The Malaco-Faunal Characteristics of the 'Sandwiched' Epe Lagoon, Lagos.

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Abstract: Problem Statement: Epe lagoon lays in-between two lagoons the Lagos and the Lekki lagoons which are relatively more documented. The paucity of information on the benthic macro-invertebrate characteristics of this sandwiched lagoon prompted this present work. **Approach:** A survey of the malacofauna of the sediment from Epe lagoon was carried out between the months of September, 2004 and February, 2005. Eight study Stations, six settlement sites and one site each on a river mouth and an island was chosen for this survey. Samples were collected once every month. **Result:** The sediment at the Epe lagoon was generally alkaline (pH rang 7.2 – 8.0). All other physico-chemical characteristics analyzed were relatively similar among the sites with slight local temporal variations. The mollusk community at the Epe lagoon was represented by two classes, the gastropoda, made up of three families and five species (*Neritina glabarata*, *Neritina kuramoensis*, *Pachymelania aurita*, *Tympanotonus fuscatus* var *radula* and Tympanotonus fuscatus) and the bivalvia, made up of four families and six species (*Macoma cumana*, *Tellina* nymphalis, *Dosinia isocardia*, *Mutilus* edulis, *Tivela* tripla and *Crassosterea* gasar). **Conclusion/Recommendation:** The mollusk community was dominated by the gastropod which accounted for over 60% of the total number of individuals collected. The occurrence of *Neritina kuramoensis* in only the brackish water sites of the Epe lagoon further confirms that this species is not a freshwater species. Generally, the diversity indices recorded for the mollusk community at the Epe lagoon was low indicative of a stressed environment.
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Key words: Malacofauna, sandwiched lagoon, Epe lagoon, Lagos, Nigeria

INTRODUCTION

Lagoons are prominent features along the coastal regions of South-Western Nigeria. Some of these lagoons are part of West African lagoon system in origin and location but are in form and features similar to freshwater lakes (Webb, 1958). The other types of lagoons are essentially brackish and tidal effects are experienced particularly in the dry season. However, all the lagoons of south-western Nigeria enter the sea through the Lagos Harbour (Nwankwo, 1998a).

Benthological data on the Nigeria lagoons are limited. Out of the six lagoons (Mahin, Lekki, Epe, Lagos, Ologe and Yelwa) on the south-western coast, the Lagos lagoon is the most extensively studied in relation to the others. The available information on the Lagos lagoon includes studies on the fisheries (Ajao and Fagade, 1990a; 1990b; 1990c), benthic invertebrate (Oyenekan, 1988; Brown, 1998; Brown and Oyenekan, 1998; Ogunwenmo and Kusemiju, 2004, Edokpayi and Nkwoji, 2007) and phytoplankton (Nwankwo, 1986, Nwankwo, 1998a). Epe lagoon the only lagoon in south-western Nigeria sandwiched between two lagoons (Lagos and Lekki lagoons) has no published information regarding its macrobenthic communities prior to the year 2000 when investigation was initiated by Edokpayi *et al*. (2004) and his students. The only available work was on the phytoplankton (Nwankwo, 1998b) and periphyton (Nwankwo and Onitiri, 1992).

The aim of this study is to provide some ecological information relating to the species composition, abundance and distribution of the mollusc invertebrate in-fauna of Epe lagoon sediment. An attempt on the effects of anthropogenic activities on the benthic community structure is also presented.

MATERIALS AND METHODS

Study site: Epe lagoon (2°50′-4°10′N, 5°30′ - 5°40′E) has a surface area of 243 km^{-2} (Kusemiju, 1988). The lagoon has an average depth of about 1.80m and situated between two other lagoon, the Lagos lagoon (brackish water) to the west and Lekki lagoon (freshwater) to the east (Fig. 1). Epe lagoon is connected to the Atlantic Ocean through the Lagos lagoon.

Epe lagoon supports a major fishery in Lagos state, Nigeria and it is also used as transportation route for people, goods and timber logs from Epe to other places in south-western Nigeria. The lagoon houses the Egbin thermoelectric power plant which serves as a major source of electric power generation in Western Nigeria. The lagoon is the major source of water for the inhabitants of Epe and other villages situated along its bank.

