Macrobenthic Fauna of Snake Island Area of Lagos Lagoon, Nigeria

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Abstract: The macrobenthic fauna of Snake Island area in Lagos, Nigeria was studied. A total of 8 sampling stations were used for the study. Twenty two macrobenthic species belonging to 4 major animal phyla were recorded. The Annelida (polycheata) constituted 64% in abundance followed by the *Molluscan bivalve* (34%), Arthropoda (crustaceans) 5% and Chordata (pisces) 1%. The spatial distribution and occurrence of species/station showed that 3 species (*Tagelus angulatus, Nereis granulata* and *Glacera tridactyla*) occurred in 6 stations out of 8 indicating the most commonly distributed within the study area. This is followed by *Notomastus latericus, Capitella capitella* and *Opheila* sp. and 2 *bivalve* sp. (*Aloides trigona* and *Tellina trilateral*) all occurring in 4 stations out of 8. The least occurring species were *Callinectes amnicola*, fish larva and *Euclymene* sp. occurring in only one station. Station 4 recorded the highest number in species diversity and richness with the value of 2.60 and 3.69, respectively. The lowest numbers for both values were recorded in station 3.

Key words: Snake island, Lagos Lagoon, macrobenthos, fauna, Nigeria

INTRODUCTION

Benthic fauna are considered important indicators of water quality and are used in a variety of ways to monitor and assess overall health of the aquatic environment. They are also used to follow a long-term monitoring programs relating to anthropogenic impacts (Boesch *et al.*, 1977; Simboura *et al.*, 1995). From monitoring perspective, benthos offer 3 attributes: They are relatively sedentary and long-lived, they occupy an important intermediate trophic position and they respond differentially to varying environmental condition. After settlement, benthos remain within a relatively constrained area for their entire adult lives. Therefore, unlike many other biotic or chemical measures, benthos reflect conditions at a specific location. Many *Benthic* sp. are also relatively long lived, with life spans ranging from weeks for some opportunistic worms to months or years for most larger taxa, leading to a community structure that reflects average condition integrated over a time period of months. However, benthos vary greatly in their responses to variations in water quality. Some taxa are relatively tolerant to organic, heavy metals, low dissolved oxygen while some are easily eliminated (Boesch *et al.*, 1977; Simboura *et al.*, 1995). Increased nutrient inputs and other anthropogenic activities can strongly affect abundances of some species, through direct or indirect pathways, while not affecting others. Therefore, by examining shifts in the benthic communities overtime, one can gain understanding of the major environmental events and processes affecting the local biota (Hyland *et al.*, 1996). The benthos constitutes the food for fishes. Hence, it is important for fisheries to have reliable information on productivity and species composition.

The study area (eastern part of Badagry creek), is part of the Lagos lagoon system that is found in the western part of Nigeria. Various authors have worked on the ecology and distribution of macrobenthic communities within the lagoon system. They include Ajao (1990), Ajao and Fagade (1990), Brown (1991), Olaniyan (1968), Oyenekan (1975, 1983, 1987) and Williams (1999) amongst others. Also, the description of the lagoon had been described as far back as Webb (1958).

The main objectives of this study, is to determine the types of benthos species occurring in the area, the abundance, spatial distribution and the species diversity and richness of the macrobenthic fauna.

MATERIALS AND METHODS

Field sampling: A total of 8 stations were sampled for the benthic macrofauna of the study area using a Van Veen grab sampler ($0.05 m^2$). The grab was dropped from the edge of the fibre-glass flash boat and hauled up into the boat. Stations sampled with their coordinates is presented in Table 1.

Table 1: Station sampled with coordinates

Stations	N-coordinates	E-coordinates
N1	N06°25.6220'	E003°20.2160'
N2	N06°26.0260'	E003°20.0520'
N3	N06°26.2060'	E003°17.7610'
N4	N06°24.5050'	E003°17.2350'
N5	N06°25.5570'	E003°21.2370'
N6	N06°24.8930'	E003°19.0870'
N7	N06°26.1470'	E003°18.5820'
N8	N06°25.1030'	E003°20.2130'

At each station, the depth, colour, texture and also, the presence of shells in the sediment were recorded. The grab sample was later emptied into a plastic bowl and water added to dissolve the sediment. It was gently stirred and carefully sieved through a 0.5 mm mesh sieve (McIntyre *et al.*, 1984). The content of the sieve after washing was transferred into a well labeled 1 L plastic container and 10% formalin (with Rose Bengal stain) added as preservative (Eleftheriou and Holme, 1984). The preserved samples were taken to the laboratory for further analysis.

