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Study of zooplankton distributions in two contiguous coastal water bodies within barrier-lagoon complex, Southwest Nigeria

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ABSTRACT

Distributions of zooplankton in Badagry Creek and Ologe Lagoon in the western part of Barrier-lagoon Complex, western Nigeria were investigated. Zooplankton samples were collected at five stations in each of the water bodies in September 2011, February and May 2012 and analysed using standard methods. In Badagry Creek, where salinity ranged from 2.00 ± 3.8‰ to 3.85 ± 4.48‰, z ooplankton community was dominated by copepods while Ologe Lagoon with entirely freshwater condition had rotifers as the dominant zooplankton taxa. Other zooplankton recorded in the water bodies belonged to the phyla Cnidaria, Ctenophora, Ciliophora and Protozoa. In Badagry Creek, calanoid copepods were the most prevalent zooplankton while plomoid rotifers dominated Ologe Lagoon. The two water bodies had low zooplankton abundance and species diversity in the month of September relative to what were recorded in February and May. Abundance and distributions were relatively uniform within the five stations in Badagry creek. However in Ologe lagoon, two stations that are close to municipal wastes discharge points with low dissolved oxygen and high biochemical oxygen demand had low zooplankton abundance and diversity especially in September. The need and desirability of regulating the anthropogenic activities for sustainable management of the water bodies are discussed.

Keywords: Badagry creek, Ologe lagoon, zooplankton abundance, productivity, anthropogenic activities, sustainable management

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INTRODUCTION

Information on zooplankton community of a water body is very crucial for sustainable management of its fisheries and other living resources. Perhaps, the zooplankton community is the major trophic channel through which energy is transferred from primary producers to higher animals in aquatic environment [1][2][3][4]. Distribution of zooplankton is therefore a major factor upon which abundance of fish and other socio-economically important aquatic macro-fauna depends.

Zooplankton have also been known to be a good bio-indicator group of organisms especially due to their sensitivity to changes in environmental quality. Study of distributions of zooplankton has therefore been widely used in assessing ecological conditions of aquatic environment especially in view of impacts of anthropogenic activities [1][2][3][4].

Badagry Creek and Ologe Lagoon are part of the network of inshore contiguous water bodies that constitute the Barrier-lagoon Complex in the westernmost part of Nigerian coastal zone. The Barrier Lagoon Complex supports high level of artisanal fishing activities and also provides great opportunities and potentials for coastal aquaculture. Meanwhile, there has been an increasing trend in the levels of anthropogenic activities which have resulted in undesirable impacts on ecological conditions of some parts of the complex such as the Lagos Lagoon [5][6][7][8].

There seems to be a dearth of current information on zooplankton community especially in the westernmost part of the Barrier lagoon complex. The study reported by [2] on zooplankton of Ologe Lagoon was actually carried out in the year 2000 and this has been quite a long time. Moreover, recent ecological studies in this axis of the complex such as those of [9][10] and [11] and are respectively on physico-chemical parameters, benthic macro-fauna and phytoplankton. Perhaps, current information on ecological conditions of this part of coastal zone will not be complete without recent data on its zooplankton community.

This study was therefore carried out to assess distributions of zooplankton in both Badagry Creek and Ologe Lagoon in the westernmost axis of the Barrier lagoon Complex, Southwest Nigeria. Findings from this work will compliment those of other recent ecological studies in providing baseline information and data that are needed for sustainable management of fisheries and biodiversity of these coastal waters. Information from this report will also be useful in regulating anthropogenic activities in this axis of the Nigerian coastal zone.

MATERIALS AND METHODS

Study Area

The study was carried out within the western axis of the Barrier-Lagoon Complex, specifically in Badagry Creek and Ologe Lagoon, southwest Nigeria (Figure 1). Badagry Creek is connected the Atlantic ocean through Lake Nokoue in Cotonu and Lagos Lagoon and Harbor in Lagos. Ologe Lagoon on the other hand is a backwater into which some rivers and streams in the western part of Nigeria drain, and it in turn empties through some tributaries into the Badagry Creek and Lagos Lagoon (Figure 1).

