Journal of Biological Sciences 6 (5): 936-940, 2006
ISSN 1727-3048

Biodiversity of Gutters in Lagos Metropolis, Nigeria

J.K. Saliu And O.J. Eruteya
Department of Zoology, University of Lagos, Akoka, Lagos, Nigeria

Abstract: A survey of the gutters in Lagos metropolis was conducted to determine the biodiversity of gutters and possibility of secondary contamination of the bursted pipes embedded within them. The biodiversity indicated that only species tolerant to organic pollution colonized the habitat. The macrofauna was represented by six taxa in order of dominance Diptera > Poecillidae > Annelida > Mollusca > Ephemeroptera > Trichoptera. The phytoplankton were represented by 17 taxa belonging to five major groups, Bacillariophyta > Chlorophyta > Cyanophyta > Dinophyta > Euglenophyta. The zooplankton was represented by a total of 18 taxa belonging to 4 major groups Cladocera > Copepoda > Rotifera > Annelida. Secondary contamination of water occurred as very minute traces of the fauna were found in the domestic water supply. It is hoped that the practice of laying pipes in gutters will be discontinued as it can endanger the health of the consumers.

Key words: Biodiversity, gutters, secondary contamination, lagos, Nigeria

INTRODUCTION

Lagos is a city without a central sewage system. The untreated wastes generated in homes, markets and industries are disposed indiscriminately into open gutters. The open gutter system is the general mode of taking waste water to sinks or local disposal sites. These gutters though made primarily for sewage transport, have become sites of secondary pollution for bursted municipal water pipes embedded within them. Nwankwo (1995) observed the same trend in storm water channels in Lagos metropolis which primarily were conduits for floodwater, subsequently became sites of high organic pollution with a rich bloom of euglenoids.

Sewage has been implicated in the spread of infectious disease, because they harbour pathogenic organisms (Akpata and Ekundayo, 1978) and lead to planktonic blooms, especially blue green algae (Reynolds 1984). Such blooms have a detrimental effect on the domestic and recreational use of water (Bryant, 1994). *Anabaena* and *Oscillatoria* are recognized as potential toxic organisms because they produce anatoxin-a and their blooms in drinking water is of great importance. This study intends to identify the biodiversity of selected drainage systems in Lagos metropolis and to investigate the possible intrusion of such into our public water supply.

MATERIALS AND METHODS

Eight Local government areas were selected randomly for studies (Agege, Alimosho, Ikeja, Apapa, Yaba, Mushin, Ikoyi and Surulere). Within each local government, 3 streets with high frequency of occurrence of bursted service pipes embedded in gutters were sampled.

At each site, water emerging from the bursted pipes and water from the surrounding gutters were collected weekly from July-October 2001. The water samples were collected in 2 L white plastic kegs and analysed for heavy metals such as Iron, Magnesium, Lead and Cadmium (APHA, 1985). The nitrate and sulphate content of the gutter water and bursted pipes were analysed by the Hanna multi-ion parameter analyzer and turbidimetric method, respectively.

Plankton and invertebrate samples were taken from the gutters. The plankton samples were collected with the aid of plankton net of mesh size 55 μm. They were subsequently preserved in 4% formalin and identified using keys by Ward and Whipple (1950), Needham and Needham (1962). The plankton count was done using a 1ml sledgewick rafter count cell. The diversity index was determined as described by Shannon and Weaver (1963) and the species richness as described by Margalef (1951). The invertebrates were collected with the aid of an improvised scoop and the sediments sieved with a 0.5mm mesh size sieve. The sediment was sorted and invertebrates preserved in 4% formalin buffered with borax and identified using keys by Quigley (1977).

RESULTS

Salts such as phosphate, nitrate sulphate and chloride and metals such as calcium and iron influenced the biodiversity of the fauna (Fig. 1 and 2).

Corresponding Author: J.K. Saliu, Department of Zoology, University of Lagos, Akoka, Lagos, Nigeria

Table 1: The mean values of macro-fauna sampled in gutter water in lagos metropolis Nigeria