Laboratory analysis: The preserved samples were again washed through a smaller mesh sieve (0.4 mm) with fresh water to remove excess mud and to reduce turbidity. Each washed sample was transferred onto well lit sorting tray and was thoroughly examined with the aid of a hand lens and dissecting microscope for macrobenthos. Sorted samples were kept in separate containers and preserved with 5% formarlin. The animals were later identified as far as species level and the number of each species observed were recorded. Identification was done after Barnes (1980), Branch and Branch (2002), Branch *et al.* (2002), Dance (1974), Edmunds (1978), Hayward and Ryland (1995), Kerkut (1961) Gosner (1971), Fischer *et al.* (1981), Yankson and Kendall (2001), Olaniyan (1968) and Schreider (1990).

Data analysis: All the data obtained were stored in excel spread sheet and the following analysis were performed:

- Numerical abundance and number of species
- Species distribution/occurrence/station
- Species diversity using the Shannon-Weaner diversity index (Valiela, 1995)

$$\text{Shannon-Weaner Index (H)} = -\Sigma P_i \ln P_i$$

where:
H = Diversity index
P_i = Proportion of no of individuals in each species to the total no of individual of all species

- Margalef's Species Richness index (Valiela, 1995)

$$d = (S-1)/\ln N$$

where:
S = No. species
N = Total number of individual of species

RESULTS

General overview: A total of 8 samples (corresponding to number of stations) were examined for the benthic macrofauna. Observations of the sediments sieved during the field sampling indicated that the area has a soft-bottom substrate.

Number of species and numerical abundance: A total of 22 macrobenthic species belonging to 4 major animal phyla were recorded from the total samples examined. The animal phyla recorded were Annelida, Mollusca, Arthropoda and Chordata. The total number of individuals (numerical abundance) and total number of species recorded/major phyla is as shown in Fig. 1.

From the Fig. 1, the phylum annelida (mainly polychaetes) had the highest number of species recorded 13 from all the stations sampled. This was followed by the phylum mollusca 4 and the crustacean arthropods 4. The least number of species was recorded from the phylum chordata (fish larva). Similar pattern was also observed for the numerical abundance of the species recorded for the area sampled (Fig. 1). Figure 2 shows the number of species and the numerical abundance of species/station in the survey area.

The numerical abundance of each species and their spatial distribution (occurrence/station) is presented in Table 2. *Tagelus angulatus* (a bivalve) was the most abundant species recorded in the survey area and is followed by *Nereis granulata* and *Glycera tridactyla*, both of which are polychaete.

Three species, *Callinectes amnicola* (swimming crab), Fish Larva and *Euclymene* sp. (Polychaete) were the least abundant species recorded.

Spatial distribution and occurrence of species/station: The occurrence of species at different station is also presented in Table 2. From the observed result, 3 species (*Tagelus angulatus*, *Nereis granulata* and *Glycera tridactyla*) occurred in 6 stations, which show that they are more common and well distributed in the study area. Three polychaete species (*Notomastus latericus*,
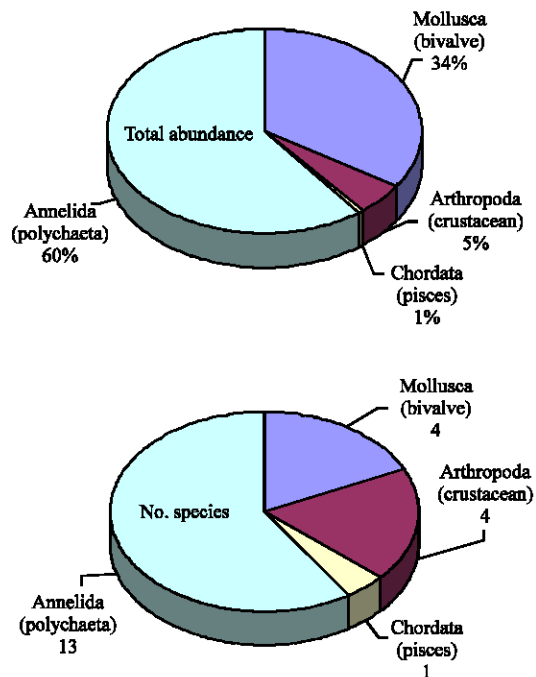
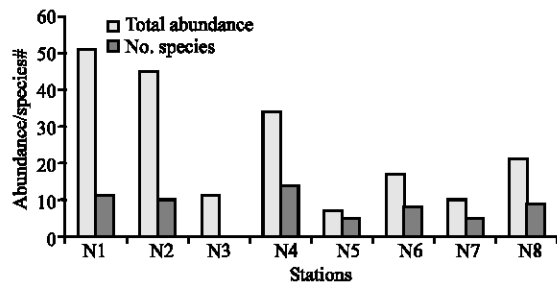Fig. 1: Numerical abundance and number of species recorded/survey area

Fig. 2: Total numerical abundance and species number recorded/station in the survey area

Capitella capitata and *Ophelia* sp.) and 2 bivalve species (*Aloides trigona and Tellina trilatera*) occurred in 4 of the stations sampled.

