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Soft-Bottom Macrofauna of Four River Mouths in Roxas, Palawan

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ABSTRACT

Surveys were carried out in four river mouths along the coastal area of Green Island Bay in October 2004, March, June and September 2005. Two replicate samples were obtained by using 0.028 m^2 modified Petersen grab and were washed through a sieve of 0.5 mm mesh. Benthic animals collected were classified into major taxa. The density ranged from 50 to 3178 individuals/m^2 for the whole sampling stations. The densest station was recorded in Caramay River mouth and the least in Magara/Rizal River mouth. Benthic macrofauna were most abundant in October 2004 and least in June 2005. Polychaetes were the densest, widely distributed and the most consistent organisms during the entire period of investigation. Crustaceans show seasonal abundance in Caramay in October 2004 and absent in Magara/Rizal for the entire period. Gastropods comprised the most abundant taxa in Tinitian, Roxas.

Keywords: benthic macrofauna, crustaceans, gastropods, polychaetes, Palawan

INTRODUCTION

Organisms in soft-bottom environments are diverse and play an important role as support systems for the aquatic environment. These organisms serve as food source for many demersal animals like fishes and crabs. The abundance and large biomass of the benthic fauna suggest overall aquatic fertility (Aswandy *et al.* 1991). Benthic organisms are also useful indicators of environmental conditions (Wass 1967, Reish 1972). These organisms are known accumulators of suspended or deposited particles; they are likewise supposed to play a crucial role in the transfer and storage of pollutants in the food chain.

Despite the grave threats, only a few studies have been made on soft-bottom communities and their importance to the coastal ecosystem in the Philippines (Yap *et al.* 1991, Estacion and Oñate 1991, Villoso and Palpal-latoc 1996, Palpal-latoc 2005).

A comprehensive assessment or evaluation of benthic communities must be initiated to monitor perturbations. This generally follows a sampling design that will determine the composition, abundance, and the spatio-temporal variability of soft-bottom macrobenthos. For Green Island Bay, basic knowledge of the characteristics of the bottom communities will be helpful in identifying the food source available to demersal fisheries in the Bay, which may help in the formulation of a more rationale management strategy to ensure the conservation of aquatic communities in general. The present assessment aims to provide initial data on four river mouths in Roxas, Palawan, which in future, may be compared with subsequent assessment. More specifically, it seeks to determine the density of benthic macrofauna in the area. The four river mouths form an integral part of the estuarine ecosystem in Green Island Bay.

METHODOLOGY

The four rivers- Tinitian, Caramay, Magara/Rizal, and Barbacan are located along the coastal area of Roxas, Palawan, which all drain to the Green Island Bay (Fig. 1). Their coordinates and average depths are presented in Table 1. One sampling station was established in each river mouth and marked using a Garmin e-trex global positioning system (GPS). Field samplings were carried out in October 2004, March, June and September 2005. Two replicate samples were collected using a modified Petersen grab (bottom area= $0.028 m^2$) from each station. On board the boat samples were each washed through a sieve of 0.5 mm mesh. All the materials retained on the sieve were transferred to a labeled bottle and preserved with10% formalin stained with Rose Bengal. A small amount of bottom sediment from one grab at each station in October 2004 and March 2005 was set aside for grain size analysis. In the laboratory, samples were washed with tap water and the animals were sorted out with the use of dissecting and stereoscopic microscopes. Benthic macrofauna were classified into major taxonomic groups, i.e., Polychaeta, Bivalvia, Gastropoda, Crustacea, and Miscellaneous group (Echinodermata and Foraminifera), and then counted, to determine their density. Density was expressed in terms of number of individuals/m^2.

Density was computed as follows:

$$D = N/A$$

where: D=the density
N = number of individuals
A = sampled area

The sediment samples used for grain-size analysis (based on Wentworth's size classification) were sun-dried and homogenized. These were passed through a series of sieves (with mesh sizes of 2.0, 1.0, 0.5, 0.25, 0.125, and 0.063 mm) with the aid of a sieve shaker. Size fraction determination was done by weighing the amount of sediment retained in each sieve to the nearest hundredth of a gram.