Taxa	Agege I	Alimosho II	Ikeja III	Apapa IV	Yaba V	Mushin VI	Ikoyi VII	Surulere VIII	Total	Abundance (%)
Annelida										
Hirudo sp. (leeches)	6	2	1	-	1	2	-	1	97	4.34
Tubifex sp. (freshwater worms)	2	-	1	-	2	1	-	2		
Oligochae sp. (Earth worms)	15	8	10	7	4	12	6	14		
Mollusca										
Physia sp.	7	2	3	1	2	1	-	3	19	0.85
Diptera										
Chironomus sp.	15	8	10	6	2	1	2	4	1361	60.95
Mosquitoes	60	120	110	88	66	51	40	85		
Mosquitoes larvae	140	85	90	75	105	50	48	81		
Eristalis sp.	4	2	4	-	-	1	5	3		
Trichoptera										
Caddis fly	2	1	-	-	1	1	1	2	8	0.36
Ephemeroptera										
Ephemeralla sp.	-	-	1	-	2	-	2	1		
Baetidae sp.	1	-	-	1	-	2	1	-	11	0.49
Poeciliidae	151	135	120	96	82	60	51	42	737	33.01
NO. of taxa	11	9	10	7	10	11	9	11	2.33	
No. of individual	403	363	350	274	267	182	156	238		
Species diversity	0.992	1.004	1.213	1.002	0.996	1.03	0.9996	0.9980		
Species richness	4.85	3.13	3.54	2.46	3.7	4.42	3.65	4.20		

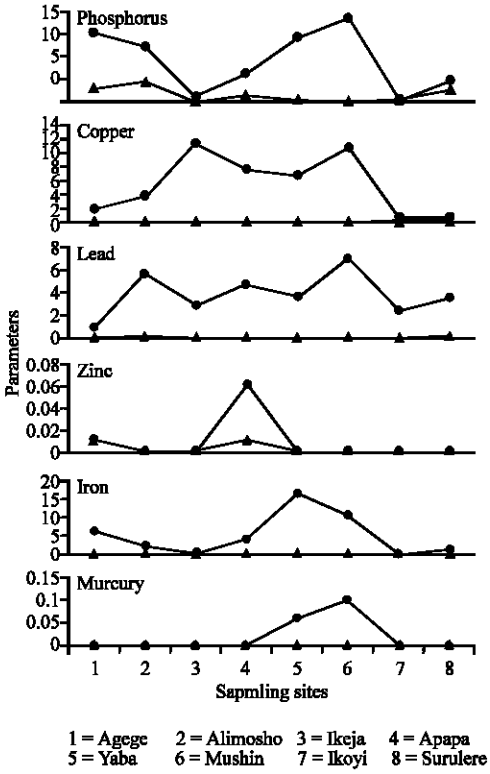

Fig. 1a: Metal and salt content of gutter (●) and tap (▲) water in selected areas of Lagos metropolis, Nigeria

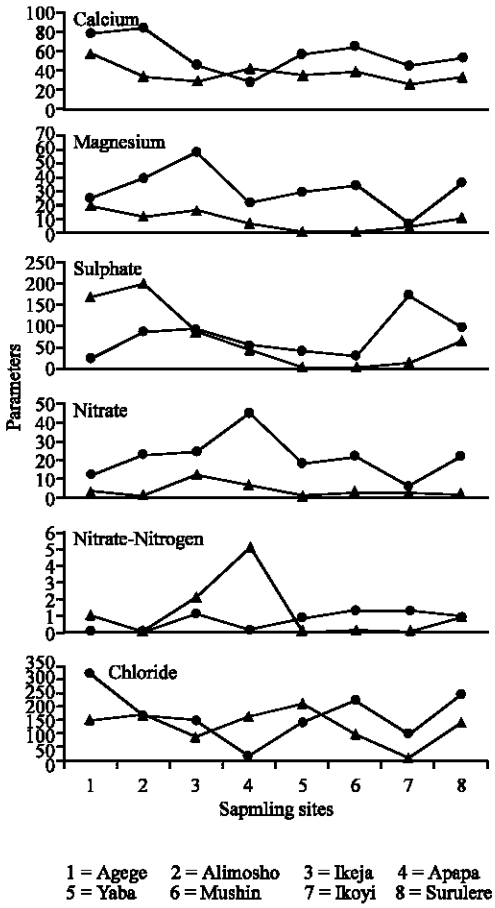

Fig. 1b: Metal and Salt content of gutter (●) and tap (▲) water in selected areas of Lagos metropolis, Nigeria

The macrofauna found in the gutters sampled in Lagos metropolis were represented by six taxa, Annelida, mollusca, diptera, trichoptera, ephemeroptera and poecillidae (Table 1). The most abundant taxa were the

Table 2: The abundance and distribution of phytoplankton in selected gutters in lagos metropolis, Nigeria

