

Notes on the composition, abundance and zonation of benthic invertebrate of an artificial rocky shore, Tarkwa bay, Lagos, Nigeria

Clement Aghatise Edokpayi¹, Taiwo Azeez Adenle¹, Muyideen Owonire Lawal¹

¹ Benthic Ecology Lab, Department of Marine Sciences,
University of Lagos, Nigeria.
klemedokpayi@gmail.com

Abstract: The composition abundance spatial and temporal distribution of benthic invertebrates on the artificial rocky shore of Tarkwa bay was investigated between May 2003 and April 2004. Samples were collected or counted in-situ in a 1m² quadrat along a transect at 2m intervals on the west mole. A total of 15 taxa made up of 14 genera dominated by crustaceans (Chthamalidae) and gastropods (Littorinidae and Patellidae) both accounting for more than 60% of the total number of individuals observed. Using the spatial distribution of the dominant species, two broad zones, *Chthamalus/Patella* zone, (0 – 6m) and the *Littorina* zone (4 – 12m) were observed. All species were recorded throughout the study period except for *Tectarius granosus* and *Brachyodonte niger* which were not observed in some months. These species appears to be seasonally distributed as they occurred only during late rainy season (August) and dry season months (September – October). *Ligia gracilipes* and *Plagosia depressa* were found on the littoral fringes, while the pin-hole limpet, *Fissurrella nebecula* and the sea urchin, *Arbacia lixula* were restricted to the sublittoral zone. In general, the distribution of macrobenthic fauna observed at the Tarkwa bay was typical of exposed rocky shore influenced by strong wave and tides. [New York Science Journal 2010;3(9):63-67]. (ISSN: 1554-0200).

Keywords: Tarkwa Bay: benthos: zonation: rocky shore: Nigeria

Introduction

Although Nigerian coastline is generally free of indentations along its 800km length, it is however frequently interrupted by numerous river mouths which open through wide estuaries and large deltas. The Nigerian coastline is characterized by natural sandy and muddy beaches. There are no naturally occurring rocky shores along the Nigerian Coast. However, between 1901 and 1930, three artificial moles of stones were built seaward to limit bar formation and a fairway dredged to permit the entry of large vessels into the Lagos harbour. These breakwaters at Takwa Bay in Lagos provide artificial rocky surfaces for the settlement of littoral communities (Hill and Webb, 1958). The physico-chemical characteristics and the algae community of Tarkwa Bay have been described (Nwankwo, 1993). Information on the benthic fauna of the artificial rocky shore at Takwa Bay is nonexistent. This paper presents the results and discussion on the composition, monthly fluctuations in abundance and the vertical distribution of macrobenthic invertebrates of the artificial rocky shore at Tarkwa bay.

Study Area

The artificial rocky shore of Nigeria is made up of three moles, the west, training and east moles (Fig. 1). The study site is the exposed side of the

West Mole. The training mole encloses the Tarkwa Bay, while the construction of the west and east moles has resulted in sand deposition in the Light house beach and attrition (erosion) in the Victoria Beach respectively over time. The littoral algae on the west mole include *Chaetomorpha anteninna*, *Cladophora protifera*, *Bryopsis penneta* and *Hypnea musciformis*. The main human activity around the study area is recreational. Fishing activity is minimal and involves artisanal fishermen throwing cast nets for pelagic fishes. The tidal rhythm at the study site is semi-diurnal. Water samples were collected at monthly intervals for a period of twelve months from May 2003 to April 2004. Samples were collected in the last week of the month between 0800h and 1200h at low tide.

Water samples were collected in pre-washed polyethylene containers and analyzed in Lagos State Environmental Protection Agency (LASEPA) laboratory for pH, salinity, total dissolved solids, nitrate, phosphate, and alkalinity. Using the methods recommended by APHA (1998). Air and water temperature were measured in-situ using mercury-in-glass thermometer and readings taking to the nearest 0.1^oC.