Five stations each were selected in Badagry Creek (stations A1 to A5) and Ologe Lagoon (B1 to B5) for sample collections. The sampling stations in Badagry Creek lie between Longitude 2^0 52.51"E and 3^0 06.3"E and Latitude 6^0 24.48" and 6^0 24.78"N while those in Ologe Lagoon are between Longitude 3^0 5.64"E and 3^0 6.57"E and Latitude 6^0 27.31"N and 6^0 29.98"N (Figure 1). Littoral mangroves and coconut are the major vegetation of the study area in the Badagry Creek while Ologe Lagoon was characterized mostly by rooted and floating macrophytes as well as dense rainforest especially in areas with low anthropogenic activities

Apart from sand mining and motorized boat operations which are major activities observed in the two water bodies, wastes from a major market in Badagry are discharged into Badagry creek at a location close to station A5. Ologe Lagoon receives municipal effluents through drainage canals at Agbara (station B1) and wastes from an abattoir at Ijanikin (station B2).

Collection and Analysis of Samples

Zooplankton samples were collected on board a motorized boat using standard plankton net of 52µm mesh size. At each station, the plankton net was lowered deep below water surface and hauled vertically for sample collection. Samples were concentrated and fixed under 4 % unbuffered formalin.

Zooplankton samples were later analysed with the aid of a Wild M11 binocular microscope following standard methods. Identification of zooplankton to species level was done using appropriate and standard texts [12][13][14]. Community structures of zooplankton were determined using diversity indices such as Margalef species richness (d) diversity and Shannon Wiener (H). The diversity indices values were computed as described by [15] using a computer software package, 'PAST' by [16]. Collection and analysis of zooplankton samples in each of the two water bodies were done in the months of September 2011, February 2012 and May 2012. However, zooplankton sample could not be at station B1 in May 2012 because the water level was very low during the period at the station.
Some physico-chemical parameters such as surface water temperature, salinity, dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrate and phosphate were determined for every station using standard methods as described by [17].