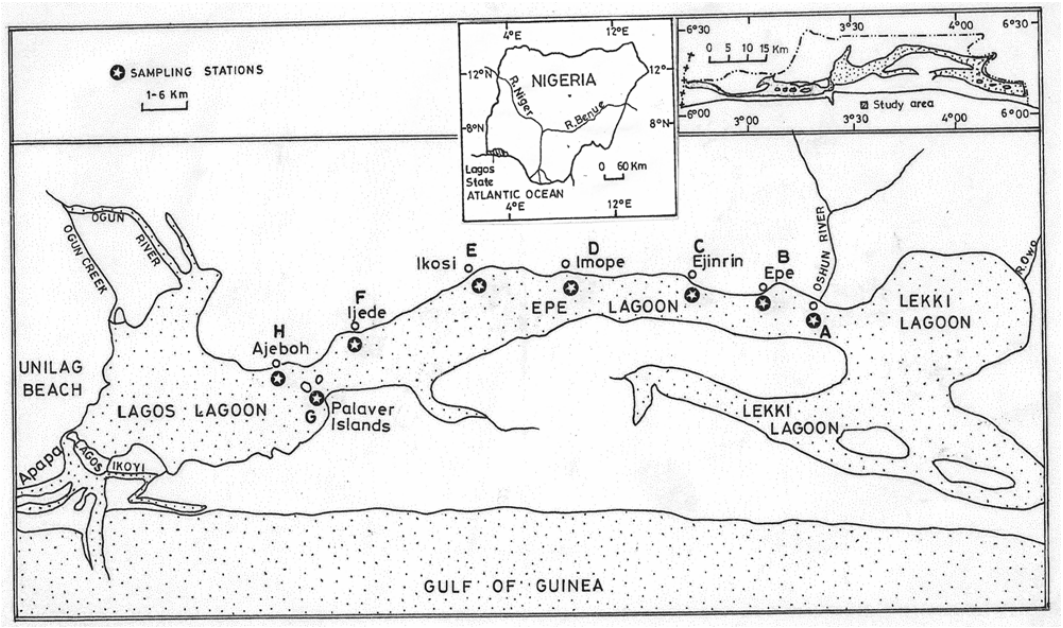

Fig. 1: The sandwiched Epe lagoon showing the study stations

Over the years the population of Epe and other villages along the bank of the lagoon has increased through expanding commercial activities due to its closeness to metropolitan cities of Lagos state. This has inadvertently led to an abuse of the environment especially as there are no modern sanitary and waste treatment facilities in most of the settlements. Human faeces and other domestic wastes, garbage, petroleum products and other forms of domestic and industrial wastes are deposited in the lagoon indiscriminately. In addition, the heated coolant water discharged directly into the western end of the lagoon from the Egbin power plant is an added source of environmental stress in the lagoon.

Eight sites (Stations A-H) made up of six settlement sites (Epe, Ejirin, Imope, Ikosi, Ijede and Ajeboh) and two ecological feature sites (Mouth of the Osun river and Palaver Island) where chosen for this study (Fig. 1). Each site is approximately 1.5km apart and the water colour is brown. The settlement sites are characterised by floating mate of aquatic vegetation dominated by water hyacinth (*Eichhornia crassipes*). The inhabitants are mainly fishermen. Other human activities at these sites include sand mining and refined crude oil product bunkering at a local jetty in Epe settlement. The Egbin power station is located at the Ijede site. The Osun river month and the Palaver Island are relatively calm and a human activity is restricted to fishing.

Methods: Sampling was carried out over a period of six months (September 2004-February 2005). At each site, monthly samples were collected using a 0.05 m^2 Eckman grab for the infauna. Replicate grab samples were sieved over a 0.5 mm mesh, the retained fauna being washed into a jar and preserved in polythene bottles for later identification. Core subsamples from the grab were used to describe sediment characteristics. Sediment composition was analysed by a combination of dry sieving for the larger grain sizes (>63 μ) and pipette analysis of the finer fractions. The faunal were identified using Sandison and Hill (1966); Yoloye and Adegoke (1977); Adegoke *et al*. (1969) and Edmunds (1978). Routing statistical analysis and species diversity indices were adopted from standard methods in Zar (1996).

RESULTS

The physico-chemical characteristics of the bottom sediment at the Epe lagoon study sites are presented in Table 1. Generally, the sediment was alkaline with overall range of 7.2-8.0. The study sites were statistically similar with minor local variations in all the five chemical characteristics analysed for the sediment (Table 1). The total organic content was however slightly higher at stations A and B than the other sites.

