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# On Zooplankton Dynamics of Majidun River, Lagos State, Nigeria.

By

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## ABSTRACT

Majidun River is used for artisanal fishing, transportation and domestic activities in Ikorodu, Lagos State. At the lower course, the river receives eluate from solid wastes dumped at the shore; this coupled with sand mining could impact adversely on the biota and their environment. There is dearth of information on their plankton dynamics. The aim of this study was to investigate the zooplankton composition of Majidun River in order to provide information for effective management. Monthly sampling was carried out from three randomly selected sites on Majidun River (from September 2019 to August, 2020. zooplankton samples were collected with plankton net of 55µm mesh size. The net was towed horizontally along each sampling point at a distance of 20m to 30m for an approximate speed, just below the water surface to collect zooplankton. Zooplankton samples collected were immediately fixed and preserved in 4% formalin solution in the field according to Onyema (2007). Keys provided by Prescott (1954), Whitford and Schumacher (1973), Needham and Needham (1962), Mason (1991), Jeje and Fernando (1986; 1991), APHA/AWWA/WEF (1998) and Nwankwo (2004) were used for identification of the

plankton species. The total number of organisms per millilitre for each sample was determined by simple calculation after counting the number in the 0.1mL sub-sample examined.

Ke words: zooplankton dynamics, Majidun River and Reservoir.

## INTRODUCTION

Rivers are longitudinal reactions that store, transform and transfer organic matter and nutrients to adjacent flood plains, groundwater, lakes and coasts and to the atmosphere (Battin *et al.*, 2009, Benstead and Leigh, 2012). These water bodies are often used for the disposal of industrial and anthropogenic effluents on the wrong assumption that aquatic ecosystems have self-purifying ability (Fakayode, 2005; Adeogun *et al*., 2011). The explosion in population density, urbanization and industrialization had profound impact on human life and aquatic environment in terms of quantity and quality (Herschy, 1999). More so seasonal and climatic changes affect the quality and physico-chemistry of surface water. The increased demand for water as a consequence of population growth, agricultural and industrial development had been accompanied by research oriented towards the definition of criteria and guide for water quality (W.H.O, 1966).

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**The objectives of this study are to**:

1. determine the zooplankton composition of Majidun River.

2. assessment of zooplankton abundance of Majidun River.

**Justification**

Majidun River is used for artisanal fishing, sand-mining, transportation and domestic purposes. It is a dump site for domestic and industrial wastes. The condition is worsened by the proliferation of urban and industrial establishments along the shores of the river. Despite the increasing anthropogenic influences occasioned by the rapid development of Majidun town and its environs in recent times, there is dearth of information regarding its zooplankton dynamics. It is also an opportunity to study the zooplankton composition of Majidun River as part of the important baseline information, which can be utilized as a platform for impacts assessment, planning, and implementation of policies for monitoring and effective development.

## Materials and Methods

### Study Area

Majidun River is located in Ikorodu Local Government Area, Lagos State. It lies within longitude 3.22° and 3.29°E, and latitude 6.39° and 6.41°N of Nigeria coastline (Fig. 3.1 and 3.2). It has a catchment area of 2.9 km2 with its major source from River Owuru in Ogun State and flows into Lagos Lagoon at Ipakodo where it receives tidal waters from the Lagoon (Fig. 3.3) Majidun River is characterized by a humid tropical climate with an annual average Relative Humidity of 80% and atmospheric temperature ranges between 26°C and 29°C (Olaniyan, 1975). The river has a width range of about 100-150 m. The water depth increase sharply towards the mid-channel zone to a range of 15m and 25m, probably due to the sand mining activities in the area. The annual rainfall is 4021mm with a peak in July-August; least rainfall occurs between December and February (Hastenrath, 1985). The southwest trade winds, bearing rains from the Atlantic Ocean is predominant.

