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Full Length Research Article

WATER PROPERTIES AND ZOOPLANKTON DIVERSITY OF AGHALOKPE WETLAND IN DELTA STATE, NIGERIA

K. I. Iloba

Department of Animal and Environmental Biology, Faculty of Sciences, Delta State University, Abraka, Delta State, Nigeria

Author's Email Address: kisyiloba@gmail.com/ iloba@delsu.edu.ng Phone: +2348036761306

ABSTRACT
Characterizing the basic components of our wetlands is the first step to successfully utilizing these important resources and no such data on this wetland are available. On this background, weekly examination of water properties and zooplankton diversity of Adagbarasa wetland from April to May 2015 was carried out. Water quality results, in the present study indicate that Aghalopke wetland showed favourable conditions for aquatic lives but for low oxygen levels (0.05- 3.5 mg/L). Linear correlation and cluster analyses results revealed catenation of most of the water properties which demonstrated the connectivity of the wetland. Air and water temperature, dissolved oxygen, acidity, alkalinity, carbon dioxide, conductivity were identified as chief drivers of the study area's water properties. Upon careful observation (zooplankton assemblage), four (4) taxonomic groups were found; Copepoda, Rotifera, Cladocera and Protozoa. The numerical stock taking found copepods more in biomass (120/ml) than species (only 2 records) while rotifers had 16 species being dominant, sub dominant in biomass (103/ml). Rotifers, copepods and protozoa had positive negative associations with some water variables. The zooplankton diversity indices (0.44 to 1.76) revealed a deteriorated environment.

Keywords: Water Quality, Zooplankton, Copepodites, Rotifers and Adagbarassa Wetland

INTRODUCTION
Wetlands are one of our diverse heritages in Nigeria. Amazingly, these resources have suffered immerse deterioration without significantly contributing to the development of the communities and that of the nation at large (Untoo *et al.,* 2016; Chapparo *et al*., 2018). The safe manipulation, utilization and conservation of these resources within limit is to know its running components and respecting their limits particularly zooplankton through which the productivity of any ecosystem could be deduced (Angeler *et al*., 2003; Pal *et al*., 2015;Vaidya, 2017).

Zooplankton are first predators in aquatic food chain, transforming plant materials into animal tissues and subsequently to the next trophic level (Brraich & Kaur, 2015). The efficiency of such transfers depends on the quantity and quality of zooplankton. The importance of zooplankton in aquatic food chains has been elucidated by several researchers, due to their nutritional composition (Bhatnagar & Devi (2013); Napiorkowskwa-Krzebietke, 2017). Zooplankton are also preferred meal or diet for fish juveniles. In aquatic production, zooplankton bridges the gap between primary production and higher trophic levels (Dutta *et al*. 2017). This intermediary role allows zooplankton to respond to changes induced by pollutants and non-pollutants as well as to food and to predation (Baloch *et al*. 2010; Khalifa *et al*. 2015; Dhanasekaran *et al.* 2017) while this sensory role is swift and effectual because they are relatively immobile(Majagi 2014; Dutta *et al*., 2017).

In zooplankton production, several factors including physicochemical variables (Basu *et al*., 2010) have been implicated as production drivers. To this point, dominance of zooplankton community and their seasonality are highly variable in different water bodies in accordance to nutrient status, age, morphometry and other location factors of the water (Amanu 2015; Iloba *et al*., 2016; Rai *et al*., 2016).

Till recent times, zooplankton have been established to play a critical role as indicators of condition of their habitats, and can respond quickly to aquatic changes of their immediate environment (Basu *et al*., 2010, Yang et al., 2017). The factors that influence the number and distribution of zooplankton are abiotic factors such as pH, alkalinity, temperature, and nutrients to mention but a few, these are responsible for aquatic organic production (Amanu 2015; Untoo *et al*., 2016).

With several important aspects in water biological monitoring, zooplankton diversity have been chiefly used to evaluate the health status of aquatic environment (Uttah *et al*., 2008; Malik & Panwar 2016), reasons as earlier highlighted. Uttah *et al.,* (2008) noted that diversities, numbers of organisms that co-exist in any given river can reportedly be used to assess health status of any river. In the light of this, this study the first in this wetland was therefore designed to evaluate the physico-chemical properties and zooplankton of Aghalokpe wetland, Delta State in Nigeria; with the goal of knowing the composition, diversity and abundance of zooplankton in the system, an important attributes required in its optimal utilization, restoration and future management.