The species with the least occurrence in the area were *Callinectes amnicola*, fish larva and *Euclymene* sp.

Species diversity and richness indices: The species diversity of the study area per station is presented in Table 3.

The highest values of 2.60 and 3.69 for species diversity and richness, respectively were observed at station N4, while the lowest values of both indices (1.34 and 1.25, respectively) were observed in station N3. Coincidentally, station N4 recorded the highest number of species while station N3 recorded the lowest number.

Table 2: Numerical abundance and occurrence of species (spatial distribution)/station

Class/group	Species	Total abundance	Occurrence
Bivalve	*Tagelus angulatus*	39	6
Polychaeta	*Nereis granulate*	27	6
Polychaeta	*Glycera tridactyla*	18	6
Polychaeta	*Notomastus latericus*	17	4
Polychaeta	*Capitella capitata*	13	4
Bivalve	*Aloides trigona*	10	4
Polychaeta	*Ceratonereis keiskama*	10	3
Bivalve	*Mercenaria* sp.	10	2
Polychaeta	*Ophelia* sp.	9	4
Bivalve	*Tellina trilateral*	8	4
Polychaeta	*Dasybranchus caductus*	6	2
Crustacean	*Gammarus* sp.	5	3
Polychaeta	*Neoamphitrite* sp.	5	2
Polychaeta	*Pectinaria* sp.	5	2
Polychaeta	*Nereis angulhana*	3	2
Polychaeta	*Dendronereis* sp.	2	2
Polychaeta	*Glycera rouxi*	2	2
Crustacean	*Penaeus notialis*	2	1
Crustacean	*Tania* sp.	2	1
Crustacean	*Callinectes amnicola*	1	1
Chordata	Fish Larva	1	1
Polychaeta	*Euclymene* sp.	1	1
Total abundance		196	
Total no. species		22	
Total no. stations			8

Table 3: Species number, diversity and richness

Station no.	N1	N2	N3	N4	N5	N6	N7	N8
No. species	11	10	4	14	5	8	5	9
Species diversity	1.72	2.14	1.34	2.60	1.55	1.96	1.56	2.04
Species richness	2.54	2.36	1.25	3.69	2.06	2.47	1.74	2.63

DISCUSSION

The results of the macrofauna analysis of the 8 samples from the study area showed a benthic community typical of a soft sediment area (Sanders, 1968). The sediment type varies from mud to coarse sand in grain size composition with visible organic debris in most areas. These organic materials are plant materials washed down from upper vegetation or are being transported as a result of net lagoon water movement towards the harbour.

Four major animal phyla were observed and annelida (comprising of only polychaetes) constitute the most abundant number of individuals with highest number of species. Mollusca (mainly bivalves) are the next groups with higher levels than the remaining groups observed. The reason for this observation may be due to the muddy nature of the sediment that favours burrowing and tube dwelling activity of these groups. Also, majority of the species in these groups are deposit feeders feeding on detritus and the organic matter in the sediment. Most species recorded had been reported by Ajao (1990), Ajao and Fagade (1990), Brown (1991), Olaniyan (1968), Oyenekan (1975, 1983, 1987) and Williams (1999).

The least abundant group was the chordate (fish larva), which may be a juvenile of a demersal fish

species. Fish species are in the group of highly mobile megafauna and are capable of escaping the sampling gear but the juvenile fish caught was. The presence of the juvenile fish in the sample from the survey area may also shows that the area serves as a nursery ground for many fish species due to the estuarine nature of the lagoon (Webb, 1958).

Three macrobenthic species (*Tagelus angulatus*, *Nereis granulata* and *Glycera tridactyla*) are the most widely distributed in the area occurring at 6 stations out of the 8 stations sampled. Other species in the area with high occurrence are the polychaete (*Notomastus latericus*, *Capitella capitata* and *Ophelia* sp.) and the bivalves (*Aloides trigona* and *Tellina trilatera*) (*Cirratulus cirratus*) occurring in 4 stations of the study area. These species are known to be well adapted to live in soft sediments and are also deposit feeders.

One interesting species recorded among the polychaete group was *Capitella capitata*. This species is known to inhabit and preferred a highly organically polluted area, hence, it has been used as indicator organism for organic pollution (Ajao, 1990; Ajao and Fagade, 1990; Oyenekan, 1981). The area therefore, is organically polluted as with other part of the total Lagos lagoon. The sources of this pollution was described by Ajao (1990) and other authors such as Akpata (1980), Akpata and Ekundayo (1978) and Akinwande and Iseghohi (1997) amongst others.

CONCLUSION

The samples collected and analysed showed that the area is a soft sediment area with grain size ranging from mud to coarse sand. The macrobenthic species; polychaetes, bivalves and crustaceans obtained are typical for this type of sediment and are well adapted. The area may be organically polluted by the presence of an indicator species, *Capitella capitata*.

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