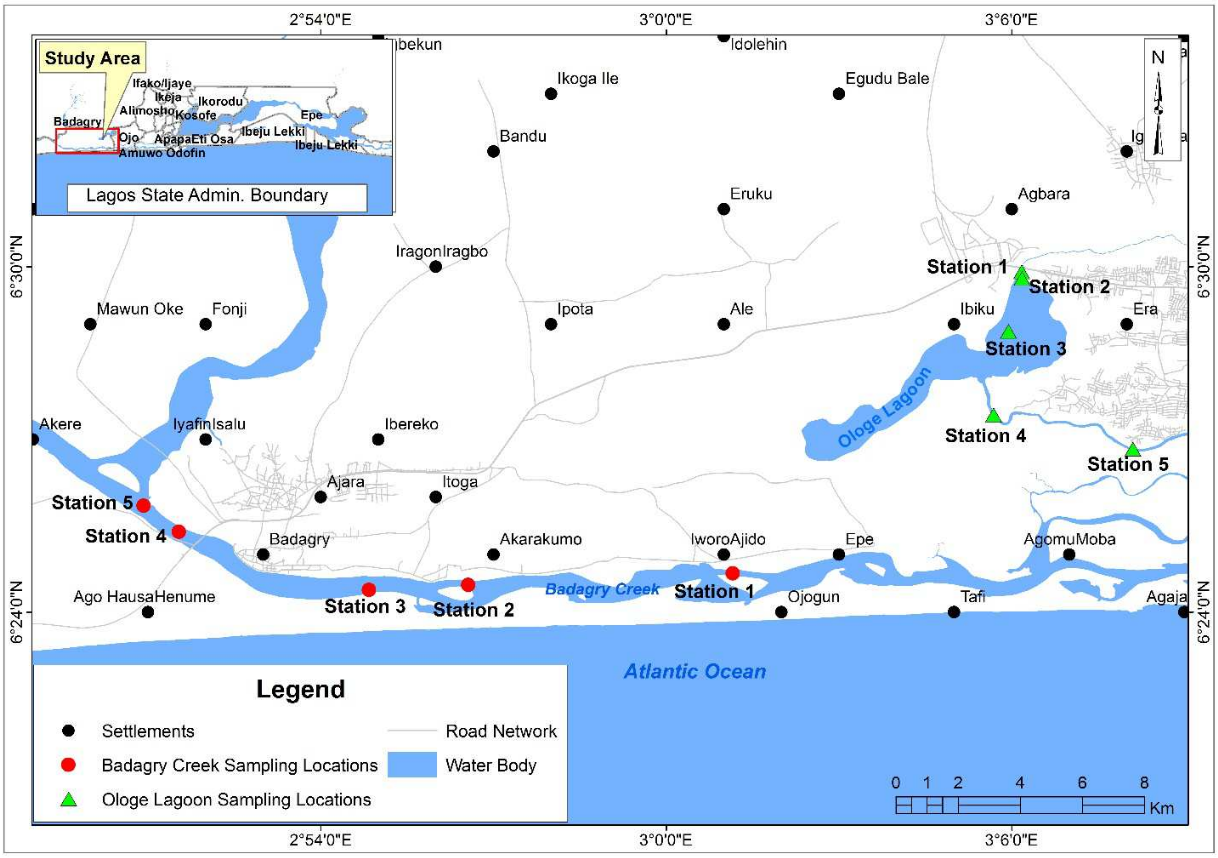

Fig. 1: Map showing sampling stations in Badagry Creek and Ologe Lagoon

RESULTS

Physico-chemical parameters

In Badagry Creek, water surface temperature ranged from 31.1 ± 1.44°C at station A1 to 31.75 ± 0.5°C at station A5 while a range of 2.0 ± 3.8 ‰ to 3.85 ± 4.48 ‰ was recorded for salinity. Spatial distributions of the physico-chemical parameters of Badagry Creek are presented in table 1. DO range from 3.30 ± 0.22mg/l to 5.73 ± 1.16mg/l while 2.20 ± 2.51mg/l to 8.15 ± 1.66mg/l was recorded as BOD range (Table 1).

In Ologe Lagoon, water surface temperature and salinity respectively ranged from 30.5 ±2.4 °C to 31.18 ±0.6 °C and 0 to 0.05 ±0.2‰. Spatial distributions of the physico-chemical parameters of Ologe Lagoon are presented in table 2. Stations B1 and B2 had relatively low DO levels of 1.08 ± 0.96mg/l and 3.68 ± 3.2mg/l respectively (Table 2). The two stations had relatively high BOD levels of 16.9 ± 10.46mg/l and 9.4 ± 7.56mg/l (Table 2).

Zooplankton in Badagry Creek

The zooplankton recorded from Badagry Creek belonged to phyla Arthropoda, Ctenophora, Mollusca (larval/juvenile stages), Protozoa and Rotifera. Arthropods recorded were mainly orders Copepoda and Cladocera which belong to the class Crustacea. Table 3 presents checklist, abundance distributions and diversity of zooplankton recorded in Badagry Creek. The zooplankton spectrum was dominated by the copepods which were the most abundant group, constituting 53.97% of the total zooplankton abundance (Table 3). Among the calanoid copepods, *Acartia negligens, Paracalanus parvus* and *Temora turbinata* were the most prevalent forms (Table 3). *Oithona nana* was the most prevalent of the cyclopoid copepods. Of the harpacticoid copepods, *Euterpina acutifrons* was prevalent in the wet month of September, while during the dry month of February and early wet month of May, *Microsetella norvegica* was prevalent. Six and ten species were respectively recorded for Cladocera and Rotifera while the tintinnids comprised 2 species. *Oxygyrus keraudreni* and *Arcella gibbosa* were among the mollusk and protozoan recorded respectively. Of the juvenile forms, nauplii of *Acartia* and *Oithona nana* were prevalent in September, while *Temora turbinata* nauplius, *Oithona* metanauplius, *Balanus balanoides* cypris and *Acartia* nauplius were prevalent during in the months of February and May (Table 3). Among the juvenile stages, *Acartia* nauplius had the highest abundance across various stations particularly in the months of February and May (Table 3). Relatively high total abundance and Shanon-Wiener diversity index levels were generally recorded during the months of February and May 2012 especially at stations A3 and A5 while most stations however had relatively high Margalef diversity index values in September (Table 3).