Benthic fauna were collected along a rope-marked transect graduated at 1m intervals. A quadrant of 1m² was used to standardize the sample size. Fauna

were collected at 2m interval from water level to the top of the mole. Animals found within the quadrant were counted in-situ or representative collected and fixed in 10% formalin. The fauna were identified using identification keys of Edmunds (1978), Oyeneke (1988) and Yankson and Kendall (2001).

Results

Table 1 presents the summary of the physical and chemical parameters measured at the study site. Comparison of months using ANOVA for all parameters except pH and Kruskal – Wallis test for pH, showed no significant differences ($p > 0.05$) in the monthly fluctuations of the physical and chemical parameters studied.

Fifteen invertebrate taxa were collected during the study period. Table 2 lists the taxonomic categories of invertebrates, the number of taxa recognized within each category, their distribution and abundance along the transect. The number of individuals (Fig.2) were highest at the eulittoral zone (42%) and lowest at the Littoral fringes (17%). However, the highest number of taxa (13) was recorded at sublittoral zone (Table 2, Fig. 3). The artificial rocky shore fauna was dominated by Chthamalidae, Patellidae and Littorinidae both families accounting for more than 60% of the total individuals recorded (Fig. 4). *Littorina punctata* and *L. cigulifera* was recorded at all the zones from the sublittoral (0 – 1m) to the littoral fringe (6m – 9m). *Brachyodontes niger* (mussel), *Arbacia lixula* (sea urchin), *Fissurella nubecula* (key-hole limpet) and sea anemones were restricted to lower part of the eulittoral to the sublittoral zone. The eulittoral (1 – 6m) zone was dominated by *Chthamalus dentatus*, while *Tectarius granosus* and *Ligia gracilipes* (isopod) were mainly found on the littoral fringes (splash zone). All species were recorded in all the months sampled except for *Tectarius granosus* and *Brachyodontes niger* which occurred mainly in late rainy season to dry season months.

Discussions

Tarkwa Bay is the only rocky shore in Nigeria coastline and the macrobenthic fauna have not been documented. The physical and chemical characteristics of the sea water at Tarkwa bay recorded in this study were similar to those reported by earlier workers (Hill and Webb, 1958; Nwankwo, 1998). The fauna composition of the Takwa bay was similar to those reported for the rocky shores of Ghana and other West African rocky shores (Yankson and Kendall, 2001). The dominance of Chthamalidae (Crustacean) at the eulittoral zone and Littorinidae (Gastropod) at the sublittoral to the littoral fringes appears to be related to their ability to withstand

desiccation resulting from exposure during low tide, and strong waves during high tides.

The occurrence of *Tactarius granosus* and *Brachyodontes niger* in the dry season months reflects seasonal distribution of these species at the study site

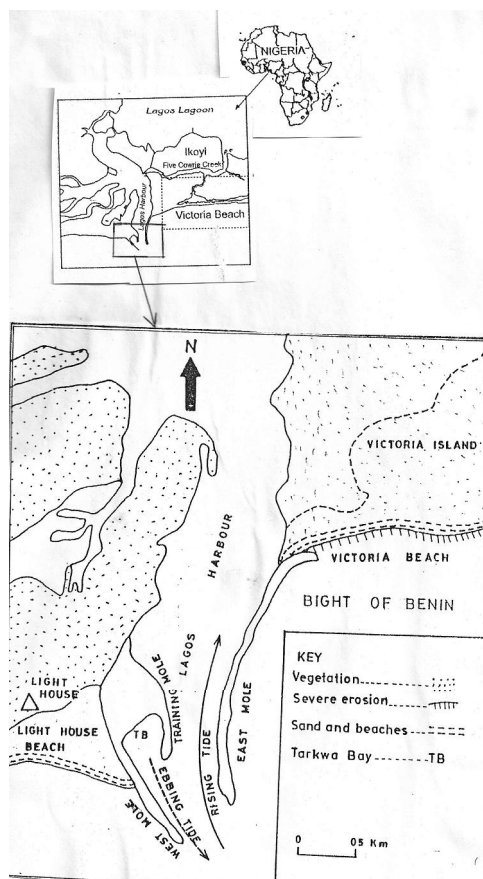


Fig. 1. Map of Tarkwa Bay showing the moles.

