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Inorganic Sediments Deposited in Green Island Bay, Roxas, Palawan

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ABSTRACT

Green Island Bay was studied to assess and evaluate the amount of inorganic sediments deposited in its catchments and further determine which of the four rivers had a significant contribution.

Results revealed that Rizal River had the highest amount of inorganic sediments deposited in Green Island Bay and was followed by Barbacan, Tinitian and Caramay rivers. The amount deposited by each river was not significant for all sampling periods except for the month of June 2005 and August 2005.

Activities in the watershed of the rivers under study may influence the amount of inorganic sediments carried and deposited in Green Island Bay.

Keywords: Barbacan, Caramay, Rizal, Tinitian, Green Island Bay, inorganic sediments

INTRODUCTION

Estuaries receive a load of pollutants from toxic chemicals, pesticides and sewage to silt from mining, agriculture, construction and lumbering (Smith 1992) carried and transported through wind or water erosion resulting to the loss of all top soil and some of the subsoil (Enger and Smith 1992). In excess, sediments deposited in the river mouths may create valuable deltas and islands (Cunningham & Saigo 1999).

Excessive infusion of eroded sediments into river systems caused by improper land use (Winger 1981) is a major factor affecting fish habitats such as coral reefs (Ross 1997). The transport of excessive amounts of sediments in rivers can affect fish communities (Rabeni 1993; Spalding *et al.* 2001).

Erosion and runoff from croplands contribute about 25 billion metric tons of soil, sediment and suspended solids to the world surface waters each year. Forests, grazing lands, urban construction sites, and other sources of erosion and runoff add at least 50 billion additional tons (Cunningham & Saigo 1999). Estimated soil loss for agricultural lands is 2 to 81 mg/ha/yr (El-Swaify 2000).

Accumulation of inorganic sediments may pile up and serve as a major factor affecting the deepness of the aquatic environment. It is more critical compared to organic sediments in a way that decomposition takes a long period of time.

The Green Island Bay's watershed is now experiencing a lot of activities particularly mining industry (nickel mining in Barbacan and gold panning in Magara and Caramay) and agriculture (upland and lowland rice farming) which could contribute great deposition of sediments and trigger adverse effects in productivity. For the government to act, they should be provided with baseline information regarding the effect of mining industry and illegal farming.

Thus, this study was conducted to assess and evaluate the amount of inorganic sediments carried and deposited in the coastal areas of Green Island Bay and to determine which of the rivers under study had the significant amount of inorganic sediments deposited in Green Island Bay. The results could be considered by the local government of Roxas, Palawan in land use planning and zoning activities.

METHODOLOGY

To assess and evaluate the amount of inorganic sediments carried and deposited in the coastal areas of Green Island Bay, four rivers were considered namely: Barbacan, Caramay, Rizal, and Tinitian (Figure 1). In each of the river, three stations were established (Table 1a, 1b, 1c, 1d) with an interval of approximately 100m.

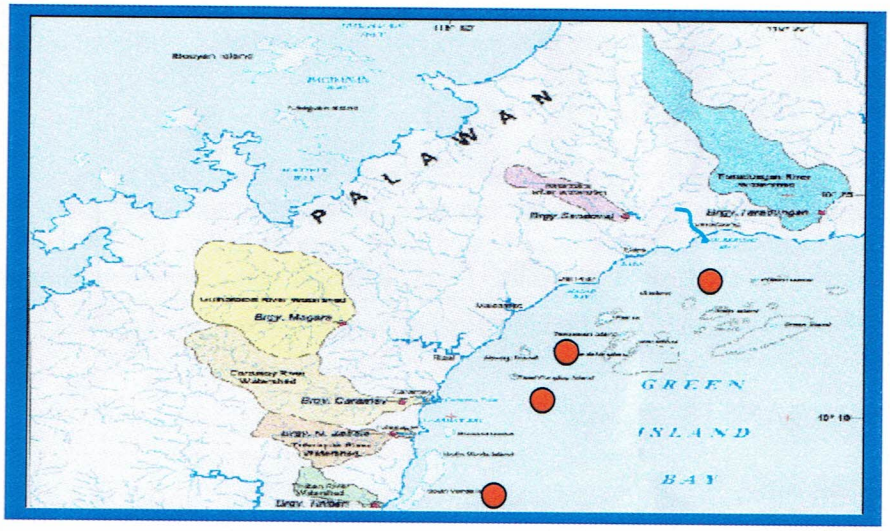

Figure 1. Map of Green Island Bay, Roxas, Palawan showing the rivers under study.