Zooplankton in Ologe Lagoon

The zooplankton collected from Ologe Lagoon generally belonged to six phyla (Cnidaria, Ctenophora, Arthropoda, Rotifera, Ciliophora and Protozoa), ten orders and 52 species. The zooplankton community was dominated by the phylum Rotifera with respect to both species diversity (28 species) and abundance (95.83% of total zooplankton abundance). The checklist, abundance distributions and diversity of zooplankton recorded in Ologe lagoon are presented in Table 4. Among the rotifers, the ploimid rotifers were the most diverse group making up 27 species (including *Filinia tecta*, *F. opoliensis*, *Keratella cochlearis* and *Brachionus falcatus*) while *Philodina* sp. was the only bdelloid rotifer, recorded only in the month of May (Table 4). The copepods, cladocerans and tintinnids belonged to ten, nine and two species respectively while one species was recorded for each of Protozoa and Ostracoda (Table 4). The juvenile forms were mainly recorded in the months of February and May as only one specimen of each of *Acartia* sp. and *Oithona nana* were recorded in the wet month of September (Table 4). Zooplankton species number and total abundance as well as diversity indices (Shanon-Wiener and Margalef) values were relatively high across the five stations during the months of February and May (Table 4). Stations B1 and B2 had very low species diversity and abundance values in the month of September (Table 4). Station B2 however had very high total zooplankton abundance in the month of May mainly due to high populations of two species of rotifers: *Keratella* and *Filinia* sps. (Table 4). Lowest species number and diversity indices values were recorded at this station B2 during the month of May (Table 4).

Table 1: Spatial distributions of Physico-chemical parameters in Badagry Creek

Parameter	A1	A2	A3	A4	A5
Surface Water Temperature (°C)	31.1 ±1.44	31.38 ±0.75	31.5 ±0.58	31.4 ±0.43	31.75 ±0.5
Salinity (‰)	3.85 ±4.48	3.57 ±4.04	2.00 ±3.80	3.24 ±3.54	3.12 ±3.39
DO (mg/l)	5.73 ±1.16	5.60 ±0.86	5.63 ±1.78	5.60 ±0.86	3.30 ±0.22
BOD (mg/l)	4.15 ±2.51	2.20 ±2.51	2.60 ±1.86	3.50 ±2.43	8.15 ±1.66
Nitrate (mg/l)	0.28 ±0.16	0.39 ±0.20	0.37 ±0.32	0.75±0.61	0.66 ±0.49
Phosphate (mg/l)	1.15 ±1.4	1.54 ±2.7	1.34 ±1.14	1.15±1.84	0.66 ±0.9

Table 2: Spatial distributions of Physico-chemical parameters in Ologe Lagoon

Parameter	B1	B2	B3	B4	B5
Surface Water Temperature (°C)	30.5±2.4	31.00±2.2	31.1±0.13	30.8±1.0	31.18±0.6
Salinity (‰)	0.00	0.03±0.05	0.05±0.2	0.05±0.1	0.00
DO (mg/l)	1.08±0.96	3.68±3.2	5.93±0.90	4.50±2.72	4.48±1.75
BOD (mg/l)	16.9±10.46	9.40±7.56	6.35±5.12	5.35±2.22	5.95±3.89
Nitrate (mg/l)	0.16±0.17	0.13±0.09	0.23±0.34	0.14±0.20	0.47±0.78
Phosphate (mg/l)	1.17±1.36	0.72±0.59	0.38±0.12	1.10±1.32	0.01±1.60

Table 3: Checklist, Abundance Distributions and Diversity of Zooplankton in Badagry Creek (September 2011 – May 2012)