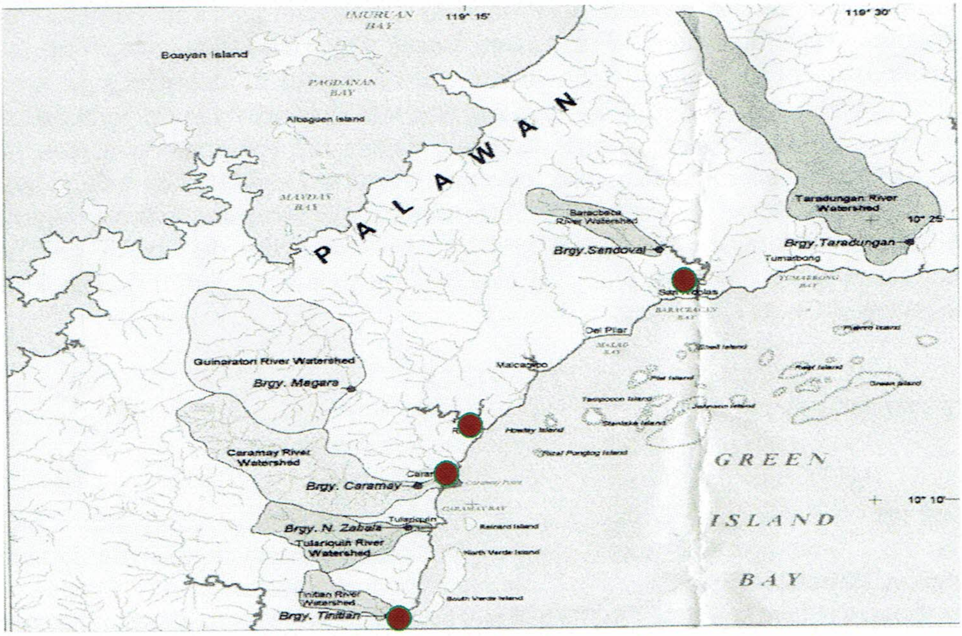

Figure 1. The four sampling stations (dots) in the river mouths that drain to the bay.

Table 1. The coordinates and average depths of four river mouths.

Rivers	Coordinates		Average depth (m)
	Latitude (N)	Longitude (E)	
Tinitian	10 ° 03.777'	119° 12.327'	0.7
Caramay	10 ° 10.843'	119 ° 14.003'	3.0
Magara/Rizal	10 ° 13.897'	119 ° 15.619'	3.2
Barbacan	10 ° 20.740'	119 ° 23.682'	3.8

RESULTS AND DISCUSSION

Composition and Occurrence of Samples

The composition of major taxa varies temporally and spatially. In Tinitian, four major taxa- gastropods, bivalves, polychaetes and crustaceans were present in March 2005, and included miscellaneous group (echinoderms and foraminiferans). In Caramay, similar major taxa were present in October 2004 and September 2005 and miscellaneous group was present in March 2005. In Magara/Rizal, only gastropods, bivalves and polychaetes were observed in October 2004. In Barbacan, similar taxa as in Caramay in October 2004 and September 2005 were present in October 2004 (Table 2). Estacion and Oñate (1991) reported two more major taxa

(Scaphopoda and Nematoda) in addition to the present study. They used 0.02 m^2 Ponar grab and sieves of 5, 3, 2, 1 and 0.5 mm mesh. Yap *et al.* (1991) obtained very similar result, however echinoderm was classified as a major taxon. A bigger Ekman grab of 15.2 m^2 and sieves of 5, 3, 2, 0.85 and 0.30 mm were used in data collection. A very similar method used in Southern Palawan reported 12 major groups of animals (Palpal-latoc 2005). Palpal-latoc (2005) used 0.0225 m^2 Ekman grab and 0.5 mm mesh sieve. The difference in composition of organisms maybe related to bio-physical condition of the area. Palpal-latoc (2005) collected samples from the bay which is calm and sheltered against strong waves. On the other hand, river mouth is more dynamic than bay. It is strongly influenced by outgoing flood during rainy season and by the incoming daily high tide.

Table 2. Composition and occurrence of organisms in four river mouths for the whole duration of study (√ - present, blank – absent).