Table 1. Location of the 3 stations in Barbacan River, Roxas, Palawan

Station	Position	Average depth (m)
Inner	N $10^0$20.791' E $119^0$23.686'	3.5
Middle	N $10^0$20.733' E $119^0$23.713'	3
Seaward	N $10^0$20.646' E $119^0$23.747'	2.75

Table 1b. Location of the 3 stations in Caramay River, Roxas, Palawan

Station	Position	Average depth (m)
Inner	N $10^0$10.844' E $119^0$14.029'	1.25
Middle	N $10^0$10.831' E $119^0$14.055'	<1
Seaward	N $10^0$10.821' E $119^0$14.108'	<1

Table 1c. Location of the 3 stations in Rizal River, Roxas, Palawan.

Station	Position	Average depth (m)
Inner	N $10^0$13.944' E $119^0$15.493'	3.5
Middle	N $10^0$13.896' E $119^0$15.503'	2.75
Seaward	N $10^0$13.849' E $119^0$15.519'	2.5

Table 1d. Location of the 3 stations in Tinitian River, Roxas, Palawan.

Station	Position	Average depth (m)
Inner	N $10^0$03.886' E $119^0$12.339'	<1
Middle	N $10^0$03.869' E $119^0$12.384'	<1
Seaward	N $10^0$03.861' E $119^0$12.407'	<1

In collecting transported sediments, three sets of sediment traps (1 set is composed of three individual traps measuring 5cm in diameter and 11.5cm in length) were deployed in each station. Deployed traps were retrieved after a day cycle. Collected waters were filtered and were oven dried at 60°C overnight (Becira 2006; Becira 2004; English *et al.* 1997).

Approximately 2-3 grams dried sediment were transferred to a pre-weighed crucible. Crucible with sediment was weighed and systematically arranged in a furnace. Covered crucibles were heated in an oven at 850°C for 2.5 hours (after Elenbaas 1994). Heated crucibles were cooled at room temperature and then weighed.

RESULTS AND DISCUSSION

Barbacan River

In the inner station of Barbacan River, the highest deposition of inorganic sediments was in June 2005. However, in this station, high variation was also observed during the month of June 2005 (Figure 2). The inner station had an average mean sedimentation rate of 126mg/cm^2/day (Becira 2006) of which the

amount of deposited inorganic sediments had an average mean value of 89.15%. Differences in the amount of collected inorganic sediments were not significant at (P>0.05).

In the middle station, high amount of deposited inorganic sediments was in March 2005 with a minimal variability (Figure 2). Highest variation of the collected sediments in the middle station of Barbacan River was observed in June 2005 sampling although, the results may be affected by the lost of sediment traps during February 2005 and August 2005, respectively. The average mean sedimentation rate in this station was 153mg/cm^2/day (Becira 2006) of which inorganic sediments constituted 88.84%. Differences in the amount of collected inorganic sediments were not significant (P>0.05).

In the seaward station of Barbacan River, the highest amount of inorganic sediments deposited in coastal area of Green Island Bay was during September 2005. Greatest variability in the collected inorganic sediments was observed during June 2005. The average mean sedimentation in this station was 136mg/cm^2/day (Becira 2006) where the mean percentage value of inorganic sediments was 88.80%. Differences in the amount of collected inorganic sediments were significant (P>0.05).particularly between March 2005 and June 2005; February 2005 and June 2005; and June 2005 and September 2005.

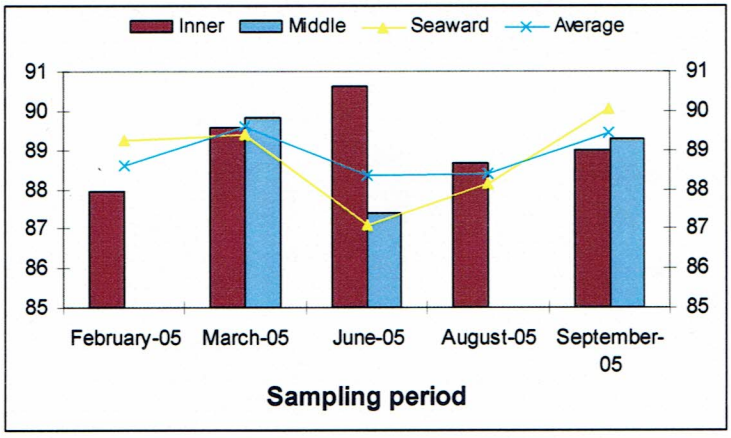

Figure 2. Mean percentage of inorganic sediments in Barbacan River, Roxas, Palawan.

Caramay River

In the inner station in Caramay River, the highest amount of inorganic sediments deposited in its coastal area was during February 2005 (92.45%) and gradually lowered towards September 2005 (Figure 3). Variation of collected inorganic sediments was higher during September 2005 sampling. Of 45mg/cm^2/day average mean sedimentation in the inner station in Caramay River (Becira 2006), 88.60% of this is made up of inorganic sediments.

