrofauna composition associated with seagrass communities in west and east portions of Igang Bay Nueva Valencia, Guimaras. A monitoring study of the seagrass communities in the said sites started on April 2008 and is still ongoing until April 2010. However, a faunal composition associated on east and west Igang Bay seagrass communities has never been conducted. This study will provide insights on the habitat health of the seagrass communities in Igang Bay. Specifically, the determination of faunal composition of the macrobenthos in east and west Igang Bay seagrass communities and the physical factors like the substrate type, temperature, salinity, and water depth will be addressed.

FRAMEWORK

Benthic fauna in the world conatin cosmopolitan genera and species which occupy similar ecological niches. Their distribution is affected by various physical factors. No single variable is controlling, rather influence can be heightened or lessened depending on their combination (Maurer et al., 1978). It has been shown that the substratum is a significant factor influencing benthic diversity (Li and Gao, 1989). At the Berg River estuary, distribution and seasonal abundance of invertebrate macrofauna was closely tied to sediment characteristics and vegetation cover (Kalejta and Hockey, 1991). The benthos of gastropod group at the Berg River estuary were restricted to certain sediment types favouring a coarse sediment. Salinity can be factor in determining the distribution of benthic organism. Freshwater, marine and estuarine benthos all play similar ecological function, but the composition can be quite different (Coumo and Zinn 1997). As a response of stenohaline species to reduce salinity, a reduction in the number of marine macrofauna toward the estuaries can be expected. Gage, 1972 in Maurer et al., 1978 concluded that salinity was more influential in controlling the distribution of brackish macrofauna than sediment type in shallow water but at greater depths, the reverse was true.

Waves are the main reason for water movement (Levinton, 2001), especially in the intertidal area of the sea. Its effect can reach up to a maximum depth of 10-20 meters wherein sand is moved. These vertical disturbances to the water surface can cause resuspension of the fine-grained sediments, extend the intertidal zone and influence mixing of atmospheric gases and penetration of light (Li and Gao, 1989 (. In shallow, enclosed inlets, the tides play role in the periodic movement of water. The dynamic physical environment is rarely considered in relation to faunal community despite the role played by tidal currents in influencing the nature of the bottom substrate. Warwick and Uncles, 1980 in their work on the Birstol Cahnnel, were able to directly correlate faunal type and tidal stress. Frascari et al., (2002) attributed the dominance of mollusks and a polychaete in the shallow areas of the Fattibelo Lagoon to continue oxygenation of tidal currents and wave motion. Such findings are relevant to initial understanding of physical control of community structure and function. Biotic predations, such as predation and competition can also play a role in controlling community structure.

It has been reported that in eutrophical site, predation is not major controlling factor of community structure. However, in non-eutrophicated site, it could be an important factor controlling abundance at least of some faunal components. Berge and Valderhaug (1983) studied the effect of epibenthic macropredators in a low-energy subtidal eutrophicated habitat of the Oslofjord, in an attempt to verify and elucidate previous findngs and concluded that macropredators are not important in determining community structure in sediments, exerting a small controlling effect on the densities of the macrofauna. Their conclusion was contrary to findings of Alongi and Christofferson

(1992) who concluded that epibenthic predation, along with several other factors such as low food availability, periodic disturbance by tidal effects, etc. to be one of the major regulators in the distribution, abundance and structure of benthic infaunal assemblages in the Great Barrier Reef.

METHODOLOGY

The study was conducted in the seagrass communities of east and west Igang Bay where the monitoring study is conducted. Three 50-meter transects with a distance of 50 meters from each transect were laid in each site. From each transect, 3 points at 5, 25 and 45 were sampled by placing 1 m x 1 m quadrat in each point. The macrobenthic animals found inside the quadrat was recorded and the numbers were counted. The physico-chemical parameters were noted such as the temperature at each point at the mid-water depth. Water samples were taken for salinity and substrate types were characterized and noted. The degree of vegetation was described and recorded.

The macrobenthic animals present in every quadrat were identified and recorded according to their groups (i.e., bivalves, corals, gastropods, starfish, sea urchin, sea cucumbers, crabs, shrimps, sponges). The relative abundance, frequency, dominance and important values of every group of macrobenthos and the indices of diversity and similarity of macrobenthos of one site to the other were determined using the following formulas (Odum, 1971):

Relative density = number of individual organism per group x 100
Total sampled area (9 square meter)

Relative frequency = number of occurrence of each group x 100
Total number of occurrences of all groups

Relative Dominance = number of individual organism per group x 100
Total number of all individuals

Importance Value = Relative density + Relative frequency + relative dominance

Index of diversity (Shannon index of general diversity H') = - ∑ (ni/N) log (ni/N)

Where: ni = importance value for each group

N = total of importance values

Index of similarity (S) = 2C / A + B

Where: A = number of groups in east Igang

B = number of groups in west Igang

C = number of groups common to both sites

RESULTS AND DISCUSSION

Eight groups of macrobenthos were found to occur in the seagrass community of West Igang which include the hard coral, gastropods, bivalves, soft coral, starfish, limpet, hermit crab and cowrie (Table 1) while only seven groups were recorded in East Igang that include the bivalves, gastropods, snail, cowrie, hard coral, hermit crab and sponge (Table 2). Common to both sites were bivalves, gastropods, hard coral, hermit crab and cowrie while soft coral, starfish and kimpet were observed in West Igang and but not found in East Igang. On the other hand, snail and sponge were not sampled in West Igang Igang which were not observed in West Igang (Table 4).