Taxa	Agege I	Alimosho II	Ikeja III	Apapa IV	Yaba V	Mushin VI	Ikoyi VII	Surulere VIII	Total	Abundance (%)
Chlorophyta										
Closterium gracile	2	-	1	2	6	1	1	-	83	26.6
Oedogonium sp	1	-	2	1	-	2	2	1		
Spirogyra sp	2	8	7	4	6	3	2	4		
Volvox africana	3	2	-	-	1	2	-	3		
Desmidium sp.	-	-	-	1	2	3	2	4		
Dinophyta										
Peridinium sp.	1	2	-	3	5	-	2	4	18	5.77
Euglenophyta										
Phacus sp.	2	-	-	-	-	-	-	-	02	0.64
Cyanophyta										
Microcystis sp.	2	4	5	1	4	2	3	6	56	17.95
Oscillatoria sp.	5	1	2	3	6	1	-	4		
Microcystis natan	2	3	-	1	-	-	-	1		
Bacillariophyta										
Aulocosira g.	2	1	4	5	-	6	1	1	152	49.09
Coscinodiscus o.	5	-	2	1	2	-	2	2		
Navicula sp.	4	1	1	3	4	2	1	-		
Nitzschia sp.	3	3	3	1	6	1	3	1		
Melosira sp.	1	5	1	-	5	3	4	5		
Fragilaria sp.	6	4	2	6	2	6	-	6		
Gomphonema sp.	1	5	6	-	5	1	3	4		
No. of taxa	16	12	12	13	13	14	12	14	311	
No. of individual	42	39	36	32	54	34	28	46		
Species diversity	0.9912	0.994	1.002	0.9584	1.004	0.994	0.9789	1.002		
Species richness	9.242	6.914	7.069	7.973	6.895	8.895	7.602	7.817		

Table 3: The abundance and distribution of zooplankton in selected gutters in lagos metropolis, Nigeria

Taxa ($\times 10^3$ Cell m^{-3})	Agege I	Alimosho II	Ikeja III	Apapa IV	Yaba V	Mushin VI	Ikoyi VII	Surulere VIII	Total	Abundance (%)
Polychaete larva										
Polychaete larvae	4	2	1	-	2	-	-	1	11	2.45
Rotifera										
Monostyla	4	1	2	1	1	3	-	1	73	16.26
Branchionus sp	3	-	-	1	4	2	1	3		
Asplanchna sp.	1	1	-	2	1	3	4	5		
Filinia sp.	2	2	3	1	1	1	-	1		
Keratella tropical	5	-	2	1	3	4	1	2		
Copepoda										
Tropodiaptomus sp	10	3	6	1	4	5	-	3	106	23.61
Eucyclops macurunus	15	4	7	8	1	4	1	4		
Halicyclops sp	-	1	2	-	-	-	-	1		
Troglodyte sp	-	-	-	-	-	-	-	-		
Diaptomus sp	3	-	1	-	1	-	-	2		
Paracalanus scotti	6	4	2	1	-	1	1	4		
Cladocera										
Podon sp	-	-	-	-	1	-	1	2	259	57.68
Daphnia sp	8	12	1	6	4	3	2	10		
Alona sp	2	4	5	1	4	5	2	4		
Macrothrix spinosa	17	1	-	-	12	16	-	-		
Bosminopsis deitersi	16	8	14	22	30	12	6	13		
Bosmina longirostri	4	-	-	-	2	4	5	-		
No. of taxa	15	12	12	11	14	13	10	14	449	
No. of individual	10	44	46	45	71	63	24	56		
Species diversity	1	1.002	0.996	0.9523	0.998	0.8742	1.006	0.9686		
Species richness	7000	6.707	6.704	6.045	5.042	6.67	6.521	7.437		

dipteran and the poecillidae accounting for 60.95 and 33.01%. The ephemeropterans and the trichopterans were the least abundant taxa with percentage abundance of 0.49 and 0.36%, respectively. The gutters sampled in Agege local government had the highest number of macrofauna (403) with species diversity 0.9920 and species richness 4.85. Ikoyi station had the least number of individuals (156) with species diversity 0.9996 and species richness 3.65. The tap water samples did not contain any of the macrofauna.

The phytoplankton was represented by 17 taxa belonging to five major groups namely Chlorophyta,

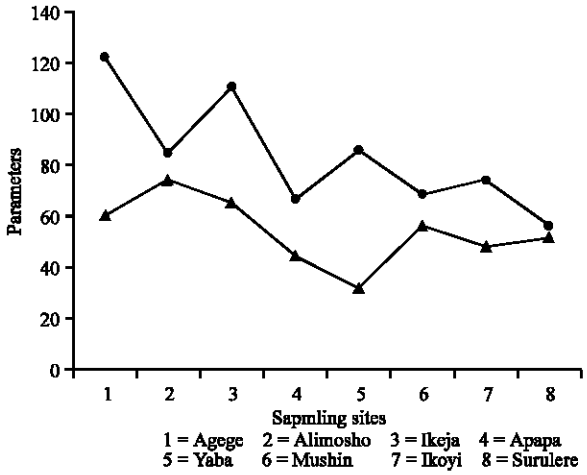

Fig. 2: Total Hardness of gutter (●) and tap (▲) waters from selected areas of Lagos metropolis, Nigeria

dinophyta, euglenophyta and bacillariophyta (Table 2). The dominant group was the bacillariophyta (49.09%) while the euglenophyta was the least abundant (0.64%). However, the green algae (26.60%) and the blue green algae (17.95%) were predominantly represented in the gutters. The highest number of phytoplankton taxa was recorded at the Agege local government area, while Ikoyi, Alimosho and Ikeja had the lowest phytoplankton taxa. Traces of phytoplankton from the bacillariophyta green algae and blue algae were found in the tap water.