**Vegetation** The vegetation is characterized by floating higher plants such as duckweed (*Lemna* spp.) water lettuce (*Pistia*) and water hyacinth (*Eichhornia crassipes*). Rooted trees with dense undergrowth of shrubs such as *Rhizophora racemosa, Avicennia germinans, Mariscus alteriforlus* and *Paspalum orbiquilare* are also typical of its flora in Majidun River.

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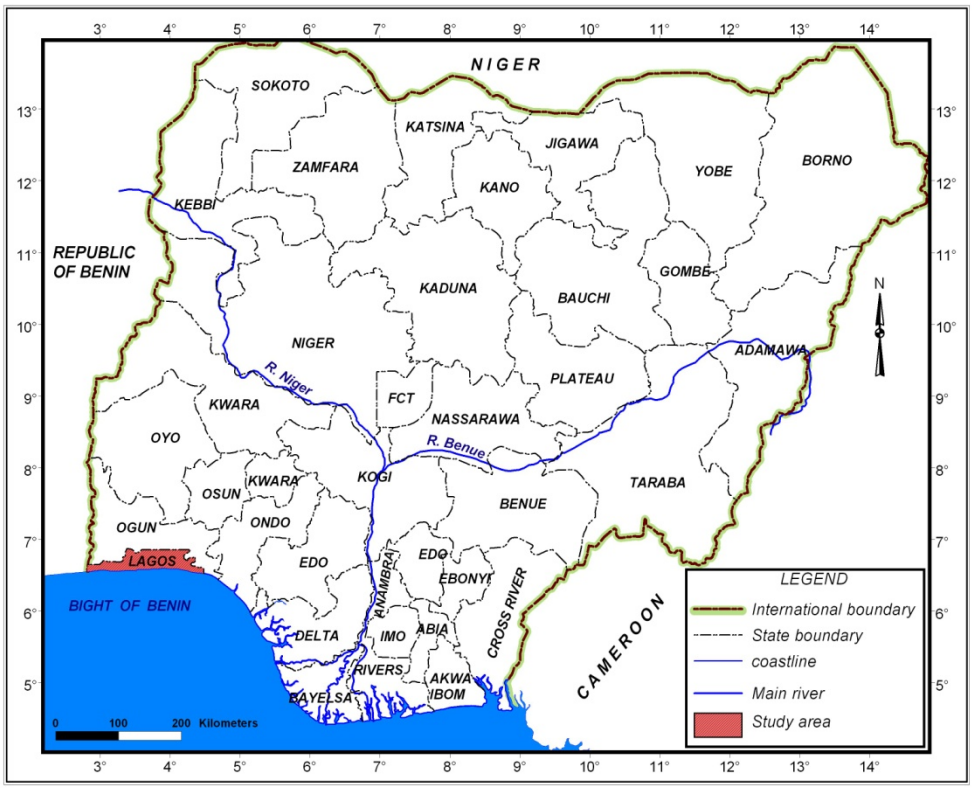


Fig 3.1: Map of Nigeria showing Lagos State ( )