MATERIALS AND METHODS

Study Area
Study was conducted in Aghalokpe wetland, located in Okpe Local Government Area of Delta State, Nigeria (Fig. 1). This wetland of about 2km long lying within longitude 5˚12N of the equator and latitude 5˚ 45E of the Greenwich meridian, is prominent with high anthropogenic actions like farming, bathing and fishing by the locals.

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Figure 1: Showing Wetland in Aghalokpe, Study Area in Delta State, Nigeria

Sample collection and analysis

Once a week, water and zooplankton samples were collected between the hours of 9am to 2pm from April through May 2015. Six earthen ponds numbered Ponds 1-6 were chosen within the wetland were used for the present study. The randomly selected ponds did not show contrastable morphological and hydrological features. Water and zooplankton samples were collected from each pond, parameters studied and the various analytical methods employed are highlighted in Table 1.

Table 1: Limnological parameters and methods used for analysis

Parameters	Methods used and **References**
Air and water temperatures °C	mercury in glass thermometer (0.0-110˚C)
Conductivity µS/cm	Hanna Digital conductivity meter (Model DDB/303A)
Transparency cm or m	20cm diameter black and white wooded disc (Secchi disc)
Turbidity(NTU)	Turbidimerter
Total Dissolved Solids(ppm)	Hanna Digital TDS meter (Model 579312)
pH	PH meter (model H196107)
Alkalinity mg/L	Standard titrimetric method (APHA 1998).using phenolphthalein and methyl orange, 0.02 Hcl as titre
Free carbon dioxide	Spectrophotometrically
Dissolved oxygen mg/L	Winkler's modification method by the addition of sodium azide as described APHA 1998
Biochemical Oxygen Demand mg/l.	Winkler's method after 5 days as described APHA 1998
Phosphate mg/l.	spectrophotometrically following the procedure described in APHA (1998)
Nitrate mg/l.	spectrophotometrically following the procedure described in APHA (1998)
Potassium mg/L	Spectrophotometrically
Zooplankton	Collected by horizontal hauls of 25 µm mesh size plankton net, preserved with 4 % formalin and viewed under an Olympus microscope. Identified by reference to standard keys
Diversity indices	Past Statistical soft ware was used for Anova, linear correlation and Tukey's pairwise comparison analyses, p≤ 0.05

RESULTS

Outcomes of this research mean values of physical and chemical parameters and ANOVA comparisons at the six sampled different Ponds are presented in Table 2. Here, Air temperature oscillated between 21.0 and 32.0, values were seen to be lowest (21˚C) in Pond 4 and maximal (32.0˚C) in Ponds 2 and 3. The minimal water temperature was in Pond 6 and maximum (29.0 ˚C) in Ponds 1, 2 and 3 (29°C). A strong correlation was found between air and temperature(r= 0.9830). Dissolved Oxygen (DO) was quite low and varied between 0.05 mg/l in Ponds 2 and 3 and 3.5 mg/l in Pond 3. Acidity was least in Pond 6 (132 mg/l), and max (780 mg/l) in Pond 5. Alkalinity was generally low, minimal (2 mg/l) in Pond 2 and maximal in Pond 5 (40 mg/l). Conductivity values were low, minimum (10 µS/cm) in Ponds 4 and 5 and maximum (112 µS/cm) in Pond 4. Total dissolved solids were low and appear semis to electrical conductivity, although with minimal in Pond 5 and maximum also in Pond 5. pH had almost unvaried measurement varying between 5.51(station 5) - 5.9 at all Ponds. Low Phosphate records low with minimum value (0.01mg/l) in Ponds 2 and 3 and maximum value (0.34 mg/l) in Pond 3. Carbon dioxide values were low too ranging from -5.36 to 26.78 mg/L. Carbon dioxide fluctuation was high, varying from -5.36 mg/l in Ponds 1 to 3 and values in Pond 4 to 6 were relatively higher, the maximum was 26.78 mg/L in Pond 4. Potassium values ranged from 14 to 32 in Ponds 1 and 4 respectively. Conductivity, turbidity, total dissolved solids and pH were the only water properties different among the Ponds ($p<0.05$). These observed differences were confirmed using Tukey's pairwise comparison and outcome is presented Table 3. The connectivity of the water properties are presented in Fig. 2. The cluster analyses result, showed ten different limnological pathways in Adagbarra wetland, majorly influenced by acidity. The least similarities were found between air and water temperatures, dissolved oxygen and phosphate, conductivity and alkalinity.

The zooplankton composition was plethorically copepoda and rotifera aggregating 99.17 % of the total zooplankton. Copepoda contained 52.26 % whilst rotifer contained 46.91 % of the total zooplankton. Protozoa and Cladocera were rare and near absent during the study.