	SEPTEMBER, 2011					FEBRUARY, 2012					MAY, 2012					% Composition
	A1	A2	A3	A4	A5	A1	A2	A3	A4	A5	A1	A2	A3	A4	A5	
Phylum: CTENOPHORA																
Order: BEROIDA																0.0086
Beröe cumis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
Phylum: ARTHROPODA																
Order: COPEPODA																
Acartia spp.	-	-	1	-	-	3	33	40	432	6	-	-	-	-	-	
Euchaeta aequatorialis Giesbrecht	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	
Paracalanus parvus Claus	-	-	-	-	-	2	12	11	12	4	14	11	1	-	-	
Temora turbinata Dana	1	-	5	-	-	2	5	3	27	-	22	-	-	-	-	53.9711
Cyclopina longicornis Boeck	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
Oithona spp.	5	3	2	3	2	-	-	-	1	1	35	42	3500	1	2000	
Euterpina acutifrons Dana	2	9	5	-	-	-	1	-	-	-	-	-	-	-	-	
Microsetella norvegica	-	-	-	-	-	-	-	4	2	1	2	2	1	2	-	
Parathelestris croni	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	
Order: CLADOCERA																
Penilia avirostris Dana	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bosmina spp.	-	-	-	-	-	-	-	1	-	-	-	-	3	-	-	0.1633
Chydorus eurynotus	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
Moina macropa	5	1	-	-	6	-	-	-	-	-	-	-	-	-	-	
Podon sp.	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
Phylum: ROTIFERA																
Order: PLOIMA																
Dicranophorus sp.	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	
Brachionus falcatus Zacharias	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	
Brachionus urceolaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	
Keratella cochlearis Gosse	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
Keratella tropica	6	40	19	3	8	-	-	-	1	-	-	-	-	-	-	0.9197
Dipleuchlanis propatula	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lecane climacois	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
Lecane curvicornis	1	-	1	-	-	-	-	-	-	-	-	-	-	-	1	
Lecane lunaris	-	6	2	-	-	-	-	-	-	-	-	1	-	-	-	
Filinia terminalis Plate	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	
Order: HETEROTRICHIDA																0.0172
Rhabdonella amor	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
Tintinnopsis beroidea Stein	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
Phylum: MOLLUSCA																
Order: HETEROPODA																0.5759
Oxygyrus keraudreni Leseur	-	-	-	-	-	7	27	15	13	3	1	-	-	-	1	
Phylum: PROTOZOA																
Order: ARCELLINIDA																0.0344
Arcella gibbosa Penard	-	-	-	-	-	-	-	-	-	1	-	-	-	-	3	
JUVENILE STAGES																44.3098
Acartia nauplius	16	7	53	1	-	-	-	26	270	351	20	20	1,500	6	2,500	
Acartia metanauplius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Balanus balanoides cypris	1	-	1	-	-	-	-	-	-	-	-	-	-	-	120	
Lamellibranch larva	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	
Oithona metanauplius	-	-	-	-	-	8	8	29	1	-	-	1	1	-	-	
Oithona nana nauplius	16	-	5	2	14	-	-	-	-	-	-	-	-	-	-	
Temora turbinata nauplius	-	-	-	-	-	39	98	34	-	-	-	-	-	-	1	
Zoeae larva	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
Total species diversity (S)	11	11	14	4	4	6	7	11	12	12	7	6	8	4	10	
Total abundance (N)	55	70	97	9	30	61	184	165	764	372	96	77	5008	10	4636	
Shannon-Wiener Index (Hs)	0.82	0.65	0.68	0.57	0.53	0.51	0.59	0.83	0.45	0.15	0.66	0.51	3.7	0.98	3.67	
Margalef Index (d)	2.5	2.35	2.84	1.37	0.88	1.22	1.15	1.96	1.66	1.86	1.31	1.15	0.82	1.3	1.07	
Equitability Index (j)	0.78	0.62	0.59	0.95	0.87	0.65	0.7	0.8	0.41	0.14	0.78	0.65	4.1	1.63	3.67	