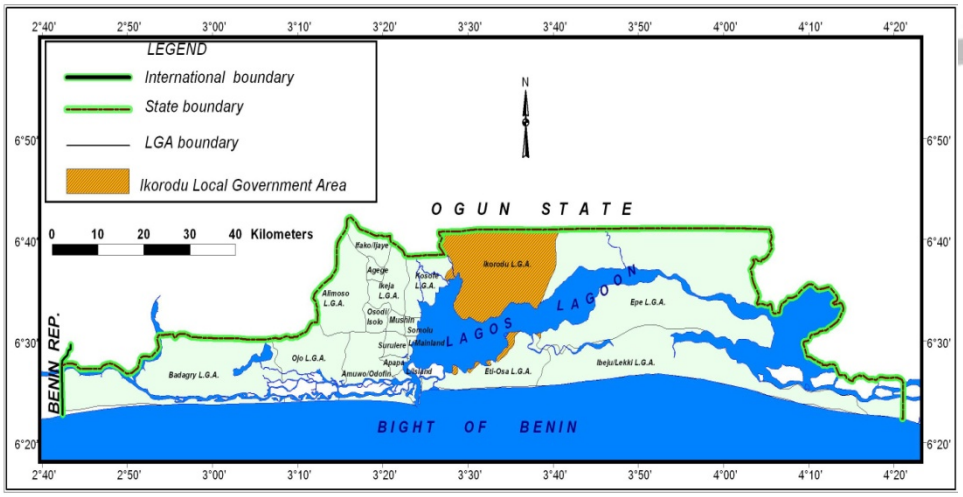


Fig 3.2: Map of Lagos State showing Ikorodu Local Government a ( )