Table 1. Macrobenthic components found associated with seagrass community in West Igang, Villa Igang, Nueva Valencia, Guimaras

Groups	Rel. Density	Rel. Frequency	Rel. Dominance	Importance Values
hard coral	31.85	29.67	31.84	93.369
gastropod	36.96	21.34	36.94	95.241
bivalve	24.53	24.37	24.52	73.419
soft coral	2.40	7.20	2.40	11.995
starfish	1.89	7.20	1.89	10.985
limpet	0.51	3.03	0.51	4.040
hermit crab	0.51	3.03	0.51	4.040
cowrie	1.39	4.17	1.39	6.944

Among groups in West Igang, the gastropods were found to be most abundant and dominant with a relative density of 36.96% and relative dominance of 36.94% while hard coral was most frequent to occur in sampled points with relative frequency of 29.67%. Least abundant, frequent and dominant groups were exhibited by the limpet and hermit crab with values of 0.51%, 3.03% and 0.51%, respectively. Most important group observed was the gastropod with importance value of 95.241 while limpet and hermit crab with 4.040 were least important groups in West Igang)Table 1).

In East Igang, the bivalve was found to be the most abundant group with 55.28% while most frequent and dominant group was gastropod with values of 40.00% and 40.39%, respectively. Sponge was found to be the least important group observed in East Igang with a value of 4.046 while the gastropod was the most important group of all with value of 106.997 (Table 2).

Table 2. Macrobenthic components found associated with seagrass community in East Igang Bay, Villa Igang, Nueva Valencia, Guimaras

Groups	**Rel. Density**	**Rel. Frequency**	**Rel. Dominance**	**Importance Values**
bivalve	55.28	24.44	36.03	99.402
gastropod	21.13	40.00	40.39	106.997
snail	2.90	8.89	2.90	18.335
cowrie	4.94	8.15	4.94	19.845
hard coral	7.04	8.89	7.04	26.610
hermit crab	7.96	8.89	7.96	24.758
sponge	0.74	0.74	0.74	4.046

Comparing the indices of sites, West Igang was found to be relatively more diverse in terms of macrobenthic organisms associated with seagrass community with an index of 0.608 than East Igang with 0.513 (Table 3, Figure 1). Index of similarity of these macrobenthos between the two sites is relatively high with a value of 0.667 (Table 3).

Table 3. Indices of diversity and similarity of macrobenthic components associated with seagrass communities in West and East Igang Bay, Villa Igang, Nueva Valencia, Guimaras

Indices	**West Igang**	**East Igang**
Diversity Index)H')	0.608	0.513
Similarity Index (S)	0.667	

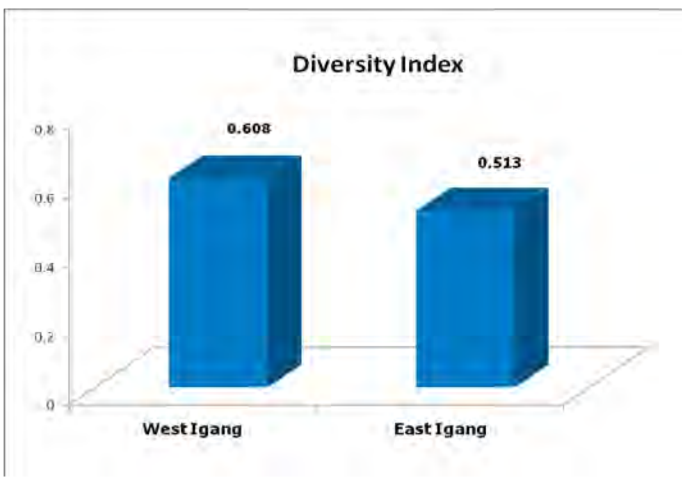

Figure 1. Index of diversity of macrobenthos associated with seagrass communities in West and East Igang Bay, Villa Igang, Nueva Valencia, Guimaras

Table 4. Groups of macrobenthos associated with seagrass communities in West and East Igang Bay, Villa Igang, Nueva Valencia, Guimaras

groups	West Igang	East Igang
hard coral		
gastropod		

bivalve		
soft coral		
starfish		
limpet		
hermit crab		
cowrie		
sponge		
snail		

The physico-chemical parameters were observed to be variable between two sites especially in temperatures. However, higher salinity was recorded in West Igang. Type of substrates was relatively similar between sites with occurrence of occasional rocky bottom in West Igang (Table 5).

Table 5. Physico-chemical parameters recorded in West and East Igang Bay, Villa Igang, Nueva Valencia, Guimaras

Physico-chemical factors	West Igang	East Igang
Temperature (^oC)		
Surface	30.67	32.67
Bottom	31.00	30.83
Salinity (ppt.)	30.00	28.67
water depth (m)	0.43	0.60
substrate	rocky, sandy, silty-muddy in transect 1	sandy, silty-muddy

Some of the macrobenthos observed in West Igang but were not included in the sampled points were the sea cucumbers, sea urchins, sand dollar, sponges and snail. starfish, brittle stars, sea urchins, sea cucumbers and soft corals were observed in East Igang on the other hand (Figure 2A-M). degree of vegetation was relatively high in both sites. Starfish was observed to be relatively more abundant outside the sampled points in West Igang than East Igang. The same observation was inherent in sponges, soft and hard corals.

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