Table 1: Summary of the physico-chemical characteristics of the sediment of the Epe lagoon, September 2004 to February 2005

		pH	Total organic content (mg L^{-1})	Sulphate (mg L^{-1})	Nitrate (mg L^{-1})	Phosphate (mg L^{-1})	(mg L^{-1})
	Conductivity						
Station A	MAX	7.5	8.5	0.15	1.3	0.32	5.2
	MIN	7.2	4	0.1	1.15	0.25	4.38
	μ ± SD		6.8±1.27	0.11±0.01	1.28±0.06	0.29±0.05	4.91±0.39
Station B	MAX	7.5	8.0	0.12	1.35	0.35	5.25
	MIN	7.2	4.52	0.1	1.2	0.25	4.4
	μ ± SD		6.8±1.25	0.12 ± 0.02	1.3±0.09	0.27±0.02	4.84±0.35
Station C	MAX	7.8	8.5	0.15	1.38	0.29	5.15
	MIN	7.2	5.25	0.1	1.16	0.24	4.4
	μ ± SD		5.4±1.63	0.13 ± 0.02	1.28±0.15	0.28±0.04	4.6±0.35
Station D	MAX	7.6	7.5	0.15	1.3	0.35	5.2
	MIN	7.4	3.08	0.1	1.12	0.24	4.36
	μ ± SD		4.7±2.20	0.15±0.03	1.27±0.06	0.26±0.03	4.72±0.21
Station E	MAX	8.0	7.3	0.18	1.37	0.32	4.95
	MIN	7.2	2.05	0.1	1.27	0.24	4.35
	μ ± SD		3.8±1.84	0.15±0.02	1.28±0.07	0.26±0.04	4.95±0.04
Station F	MAX	8.0	7.5	0.17	1.38	0.3	5.2
	MIN	7.2	2.45	0.12	1.18	0.22	4.26
	μ ± SD		4.08±1.41	0.13±0,02	1.24±0.08	0.28±0.03	4.98±0.49
Station G	MAX	7.8	5.35	0.15	1.35	0.32	5.35
	MIN	7.2	2.5	0.01	1.15	0.23	4.2
	μ ± SD		5.8±0.49	0.11±0.01	1.26±0.08	0.27±0.04	4.74±0.33
Station H	MAX	7.8	6.3	0.12	1.38	0.35	5.26
	MIN	7.2	6.25	0.1	1.18	0.25	4.4
	μ ± SD		3.43±0.12	3.4±013	1.04±0.04	0.66±0.02	1.21±0.05

Table 2: The check list of the benthic malacofauna of Epe lagoon

PHYLUM: MOLLUSCA

Class: Gastropoda
Subclass: Prosobranchia
Order: Archeagastropoda
Family: Neritidae
Neritina glabarata Sowerby (1849)
Neritina kuramoensis Yoloye and Adegoke (1977)
Order: Mesogastropoda
Family: Melaniidae
Pachymelania aurita Müller (1776)
Family: Potamididae
Typanotonus fuscatus var *radula* Linnaeus (1758)
Typanotonus fuscatus Linnaeus (1758)
Class: Bivalvia
Order: Pteriomorpha
Family: Tellinidae
Tellina nymphalis Lamarck (1818)
Macoma cumana O.G. Costa (1829)
Family: Veneridae
Tivela tripla Linnaeus (1767)
Dosinia isocardia Dunkar (1843)
Family: Mytilidae
Mutilus edulis Linneaeus (1758)
Family: Ostreoidae
Crassostrea gasar Adanson (1757)

The checklist of the mollusc species at the Epe lagoon is presented in Table 2. The overall benthic malacofauna composition, abundance and distribution at the study stations is shown in Table 3. Five families of Mollusc belonging to two classes, Gastropod (three families) and Bivalve (four families) were recorded.

The gastropoda represented by three families and five species recorded the highest number of individuals (1255) accounting for 63.20% of the benthic malacofauna. Of the five species recorded, *Pachymelania aurita* Muller occurred in the highest number (1007), out numbering every other species recorded in this study. Other species of gastropod molluscs recorded include *Neritina glabarata* Sowerby (64 individuals), *Nerita kuramoensis* Yoloye and Adegoke (1977) (60 individuals), *Tympanotomus fuscatus* (L) (62 individuals) and *Tympanotonus fuscatus* var *radula* (L) (110 individuals).