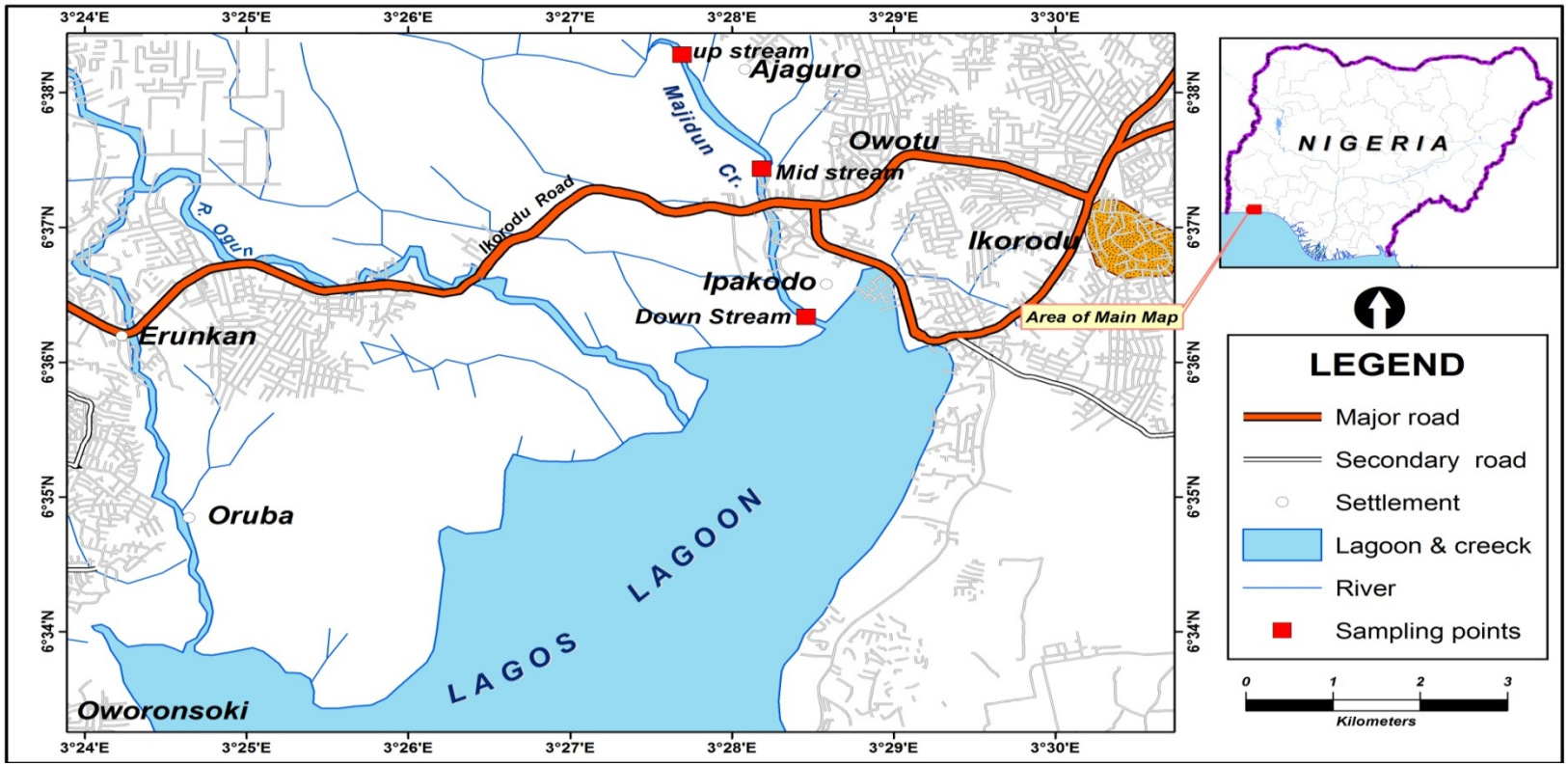


Fig 3.3: Map of Ikorodu Local Government showing Majidun River and Sampling Stations

**Sampling stations**

Three sampling stations (1-3) were established and studied (Fig 3.3) represent the Upstream Station the Midstream Station and the downstream station. Upstream station to Midstream stations were about 1500m, From Midstream station to downstream station were about 1000m (Fig 3.3).

**Collection of Samples and Analyses**

Zooplankton samples were collected with plankton net of 55µm mesh size. The net was towed horizontally along each sampling point at a distance of 20m to 30m for an approximate speed, just below the water surface to collect zooplankton. zooplankton samples collected were immediately fixed and preserved in 4% formalin solution in the field according to Onyema (2007). The samples were transported to the laboratory and kept until needed for analyses. The preserved zooplankton samples were allowed to settle first and 0.1mL of the sample was withdrawn using a pipette and observed under the microscope. Keys provided by Prescott (1954), Whitford and Schumacher (1973), Needham and Needham (1962), Mason (1991), Jeje and Fernando (1986; 1991), APHA/AWWA/WEF (1998) and Nwankwo (2004) were used for identification of the plankton species. Laboratory analyses were carried out in the Department of Zoology, Obafemi Awolowo University, Ile-Ife, Osun State and Multidisciplinary Central Research Laboratory, O.A.U, Ile-Ife.

**Statistical analysis**

Microsoft Excel 2007 (Microsoft Corporation 1985-2007) was used for graphical illustrations. Shannon-Wierner diversity index and evenness were determined using PAST software. zooplankton abundance were determined using the one-way Analysis of Variance (ANOVA) and Student's t-test on SPSS software.

**RESULTS.**

**Table 1: A checklist of Zooplankton organisms recorded from Majidun River from September, 2019 to August, 2020.**

**Rotifera**

1. *Asplanchna brightwelli* Gosse
2. *A. girodideguerne* Leydig
3. *A. herricki* De Guerne

4. *A. priondonta* Gosse
5. *Brachionus bulla*
6. *B. falcatus. Zacharias*
7. *Filinia longiseta.* Ehrenberg
8. *F. opoliensis.* Zacharias
9. *Gloetheca membranacea*
10. *Horaella brehmi Donner*
12. *Lecane tenuiseta.* Turner
13. *L bulla* Gosse
14. *Lepadella patella* Muller
15. *Testudinella greeni kosti*
16. *Trichocerca gracilis*
17. *T. iernis*
18. *T. musculus*
19. *Rotaria execulis*
20. *R. hepatica*

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**Copepoda**

21. Copepod larva
22. *Euclanis dilatat* Ehrenberg
23. *Eucyclops macrurus*
24. *Pseudocalanus elongatus*

**Cladocera**

25. *Bosmina longirostris* (O.E Muller)
26. *Podon leucarti*
27. *Ceriodaphinia cornuta*
28. *Moina micrura*

**Zooplankton composition**

The zooplankton species encountered in Majidun River during the period of study was made up of twenty-eight species belonging to three groups; Rotifera, Copepoda and Cladocera

(Table 1). The Rotifera were represented by twenty species, four species of Copepoda and four species of Cladocera.