In the middle station in Caramay River, the highest amount of inorganic sediments deposited was during June 2005 (91.34%) and the lowest was during September 2005 (83.65%). Mean sedimentation in this station was 81mg/cm^2/day (Becira 2006) of which the fraction of inorganic sediments was 88.59% although results were affected by the loss of several sediment traps.

In the seaward station, the amount of deposited inorganic sediments greatly varies in each sampling period though the highest deposition of inorganic sediments was during June 2005 (90.81%).

Differences in collected inorganic sediments in each of the station were not significant (P>0.05).

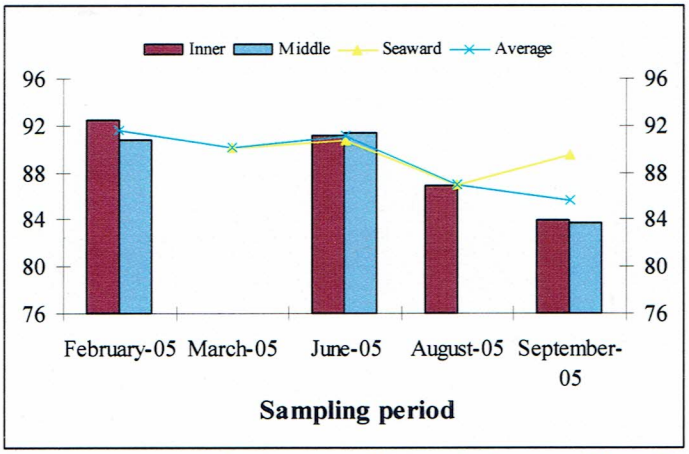

Figure 3. Mean percentage of inorganic sediments in Caramay River, Roxas, Palawan.

Rizal River

In the inner station in Rizal River, the highest amount of deposited inorganic sediments was during June 2005 (92.37%) and the lowest was observed in September 2005 (87.82%). The mean sedimentation in this station was 223mg/cm^2/day (Becira 2006) of which the mean amount of inorganic sediments was 90.52%.

The amount of inorganic sediments in the middle stations varied greatly from 86.56% to 98.22%, observed in March 2005 and February 2005, respectively (Figure 4). Mean sedimentation rate was 154mg/cm^2/day (Becira 2006), 91.89% of which is inorganic sediments.

Among the stations established in Rizal River, the seaward station is the most stable although the highest and lowest amount of inorganic sediments were measured during September 2005 (90.80%) and March 2005 (87.25%), respectively. The mean sedimentation rate in this station was 151mg/cm^2/day (Becira 2006) of which 89.49% constitute the inorganic sediments.

Differences in collected inorganic sediments in each of the stations were not significant (P>0.05).

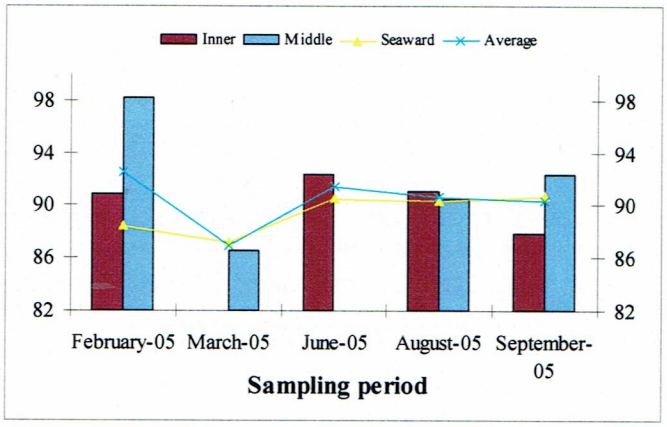

Figure 4. Mean percentage of inorganic sediments in Rizal River, Roxas, Palawan.

Tinitian River

Amount of inorganic sediments in the inner and middle stations were higher during the months of February 2005 (88.83% and 91.25%) and lower during September 2005 (86.32% and 86.72%) (Figure 5). The rate of sedimentation was 297 and 498mg/cm^2/day for the inner and middle station respectively, for which 87.57% and 89.39% are the inorganic sediments.

The seaward station exhibited variability in its inorganic sediment content with respect to sampling period with mean inorganic sediment content of 89.70% (mean sedimentation rate is 583mg/cm^2/day (Becira 2006)).