The zooplankton was represented by a total of eighteen taxa belonging to four major zooplankton groups such as polychaeta, rotifera, copepoda and cladocera (Table 3). The cladocera was the most dominant of the zooplankton community (57.68%) while the polychaete larva was the least dominant (2.45%).

The dominant cladoceran species were *Bosmina dietersi* (121), *Daphnia* (46) and *Alona* (27), Copepods like *Eucyclops macrurus* (44) and *Tropodiaptomus* (32) were also predominant. Traces of the dominant cladocerans and copepods were found in the tap water analysed. Gutters in Agege local government had the highest number of taxa while Ikoyi had the lowest.

DISCUSSION

The composition of the fauna indicated that only species tolerant to organic pollution existed in the gutters. Nwankwo and Akinsoji, 1988 identified *Euglena*, *Phacus* (Euglenoids), *Cladophora* (Green alga), *Navicula*, *Nitzschia* and *Synedra* (diatoms) as species known to be tolerant to organic pollution. These were the same sort of plankton found within the gutters.

The major factor determining the diversity and abundance of the fauna within the gutter is the chemical constituent of the sewage flowing through the gutter. Sewage is composed primarily of organic matter and water and a variety of contaminants which are potentially hazardous such as oil and grease, ammonia, pesticides, heavy metals, bacteria and viruses. The salts and heavy metals within the sewage (especially calcium, iron, nitrate, phosphate, sulphate and chloride) not only influenced the diversity and abundance of the fauna but also their distribution within the various gutters.

Reuter and Petersen (1987) reported that some species of cyanobacteria have higher requirements of trace elements as compared with eukaryotic phytoplanktons. Some researchers have found some invertebrates and algae have preferred chloride concentrations and that increase in chloride concentrations could influence the mixture of species that occurs (Paul, 2006).

Although, not on a large scale, traces of secondary infection, existed in the domestic water supply, from the bursted pipes embedded within the gutters. This is a potential health hazard to the consumers of such domestic water supply. Nwankwo (1993) reported the excessive growth of *M. aeruginosa* in part of Ogun river at Iju, which affected the water supply and impacted odour and taste to the water supply. It is hoped that this practice of laying pipes in gutters will be discontinued as it is potential source of infection to consumers.

REFERENCES

Akpata, T.V.I. and J.A. Ekundayo, 1978. Faecal pollution of the Lagos lagoon. Nig. J. Sci., 12: 39-53.

American Public Health Association (APHA), 1985. Standard Methods of the Examination of Waste and Waste Water 16th Edn. American Public Health Association. Washignton, pp: 1134.

Bryant, D.A., 1994. The Molecular Biology of Cyanobacteria. Kluwer, pp: 881.

Margalef, R., 1951. Diversidad de espicces en las Communidades naturals. Publ. Inst. Biol. Applied (Barcelona), 9: 5-27.

Needham, J.G. and P.B. Needham, 1962. A Guide to the Study of Freshwater Biology, 5th Edn. San-Francisco. Constable and Limited. London, pp: 96.

Nwankwo, D.I., 1993. Cyanobacteria bloom species in coastal waters of South Western, Nigeria. Arch. Hydrobiol. Suppl., 90: 553-542.

Nwankwo, D.I., 1995. Euglenoids of some polluted storm water channels in Lagos, Nigeria. Trop. Freshwater Biol., 4: 29-39.

Paul, M.G., 2006. Hold the salt: The impact of de-icing and other chloride containing compounds on lakes. Lake Tides, 31: 4.

Quigley, S.M., 1977. Invertebrates of Streams and Rivers. A Key to Identification. Edwards. Arnold. London, pp: 77.

Reuter, J.G. and R.R. Petersen, 1987. Micronutrient effects on cyanobacterial growth and physiology. New Zeland. J. Mar. Freshwater Res., 21: 435-445.

Reynolds, C.S., 1984. The Ecology of Freshwater Phytoplankton. Cambridge, pp: 384.

Shannon, E. and W. Weaver, 1963. The Mathematical Theory of Communication. University of Illinois Press. Uvbane.

Ward, H.B. and G.C. Whipple, 1950. Freshwater Biology. John Wiley, New York, pp: 650.