*Asplanchna brigtwelli* recorded the highest percentage abundance (4.33) amongst Rotifera while, *Gloetheca membranescea* recorded the least percentage (2.16) *Eucyclops macrurus* and *Pseudocalanus elongates* the highest percentage abundance respectively amongst Copepoda (Table 2).

*Ceriodaphina cornuta* recorded the highest percentage while amongst Cladocera while *Bosina longirostris* and *Moina micrura* recorded (2.50) respectively (Table 2).

The Rotifera dry season abundance (3373 Org/L) was higher than the rainy season (3025 Org/L) Figure 1.

The Copepoda rainy season abundance (475 Org/L) was higher than dry season (311 Org/L) Figure 1.

The Cladocera dry season abundance (489 Org/L) was higher than rainy season (476 Org/L) Figure 1.

**Spatial variations in zooplankton abundance in Majidun River**

The highest abundance for zooplankton was recorded in downstream station (226 Org/L), while the lowest value (146 Org/L) was recorded for upstream station during the study period (Table 3).

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**Diversity of zooplankton in Majidun River.**

The highest Margalef (d) value (0.54), Shannon (1.16) and Evenness (0.79) were recorded upstream, while the lowest value for d (0.50) was obtained for downstream. The lowest H (1.15) and E (0.83) were obtained for midstream station during the study period (Table 4).

**Table 2: Relative abundance of Zooplankton organisms encountered in Majidun River.**

| SPECIES | No of Org/$m^3$ | Percentage Abundance (%) |
|---|---|---|
| **Rotifera** | | |
| *Asplanchna brightwelli* | 260 | 4.33** |
| *A. girodideguerne* | 251 | 4.18 |
| *A. herricki* | 170 | 2.83 |
| *A. priondonta* | 200 | 3.33 |
| *Branchionus bulla* | 230 | 3.83 |
| *B. falcatus* | 220 | 3.67 |

| | | |
|---|---|---|
| *Ceratotrocha cornigera* | 200 | 3.33 |
| *Filinia longiseta* | 242 | 4.03 |
| *F. opoliensis* | 182 | 3.03 |
| *Gloetheca membranacea* | 130 | 2.16 * |
| *Horaella brehmi* Donner | 172 | 2.87 |
| *Lecane tenuiseta* | 240 | 4.00 |
| *L. bulla* | 191 | 3.18 |
| *Lepadella patella* | 230 | 3.83 |
| *Testudinella greeni* kosti | 250 | 4.17 |
| *Trichocerca gracilis* | 245 | 4.08 |
| *T .iernis* | 230 | 3.83 |
| *T. musculus* | 190 | 4.17 |
| *Rotaria execulis* | 205 | 3.42 |
| *R. hepatica* | 202 | 3.37 |
| TOTAL | **4661** | |
| **Copepoda** | | |
| *Eucyclops macrurus* | 260 | 4.33** |
| *Pseudocalanus elongates* | 260 | 4.33** |
| TOTAL | **520** | |
| **Cladocera** | | |
| *Bosmina longirostris* (O.E Muller) | 150 | 2.50 |
| *Podon leucarti* | 250 | 4.17 |
| *Ceriodaphinia cornuta* | 260 | 4.33** |
| *Moina micrura* | 150 | 2.50 |
| TOTAL | **810** | |
| GRAND TOTAL | 5991 | |

***=least abundance **=highest abundance**

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**Table 3: Diversity and Composition of Zooplankton from September, 2019 to August, 2020**

| **Zooplankton** | **Upstream station** | **Midstream station** | **Downstream station** |
|---|---|---|---|
| Rotifera | 102 | 140 | 148 |
| Copepoda | 20 | 35 | 48 |
| Cladocera | 24 | 25 | 30 |
| **Total Abundance** | 146 | 200 | 226 |
| **Number of Taxa** | 38 | 38 | 38 |
| **Margalef (d)** | 0.54 | 0.55 | 0.50 |
| **Shannon (H)** | 1.16 | 1.15 | 1.20 |
| **Evenness(E)** | 0.79 | 0.83 | 0.78 |