Rivers	Period	Gastropoda	Bivalvia	Polychaeta	Crustacea	Misc.
Tinitian	Oct-04	√	√	√		√
	Mar-05	√	√	√		√
	Jun-05	√	√	√	√	√
	Sep-05	√		√	√	
Caramay	Oct-04	√	√	√	√	
	Mar-05		√	√		√
	Jun-05	√	√	√		
	Sep-05	√	√	√	√	
Magara/Rizal	Oct-04	√	√	√		
	Mar-05		√	√		
	Jun-05		√	√		
	Sep-05			√		
Barbacan	Oct-04	√	√	√		
	Mar-05	√	√	√	√	
	Jun-05		√	√		
	Sep-05	√	√	√	√	

Figure 2 presents the percentage composition of major taxa in four sampling sites. In Tinitian, gastropods were the most numerous group, followed by miscellaneous group dominated by foraminiferans, then closely followed by polychaetes. In Caramay, polychaetes comprised more than half of the total organisms followed by crustaceans. In Magara/Rizal, polychaetes were the numerous group, then gastropods. A similar order was recorded in Barbacan with polychaetes as the most numerous followed by gastropods. In general, polychaetes emerged as the most numerous organisms in the estuarine area of Green Island Bay. The wide distribution of polychaetes could suggest their high adaptability to marine environmental conditions, which enable them to be present in all sampling stations (Palpal-latoc 2005).