Table 4: Checklist, Abundance Distributions and Diversity of Zooplankton in Ologe Lagoon (September 2011 – May 2012)

	SEPTEMBER, 2011					FEBRUARY, 2012					MAY, 2012					% Composition
	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5		B2	B3	B4	B5	
Phylum: CNIDARIA																
Order: NARCOMEDUSAE																
Cunina octonaria McCrady	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	0.0345
Phylum: CTENOPHORA																
Order: BEROIDA																
Beröe cumis	-	-	-	-	-	1	-	-	1	2	-	1	-	1	-	0.1035
Phylum: ARTHROPODA																
Order: COPEPODA																
Paracalanus spp.	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	
Temora spp.	-	-	1	2	-	1	20	3	-	6	-	7	-	-	-	
Cyclopina longicornis Boeck	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	0.8799
Oithona spp.	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3	
Microsetella norvegica	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
Parathelestris croni	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
Order: CLADOCERA																
Penilia avirostris Dana	-	-	-	1	-	1	19	1	-	1	-	-	-	1	1	
Bosmina spp.	-	-	1	-	2	3	1	5	4	19	-	6	3	8	1	1.7081
Chydorus spp.	-	-	1	2	-	-	-	1	-	-	-	-	-	-	-	
Moina spp.	1	-	2	1	-	-	1	1	-	7	-	-	3	-	-	
Podon sp.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
Order: OSTRACODA																
Euconchoecia chierchiea Muller	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	0.0173
Phylum: ROTIFERA																
Order: PLOIMA																
Dicranophorus sp.	-	-	3	2	-	-	-	-	1	1	-	1	6	1	1	
Asplanchna spp.	-	-	-	-	-	2	-	-	1	1	-	4	4	1	1	
Brachionus spp.	-	-	15	3	-	-	16	4	4	10	-	13	10	2	1	
Keratella spp.	-	-	5	3	8	1	16	10	6	12	-	3252	60	8	18	
Platyias quadricornis	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	
Dipleuchlanis ornata	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	95.8247
Ascomorpha ovalis Carlin	-	-	-	-	-	-	-	-	-	2	-	2	1	-	1	
Lecane spp.	1	2	2	3	-	8	5	-	-	-	-	1	3	-	-	
Lepadella spp.	-	-	-	-	-	4	1	-	-	1	-	5	4	-	-	
Filinia spp.	-	-	-	-	-	-	5	-	2	6	-	1,900	47	-	-	
Trichocerca spp.	-	-	-	-	-	-	1	2	4	-	-	2	4	8	14	
Order: BDELLOIDEA																
Philodina sp.	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	0.0518
Phylum: CILIOPHORA																
Order: HETEROTRICHIDA																
Ptychocyclis arctica	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	0.069
Unidentified Tintinnid	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
Phylum: PROTOZOA																
Order: ARCELLINIDA																
Arcella gibbosa Penard	-	-	-	-	-	2	-	-	-	-	-	5	3	2	7	0.3278
JUVENILE STAGES																
Acartia nauplius	-	-	-	1	-	1	3	-	-	5	-	4	21	2	5	
Balanus balanoides cypris	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
Oithona metanauplius	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	0.9834
Oithona nana nauplius	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cyclopina longicornis metanauplius	-	-	-	-	-	-	9	1	-	-	-	-	-	-	-	
Total species diversity (S)	3	1	10	12	3	20	19	15	12	22		18	23	14	14	
Total abundance (N)	3	2	31	21	11	30	99	31	23	75		5206	173	37	54	
Shannon-Wiener Index (Hs)	0.48	0	0.85	1.04	0.33	1.28	1.14	1.02	1.02	1.25		0.32	2.24	1.56	1.71	
Margalef Index (d)	1.82	0	2.62	3.61	0.83	5.59	3.92	4.08	3.51	4.86		1.99	4.27	3.6	3.26	
Equitability Index (j)	1	0	0.85	0.97	0.69	0.98	0.89	0.87	0.94	0.93		0.26	1.64	1.36	1.5	