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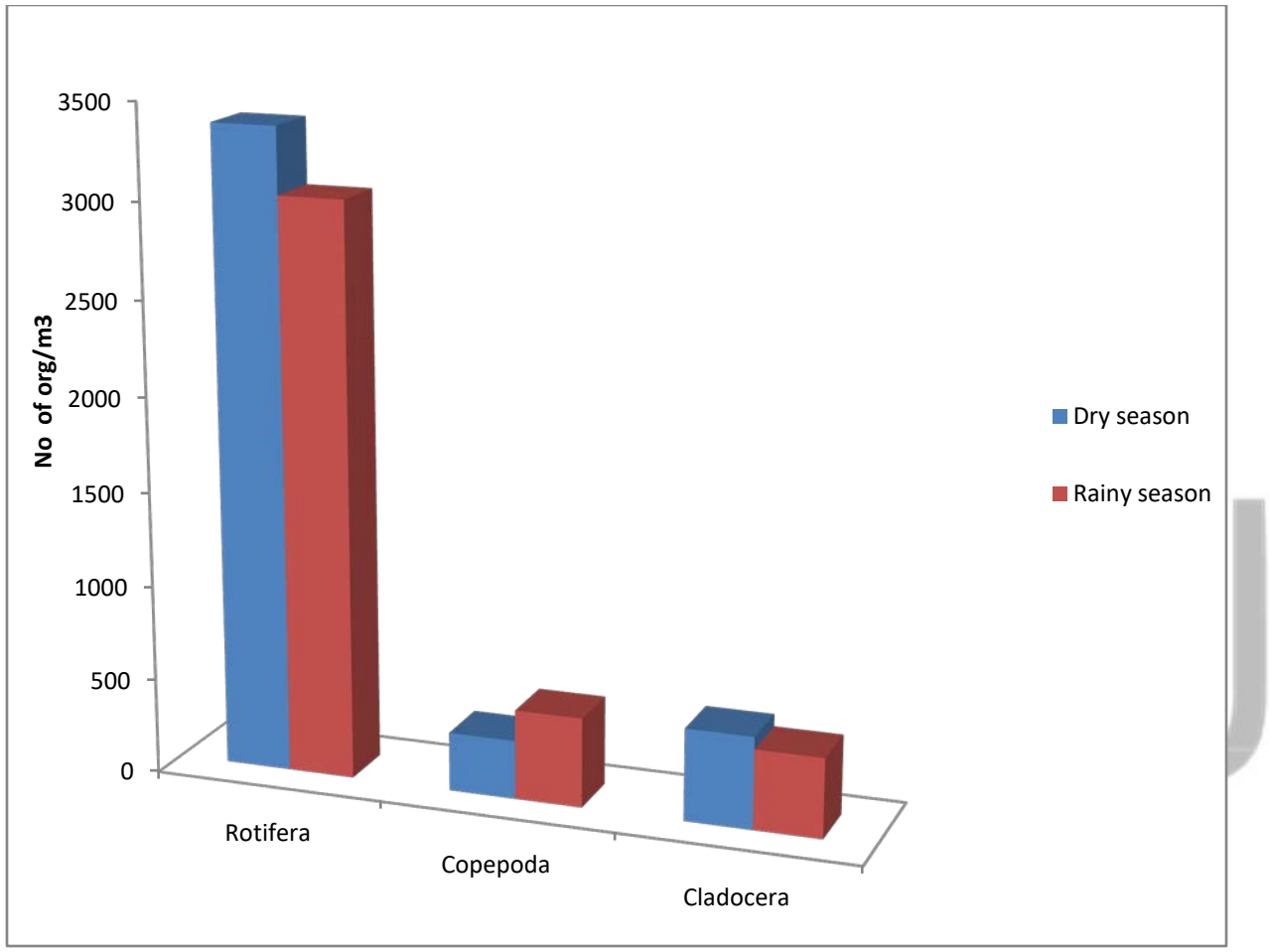