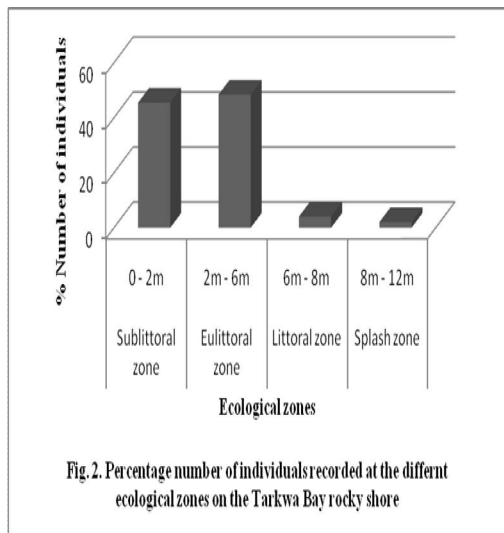


Fig. 2. Percentage number of individuals recorded at the different ecological zones on the Tarkwa Bay rocky shore

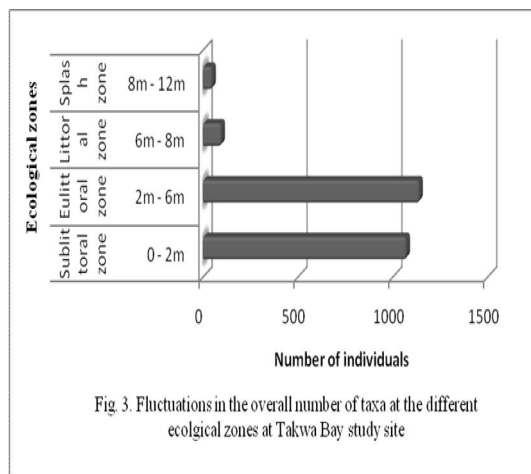


Fig. 3. Fluctuations in the overall number of taxa at different ecological zones at Takwa Bay study site

Table 1. Summary of the physical and chemical characteristics of the seawater at Tarkwa Bay; Mean \pm Standard Deviation, Minimum and Maximum values given.

Parameters	Mean \pm SD	Minimum	Maximum
Air temperature ($^{\circ}$ C)	29.47 \pm 1.92	27.00	32.00
Water temperature ($^{\circ}$ C)	28.35 \pm 1.63	26.00	30.00
Salinity (‰)	26.35 \pm 1.90	23.60	29.00
pH		7.40	7.70
DO (mg/l)	4.45 \pm 0.52	3.50	4.90
TDS (mg/l)	17.02 \pm 0.90	16.60	18.40
Nitrate (ppm)	8.26 \pm 0.29	7.95	8.75
Phosphate (ppm)	2.83 \pm 0.17	2.50	3.00
Alkalinity (ppm CaCO ₃)	197.50 \pm 3.82	195.00	200.00
BOD (mg/l)	14.00 \pm 1.15	12.00	15.00
COD (mg/l)	24.17 \pm 4.52	20.00	31.00

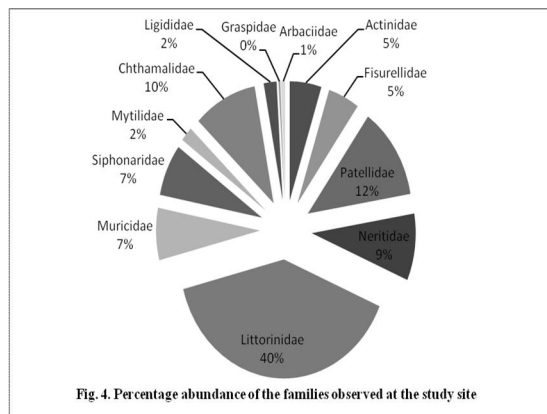


Fig. 4. Percentage abundance of the families observed at the study site

Table 2. The composition, distribution and abundance of macrobenthic invertebrates on the artificial rocky shores of Tarkwa Bay, May 2003 – April 2004.