Four families (Tellindae, Veneridae, Mytillidae and Ostreidae) of bivalves recorded were composed of the following six species, *Macoma Cumana* O.G. Costa (598 individuals), *Tellina nymphalis* Lamarek (154 individuals), *Dosinia isocardia* Dunkar (4 inidividuals), *Mytilus edulis* Linneaeus (250 individuals), *Tivela tripla* Linneaeus (6 individuals) and *Crassosterea gasar* Dautzenberg (90 individuals). Of the total number of 1102 individual bivalve observed, *M. Cumana* accounted for 26.40% of the overall malacofauna recorded and over 60% of the total number of bivalves (Table 3).

Generally, *Pachymelania aurita*, *Typanotonus fuscatus* var *radula* and the bivalve *Macoma cumana* were recorded at all the study sites sampled (Table 4). All other species had scanty distribution. The taxa diversity indices for the malacofauna infauna at the Epe lagoon are presented in Table 5. The highest diversity (H = 1.94) was observed at station H (Ajeboh settlement site) while the lowest (H = 0.47) was recorded at station A (Osun River mouth).

The three gastropod families recorded were either dominant or subdominant at all the stations except at station A, B and C. Neritidae and Potamididae were however subdominant at Station B, while Potamididae only was subdominant at station C (Table 6). For the bivalve families, Tellinidae was dominant at stations A, B and D, Ostreidae was subdominant at station G, Mytilidae was dominant at station B, while Veneridae was rare at all sites recorded (Table 6).

Table 3: Summary of the distribution, abundance and occurrence of major malacofauna groups at the Epe lagoon study sites

		Gastropoda			Bivalvia				
		Neritidae	Melaniidae		Potamididae		Veneridae		Mytilidae
	Ostreidae	Tellinidae		Total					
Station A	# of sp.		1	1			1	1	4
	# of individuals		16	3			12	100	131
Station B	# of sp.	2	1	1	1	1		2	8
	# of individuals	15	7	9	5	180		203	419
Station C	# of sp.		1	1		1		2	5
	# of individuals		1	11		10		106	128
Station D	# of sp.	2	1	2				2	7
	# of individuals	10	72	32				170	284
Station E	# of sp.	2	1	2				2	7
	# of individuals	5	282	42				46	375
Station F	# of sp.	2	1	2	2	1		2	10
	# of individuals	12	285	12	3	50		42	404
Station G	# of sp.	2	1	1	2		1	1	8
	# of individuals	24	184	10	2		78	20	318
Station H	# of sp.	2	1	2		1		2	8
	# of individuals	42	128	53		10		65	298
All Stations	# of sp.	2	1	2	2	1	1	2	11
	# of individuals	108	975	172	10	250	90	752	2357

Table 4: Spatial distribution of malacofauna species at the Epe lagoon, September 2004-February 2005

Mollusca	St. A	St. B	St. C	St. D	St. E	St. F	St. G	St. H
Gastropoda								
Neritina glabarata Sowerby (1849)	-	+	-	+	+	+	+	+
Neritina kuramoensis Yoloye and Adegoke (1977)	-	+	-	+	+	+	+	+
Pachymelania aurita Müller, 1776	+	+	+	+	+	+	+	+
Typanotonus fuscatus var radula Linnaeus (1758)	+	+	+	+	+	+	+	+
Typanotonus fuscatus Linnaeus (1758)	-	-	-	+	+	+	-	+
Bivalvia								
Tellina nymphalis Lamarck (1818)	-	+	+	+	+	+	-	+
Macoma cumana O.G. Costa (1829)	+	+	+	+	+	+	+	+
Tivela tripla Linnaeus (1767)	-	+	-	-	-	+	+	-
Dosinia isocardia Dunkar (1843)	-	-	-	-	-	+	+	-
Mutilus edulis Linneaeus (1758)	-	+	+	-	-	+	-	+
Crassostrea gasar Adanson (1757)	+	-	-	-	-	-	+	-

Table 5: The taxa diversity indices at the Epe lagoon study stations (September 2004 – February 2005)

	St. A	St. B	St. C	St. D	St. E	St. F	St. G	St. H
No of Sample	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
No of Taxa	4.00	8.00	5.00	6.00	6.00	10.00	7.00	7.00
No of Individuals	131.00	419.00	128.00	284.00	375.00	482.00	240.00	298.00
Margalefs Taxa richness (D)	1.94	0.47	1.41	0.63	1.49	1.45	1.58	1.59
Shannon Weiner's Index of Genera Diversity (H)	0.065	0.100	0.158	0.327	0.411	0.272	0.421	0.562
Evenness	0.023	0.035	0.077	0.122	0.149	0.107	0.168	0.225