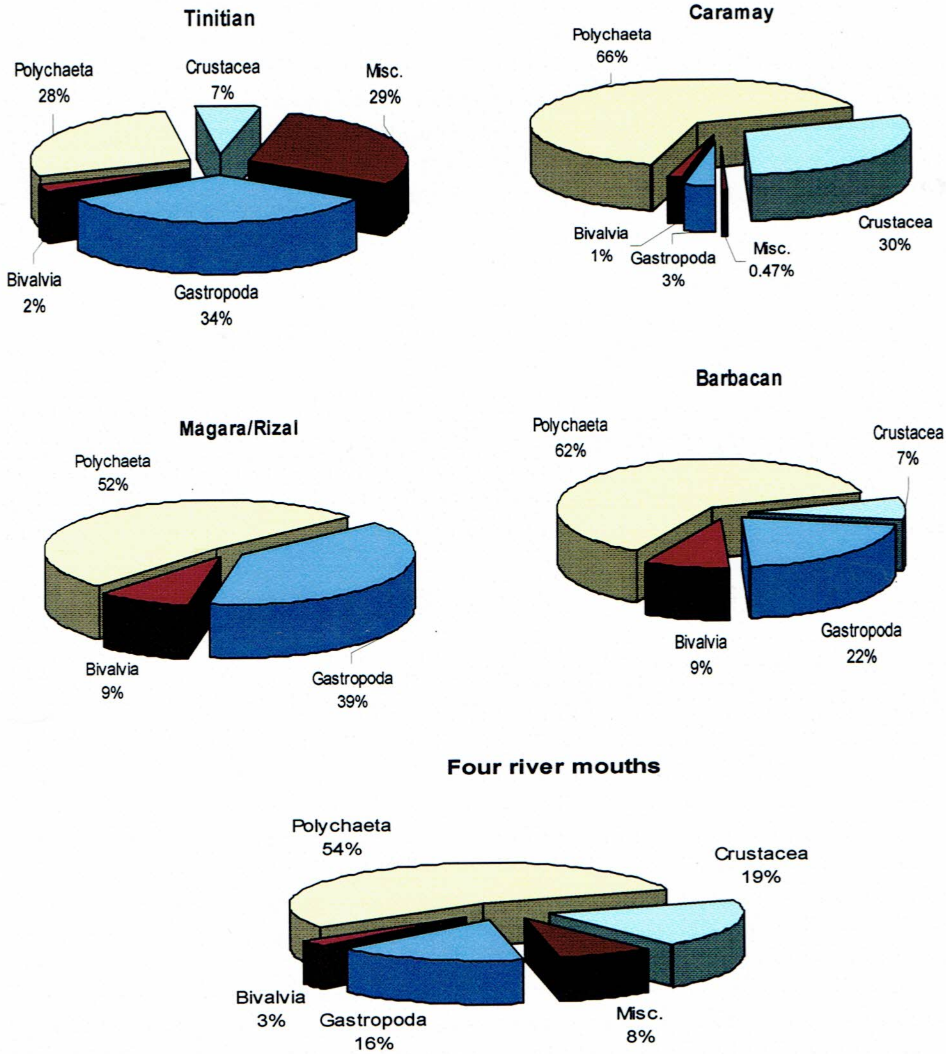

Figure 2. Percentage composition of soft-bottom macrofauna during the entire investigation period.

Density

The density of organisms collected in four river mouths in Roxas, Palawan is presented in Figure 3. Density ranged from 383 to 1500 organisms/m^2 in Tinitian, 550 to 3178 organisms/m^2 in Caramay, 50 to 422 organisms/m^2 in Magara/Rizal and 200 to 533 organisms/m^2 in Barbacan. The highest density of 3178 organisms/m^2 was obtained from October 2004 samples in Caramay and the lowest (50 organisms/m^2) was obtained from Magara/Rizal in September 2005.

In Tinitian, miscellaneous group (echinoderms and foraminiferans) contributed the highest density of 867 individual/m^2 in October 2004, polychaetes in March 2005 and gastropods in June and September 2005, respectively. In Caramay, crustacean were the most numerous in October 2004 with the density of 2133 individuals/m^2 and polychaetes dominated with 2167, 517 and 983 individuals/m^2 in March, June and September 2005. In Magara/Rizal, gastropods obtained the highest number with 367 individuals/m^2 in October 2004, while polychaetes with density of 350, 67 and 50 individuals/m^2 were abundant for the rest of the sampling period. In Barbacan, the most important taxa for the whole period were polychaetes with a density of 289, 117, 217, 167 individuals/m^2. The most numerous and consistent group of soft bottom macrofauna belongs were the polychaetes. On the other hand, crustacea was absent in Magara/Rizal during the study period. Crustacea occurred seasonally to a great extent in Caramay and foraminiferans in Tinitian both in October 2004. The highest density obtained in Caramay was higher than those reported in Southern Palawan by Palpal-latoc (2005). The seasonal occurrence of crustacea in Caramay in October 2005 maybe due to high amount of decayed organic matter embedded in samples. Furthermore, the least abundance of organisms and the absence of crustacea in Magara/Rizal may be due to siltation caused by anthropogenic activities at the upper reaches of the river.

In terms of density among rivers and sampling periods, Caramay was apparently the most productive river and October 2004 was the most productive time of the year (Figs. 4 & 5). The least productive river was Magara/Rizal and the sampling period was June 2005. The highest productivity in Caramay coincided with the rainy season (southwest monsoon). The temporal variation in density of organisms clearly follows a pattern where density decreases towards the end of dry season in June 2005 and gradually recovers in the middle of wet season in September 2005 (Fig. 5). Yap *et al.* (1991) concluded that abundance is related to depth. Consequently, Aswandy *et al.* (1991) concluded that monsoons influence the abundance of benthic animals in Indonesia.