	0-2 Meters		2-4 Meters		4-6 Meters		6-8 Meters		8-10 Meters		10-12 Meters		Overall	
	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.	No of Taxa	No of Indiv.
COELENTERATA														
ANTHOZOA														
ACTINIDAE (Sea anemone)	1	90	1	26									1	116
MOLLUSCA														
GASTROPODA														
FISURELLIDAE (<i>Fissurella nubecula</i>)	1	69	1	35	1	11							1	115
PATELLIDAE (<i>Patella safiana</i>)	1	133	1	125	1	37							1	295
NERITIDAE (<i>Nerita senegalensis</i>)	1	146	1	68	-	-							1	214
MESOGASTROPODA														
LITTORINIDAE	3													
<i>Littorina punctata</i>	1	215	1	173	1	126	1	82	1	29	1	7	1	605
<i>Littorina cingulifera</i>	1	117	1	103	1	5	1	3	1	8			1	236
<i>Tectarius granosus</i>					1	57	1	2	1	4			1	63
MURICIDAE	2													
<i>Thais haemastoma</i>	1	89	1	47									1	136
<i>Thais nodosa</i>	1	31											1	31
SIPHONARIDAE (<i>Siphonaria pectinata</i>)	1	84	1	70	1	12							1	166
BIVALVA														
MYTILIDAE (<i>Brachyodontes niger</i>)	1	47											1	47
ARTHROPODA														
CRUSTACEA														
CHTHAMALIDAE (<i>Chthamalus dentatus</i>)	1	28	1	60	1	146							1	234
LIGIDIDAE (<i>Ligia gracilipes</i>)	1				1	38	1	9					1	47
GRASPSIDAE (<i>Plagusia depressa</i>)	1	6											1	6
ECHINODERMATA														
ECHINOIDEA														
ARBACIIDAE (<i>Arbacia lixula</i>)	1	16											1	16
Total	13	1071	9	707	8	432	4	96	3	41	1	7	15	2,354

Corresponding Author:

Dr. Clement Aghatise Edokpayi
 Department of Marine Sciences
 Benthic Ecology Laboratory
 University of Lagos, Nigeria
 E-mail: klemedokpayi@gmail.com

References

1. American Public Health Association (APHA) Standard Methods for the Examination of Water and Waste Water 1998 20th Edn.
2. Edmunds, J. Sea Shells and Other Molluscs found on West African Shores and Estuaries. 1978 Ghana University Press, Accra. 146pp.
3. Hill, H. B. and Webb, J. E. The ecology of Lagos lagoon II: The topography and physical features of Lagos harbour and Lagos lagoon. 1958 *Phil. Trans. Roy. Soc. Bull.* Vol. 341: 319 – 333.
4. Nwankwo, D. I. Cyanobacteria bloom species in coastal waters of South-Western Nigeria. 1993 *Archiv fur Hydrobiologie.* 4: 533 – 542.
5. Nwankwo, D. I. The influence of sawmill wastes on diatom population of Okobaba, Lagos, Nigeria. 1998 *Nig. J. Bot.* 11: 15 – 24.
6. Oyenekan, J.A. Benthic macrofaunal communities of Lagos lagoon, Nigeria. 1988 *Nig. J. Sc.* 21: 45 – 50.
7. Yankson, K. and Kendall, A. A student's guide to the sea shore of West Africa. Darwin Initiative 2001 Report 1. Ref. 162/7/451. 132pp.

7/7/2010