Table 6: Summary of the dominant status of the major malacofauna taxonomic groups at the Epe lagoon; Values are in percentages, Dominant: ≥15%, subdominant: =5% < 15%, Rare: < 5%

	Study stations							
	A	B	C	D	E	F	G	H
Neritidae	38.89**	13.9*	-	9.26*	9.26*	11.11*	22.22**	
Melaniidae	1.83	0.799	0.1138	8.22*	32.19**	32.53**	21.01**	14.61*
Potamididae	1.74	5.23*	6.40*	18.6**	24.4**	6.97*	5.81*	30.8**
Tellinidae	27.2**	29.6**	4.75	16.7**	11.1	1.65	4.94	4.11
Ostreidae	1.34	-	-	-	-	-	5.12*	-
Mytilidae	-	16.54**	1.09	-	-	3.56	-	1.77
Veneridae	-	0.86	-	-	-	0.57	0.79	-

KEY: **: Dominant; *: Subdominant

DISCUSSION

The physico-chemical characteristics of the sediment at the eight study sites of the Epe lagoon suggest a homogenous environment with slight local variations reflecting similarity between the river month sites compared to the settlement sites. Details of the seasonality and spatial fluctuations in the sediment physico-chemical characteristics of Epe lagoon is discussed in another publication in-press.

The abundance, composition, distribution and diversity of sediment dwelling molluscs can be affected by a wide range of factors including physic-chemical characteristics of water and sediment, availability of food and nature of substrate (Bishop, 1973). Nature of

substratum and salinity of the overlying water have been reported to be of vital importance in the distribution and composition of benthic macroinvertebrates in the aquatic habitat (Webb 1958; Oyenekan, 1987; Brown and Oyenekan, 1998; Brown, 1991). However, determining the precise contribution of each factor influencing the abundance of a particular species is difficult (Victor and Ogbeibu, 1985).

The malacofauna community of the Epe lagoon recorded in this study was dominated by gastropods and similar to that reported for Lagos lagoon (Oyenekan, 1975; Brown and Oyenekan, 1998; Edokpayi and Nkwoji, 2007). This may be attributed to seemingly closely relate physic-chemical characteristics of the water and sediment of both lagoons which share a number of factors both anthropogenic and natural in common. An interesting observation in this study was the occurrence of *Neritina kuramoensis* (Yoloye and Adegoke, 1977) in Epe lagoon. This reflects a gradual migration of the newly described species once dominant in the Kuramo waters (an enclosed lagoon) where it got its name from, to the Lagos and Epe lagoons. Recent findings have shown that the species no longer inhabit the Kuramo waters due to habitat modification as a result of anthropogenic perturbation (Edokpayi *et al*., 2004). The occurrence of the species in stations E, F, G and H which are brackish water sites because of their closeness to the Lagos lagoon in relation to its absence from the other sites which are freshwater, further confirms the report of Edokpayi *et al*. (2004) that *N. Kuramoensis* is a brackish water species. The gastropod species composition dominated by *Pachymelania aurita* was also similar to that reported for the Lagos lagoon.

The bivalve molluscs were dominated by *Macoma cumana* which was also the most widely distributed as it was recorded in all the study sites. This species have been reported to be tolerant to wide variations in physico-chemical characteristics of water but relatively sensitive to siltation resulting from organic pollution (Edokpayi and Nkwoji, 2007). The occurrence of the species at all sites in the Epe lagoon could indicate that the perturbation stress in the lagoon is not organic. The subdominant status of *Crassostrea gasar* (Osteidae) at station G (Palaver Island) is because of the dense fringing mangrove vegetation at this site. The stem and prop roots of this mangrove provide suitable encrusting surface for the bivalve.

Generally, as reported for phytoplankton of Epe lagoon (Nwankwo, 1998), the malacofauna species diversity was similarly low and within the range recorded for water bodies impacted by anthropogenic perturbations (Victor and Onomivbori, 2001, Edokpayi, *et al*., 2004).

CONCLUSION

The West African coastal waters like the Epe lagoon are heavily exploited for commercial, industrial, domestic and recreational purposes. Continuous dredging and sand mining are major features of most of the lagoons. These activities alter the bottom sediment characteristics and the general stability of these ecosystems. It is therefore necessary that biodiversity monitoring programme be developed to check this ever-increasing threat in order to protect the coastal ecosystem.

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