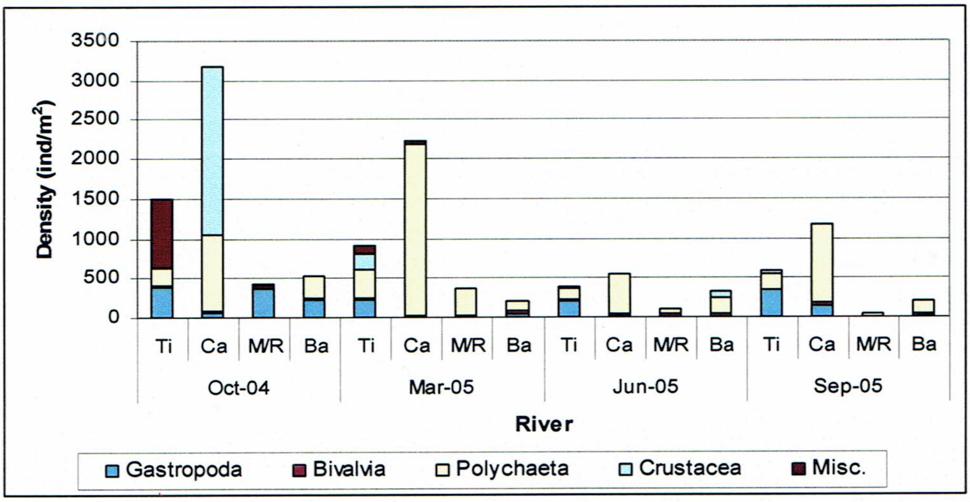

Figure 3. Density of organisms in different sampling sites at different sampling period.

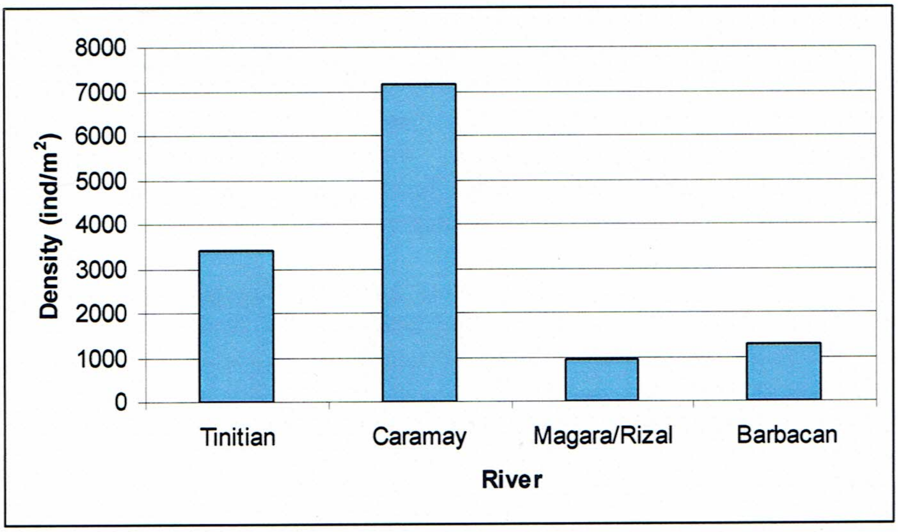

Figure 4. Spatial variation in density of organisms in four sampling periods.

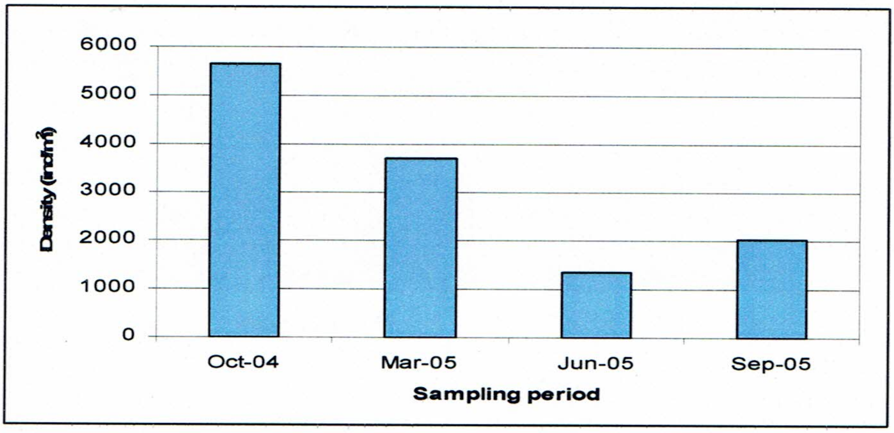

Figure 5. Temporal variation in density of organisms in four river mouths.

Composition of Sediments

Figures 6 and 7 present the percentage composition of sediments in October 2004 and March 2005. In October 2004, coarse sand (500µ) comprised the majority of sediments in Tinitian, Magara/Rizal and Barbacan, while fine sand (250 µ) shared the highest percentage in Caramay. In March 2005, coarse sand (500µ) remained to be the majority of sediments in Magara/Rizal and Barbacan and in Caramay while fine sand (250 µ) shared highest percentage in Tinitian . The nearly similar percentage composition of sediment in Magara/Rizal and Barbacan in October 2004 and March 2005 could be due to siltation brought about by anthropogenic activities.