**Figure 1: Relative abundance of zooplankton in the dry and rainy season in Majidun River**

**Discussion.**

**Zooplankton**

The zooplankton taxa, namely Rotifera, Copepoda and Cladocera, identified in Majidun River have been variously reported from different Nigerian Rivers (Olaniyan, 1957; Imevbore, 1965; Egborge 1970; Bidwell and Clark, 1977; Jeje and Fernado 1992; Egborge 1994a, Ovie, 1995; Akinbuwa, 1999; Aguigwo 1997; Ovie 1997; Imoobe and Egborge, 1997; Yakubu *et al.*, 1998; Ogbeibu and Obanor, 2002; Ibrahim, 2009; Nkwoji *et al.*, 2010; Olaniyan, 2010; Nkwoji *et al.*, 2010; Ayeni *et al*., 2011; Ude *et al.*, 2011; Ladipo *et al*., 2011; and Ezeribe *et al*., 2012). This study recorded 38 species of zooplankton, which is higher than 6 species recorded by Olaleye and Adedeji (2005) in palm oil effluent-impacted area in Oluwa River, Ondo State; 19 species recorded by Ogbuagu and Ayoade (2012) in Imo River; 30 species reported by Nkwoji *et al*. (2010) in Lagos Lagoon, but less than 39 species recorded by Esenowo and Ugwumba (2010) in Majidun River in Lagos State. This present observation of higher zooplankton species possibly indicates the presence of organic wastes deposition in Majidun River, which results in increase in phytoplankton production, consequently, zooplankton productivity.

The predominance of rotifers in the river in terms of species number and numerical abundance has been attributed to the fact that rotifers evolved from fresh waters (Green, 1960; Egborge, 1977 and Segers, 1993). Rotifers generally are adapted to warm water, occurring mostly in tropical water bodies, with high temperatures. The predominance of rotifers in some inland freshwaters has also been reported by Egborge (1990), in Osun River; Jeje and Fernando (1992), in Sokoto River; and Ayodele and Adeniyi (2006), in River Osun. The abundance of the genera *Brachionus*, *Asplanchna* and *Filinia* showed that the rotifer-fauna was made up of a tropical assemblage (Jeje and Fernando, 1986). The predominance of the Brachionidae could, however, be attributed to their widespread geographical distribution and omnivorous nutrition of most of the members (Goldman and Hornes, 1983).

The increasing order of diversity and evenness are Rotifera > Copepoda > Cladocera in the upstream, midstream and downstream, respectively. This same order was observed in both seasons. This observation is similar to those of Oben (2000) in three man-made lakes in Ibadan, Nigeria.

Seasonal variation in the abundance of zooplankton from Majidun River in this study showed higher abundance of Rotifera and Cladocera during the dry season. Most rotifers species

have been found to thrive well in warm-water conditions with high temperatures, which is usually characteristic of most Afro-tropical waters in the dry season (Segers, 1993; Kutikova, 2002)

## CONCLUSION AND RECOMMENDATIONS

This study on zooplankton dynamics is considered important which can be utilized as a platform for impact assessment, planning and implementation of policies for monitoring and effective development of Majidun River.

The downstream of Majidun River which was slightly polluted confirmed that the residents' people were without toilet facilities but all their faeces and other anthropogenic wastes were dropped into the river. Thus, the common practice especially in Nigeria and other developing nations of using natural water bodies as disposal media for anthropogenic and faecal wastes poses a serious threat to the aquatic ecosystems.

The need for further evaluation of techniques is highlighted, and the need for national and international criteria for water quality is reinforced.

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