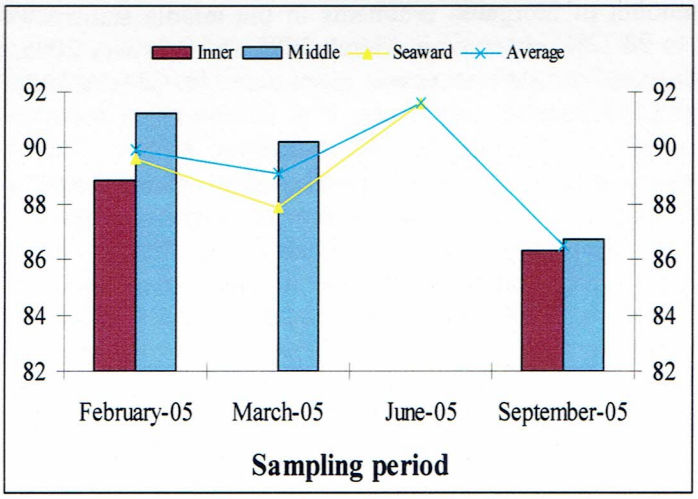

Figure 5. Mean percentage of inorganic sediments in Tinitian River, Roxas, Palawan.

Green Island Bay

The mean amount of inorganic sediments loaded into Green Island Bay from Barbacan River is stable (88.38–89.69%) throughout the sampling period with mean amount of 88.93%, although the variability of the collected inorganic sediments was higher during February 2005 and June 2005 (Figure 6). Inorganic sediments in Caramay River ranged from 85.69%-91.61% with a mean percentage of 88.85%. In each sampling period, variation in collected inorganic sediments was higher during September 2005. In Rizal River, it ranged from 86.90%-

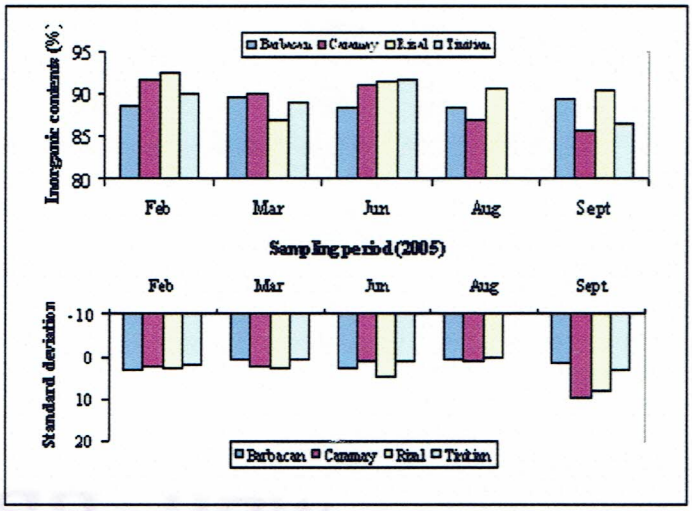

Figure 6. Average mean percentage of inorganic sediments in the four rivers discharging Green Island Bay.

92.51% with mean of 90.63%. Variability was higher during the months of June 2005 and September 2005. In Tinitian River, it ranged from 86.52%-91.59% with mean of 88.89%. Collected inorganic sediments varied every sampling period.

Range of the mean rate of sedimentation in Green Island Bay was 19.34 to 659.70mg/cm^2/day (Becira 2006) with respect to the sampling period of which the amount of inorganic sediments deposited in Green Island Bay varied from 88.13% to 90.76% with mean of 89.33%. Variability in the amount of inorganic sediment deposited in Green Island Bay was higher in September 2005 (Figure 7).

Among the rivers under study, differences in the amount of inorganic sediments deposited in Green Island Bay were not significant during February 2005, March 2005 and September 2005. Significant differences (P>0.05) were observed in June 2005 particularly between Barbacan and Caramay rivers and in August 2005 among Barbacan, Caramay and Rizal rivers.

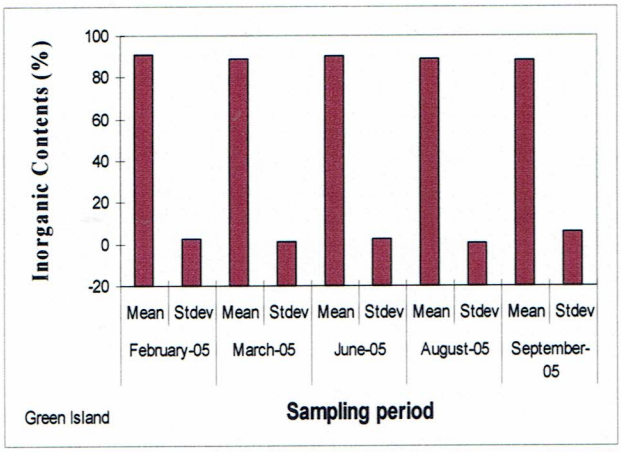

Figure 7. Percentage of inorganic sediments deposited in Green Island Bay.

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