DISCUSSION

The record of copepods and rotifers as the major taxa that constituted zooplankton community in this study is typical of tropical natural water bodies [13][18][1][3][4]. The variance however recorded between dominant zooplankton taxa of Badagry Creek and those of Ologe lagoon could be attributed to the differences in salinity profiles of the two water bodies. Brackish conditions were recorded in the five stations of Badagry Creek while Ologe lagoon was entirely with freshwater condition. Zooplankton communities in brackish coastal waters are often dominated by crustaceans [13][3][4] while rotifers usually dominate fresh coastal and inland waters [18][1].

Similar to the findings in the present study, [2] had reported the dominance of zooplankton community by rotifers in Ologe lagoon. The authors however attributed absence of crustaceans in some parts of the Ologe lagoon to high level of silt held in suspension in the water column due to dredging activities being carried out in those locations during their study. Meanwhile, [2] recorded *Brachionus falcatus* and *B. patulus* as the dominant and only widely distributed rotifers whereas present study recorded more species such as *Filinia tecta*, *F. opoliensis*, *Keratella cochlearis* and *Brachionus falcatus* in relatively high abundance across various stations. This indicates that more rotifer species have been able establish and flourish in Ologe lagoon between year 2000 when [2] carried out their survey and period of the present study.

The similarity in zooplankton composition and abundance during the dry season month of February and early rainy season month of May in the two water bodies is attributable to the time lag between commencement of rains in the study area (usually in March/April) and onset of flooding which could have prolonged dry season environmental conditions in the water bodies till the month of May [19][20]. [11] had earlier reported similar phytoplankton distribution and abundance in the months of February and May in the two water bodies.

Relatively high zooplankton abundance recorded both in Badagry Creek and Ologe Lagoon in the months of both February and May indicates higher productivity in the water bodies during these months than September. This could be corroborated by higher levels of major nutrients (particularly phosphate and nitrate) during dry than rainy season in the two water bodies as reported by [9]. Higher phytoplankton abundance was also reported for the two water bodies during dry than rainy season by [11]. Increased concentrations of nutrients during dry season perhaps as a result increased mineralization and degradation of organic matters could have elevated productivity level during the season and in turn led to increased phytoplankton abundance. High zooplankton abundance in the months of February and May could therefore be attributed to high abundance of phytoplankton (which constitutes major food for the zooplankton) during the period.

However, although [4] recorded higher zooplankton abundance during dry than rainy season in some parts of the Lagos lagoon which is similar to the findings of the present study; but contrary to [2] study in Ologe Lagoon. [2] recorded higher zooplankton abundance during rainy than dry season in the water body in year 2000 when the study was carried out. This was attributed to the fact that rains might have brought in allochtonous nutrients from drainage basins and which could have elevated primary productivity and in turn boosted zooplankton abundance during the rainy season. The variance between the findings of [2] and those of the present study could be due to the difference in the time the two studies were carried out. According to [21], plankton maxima may occur at anytime of the year in the tropics, depending on prevailing physical, chemical and biological conditions of the water body.

Relatively low zooplankton abundance and species number recorded at stations B1 and B2 in Ologe Lagoon especially in September could be as a result the anthropogenic activities close to these stations. Station B1 is close to the point where effluents form Agbara municipality drain into the lagoon while wastes from an abattoir are discharged at a location close to station B2. The record of low DO and high BOD perhaps could be attributed to the discharge of wastes close to these two stations which could have led to decline in zooplankton abundance and diversity. These anthropogenic activities could also be responsible for the record of just two rotifers, *Keratella* and *Filinia sps*. as highly dominant zooplankton at station B2 in the month of May. [11] that recorded very low phytoplankton abundance and diversity in these areas of the lagoon attributed it to the anthropogenic activities. Also, [10] reported very low benthic macro-fauna abundance and presence of only pollution tolerant ones within these wastes discharge areas. Control of discharges of wastes into Ologe lagoon is very imperative for sustainable management of the water body and resources therein.

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