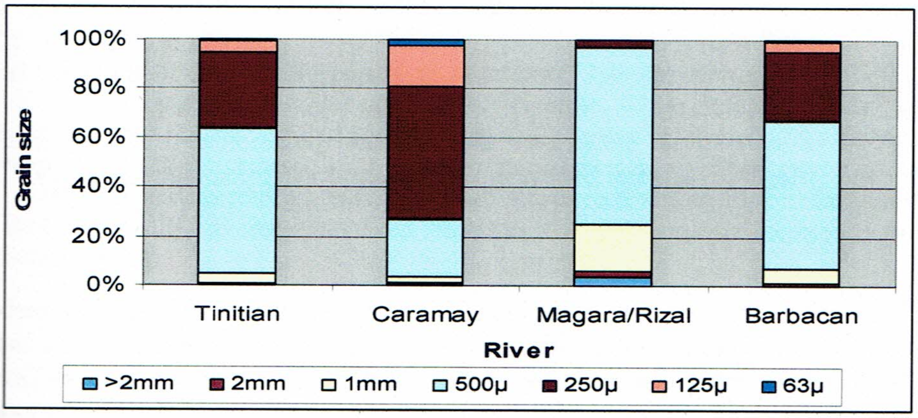

Figure 6. Percentage composition of grain size fractions of sediments in October 2004.

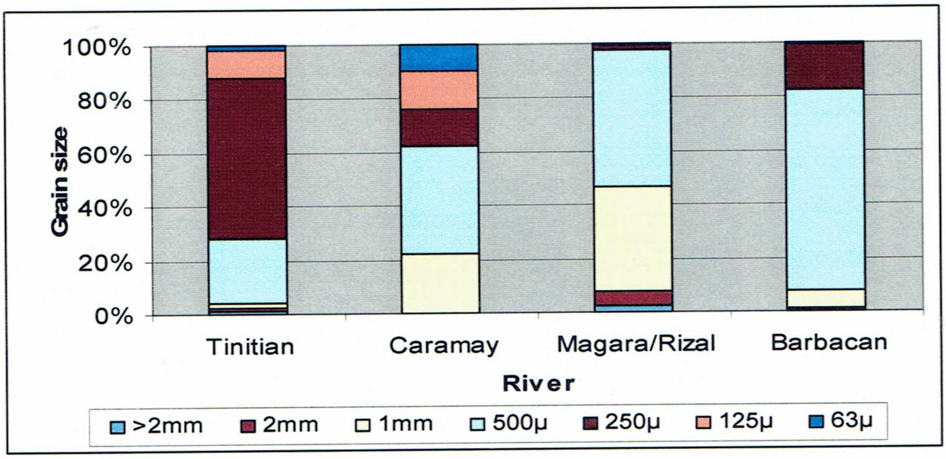

Figure 7. Percentage composition of grain size fractions of sediments March 2005.

CONCLUSIONS

Based on the above results the following conclusions are drawn:

1. The highest productivity in Caramay coincides with rainy season. This is potential to support the fish and crustacean population in the nearby area.
2. Soft bottom macrofauna are abundant during the southwest monsoon.
3. Polychaetes are regular inhabitants in Green Island Bay.
4. Substrates in Tinitian favor the growth of mollusks.
5. Siltation limits the abundance of organisms in Magara/Rizal and Barbacan River mouths.
6. Caramay provides favorable condition to crustacean during the southwest monsoon.
7. The environmental conditions in Magara/Rizal inhibit the growth of crustacean.
8. Coarse sand comprised the highest percentage of sediments in Magara/Rizal and Barbacan and fine sand in Tinitian and Caramay.

RECOMMENDATION

A separate study on water quality, water pollution and organic carbon content in sediment in similar sites should be conducted to assess the primary productivity and water quality in the river as well as in the coastal area of Green Island Bay. This would help validate the result of the present study. Furthermore, the results of this study could provide significant information on the formulation of schemes for a proper management of coastal resources in Green Island Bay.

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