Table 2: Mean value ± standard error (S.E) of measured limnological parameters of the different stations

Parameters	Air Temp (°C)	Water Temp	D.O (mg/L)	Alkalinity	Acidity	TDS (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Phosphorus	CO	Potassium (mg/L)
Site 1	29	28.1	1.2	39	293	15	32	5.6	13	0.08	4.0	14
Site 2	29.1	28.2	1.0	35	261	18	36	5.6	33	0.03	17	22
Site 3	29.1	28.0	1.2	37	236	17	35	5.6	14	0.06	2.0	22
Site 4	28.6	27	1.0	24	315	13	24	5.6	21	0.06	14	32
Site 5	28	26	1.0	17	361	14	17	5.6	24	0.03	24	21
Site 6	28.4	27	0.9	13	269	16	13	5.6	34	1.9	25	22
F- value	0.87	1.32	0.11	1.13	0.92	8.72	5.18	3.34	6.81	1.01	1.54	0.41
P- value	0.50	0.27	0.99	0.35	0.47	0.00*	0.00*	0.01*	0.00*	0.42	0.19	0.85

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Table 3: Comparison of detected significant parameters with Tukey's Pairwise Comparisons; (Q/p same).

	Stations	1	2	3	4	5	6
Conductivity	1	-	0.976	0.9941	0.7825	0.1756	0.03219*
	2	1.046	-	1	0.3328	0.03137*	0.003947*
	3	0.7696	0.2769	-	0.4457	0.05171	0.007073*
	4	1.842	2.888	2.611	-	0.8813	0.4589
	5	3.39	4.437	4.16	1.549	-	0.9774
	6	4.423	5.469	5.192	2.581	1.032	-
Turbidity	1	-	0.001444	0.9995	0.5501	0.2137	0.00107
	2	5.943	-	0.003867	0.1361	0.4096	1
	3	0.4638	5.479	-	0.7543	0.374	0.002846
	4	2.377	3.566	1.913	-	0.9895	0.1091
	5	3.247	2.696	2.783	0.8697	-	0.3511
	6	6.088	0.1449	5.624	3.711	2.841	-
TDS	1	-	0.02225	0.1317	0.1691	0.9904	0.9574
	2	4.613	-	0.9781	0.0001436	0.003964	0.1691
	3	3.588	1.025	-	0.000232	0.03106	0.5434
	4	3.417	0.03	7.005	-	0.4669	0.0225
	5	0.8542	5.467	4.442	2.563	-	0.6969
	6	1.196	3.417	2.392	4.613	2.05	-
pH	1	-	0.978	0.9941	0.6957	0.1307	0.7997
	2	1.026	-	1	0.2652	0.02224	0.3581
	3	0.7699	0.2566	-	0.3581	0.03597	0.4654
	4	2.053	3.079	2.823	-	0.8838	1
	5	3.593	4.619	4.383	1.54	-	0.7997
	6	1.796	2.823	2.566	0.2566	1.796	-

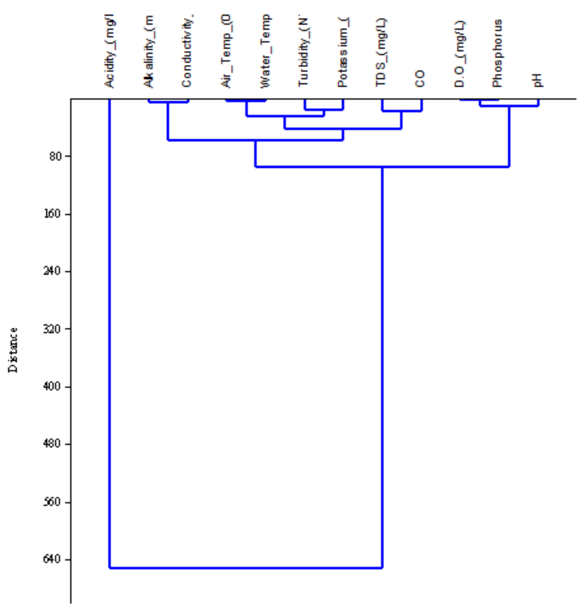

Fig. 2: Cluster analysis showing similarity lines between the studied water properties

The present study observed myriad stages of copepodite copepods preeminence in the zooplankton community in all stations during the study period. The copepodites had 120 number constituting 95.24 % of the copepods population. The copepodite size varied from study inception (40 Ind/L) at the same time the topmost reached till the end of study (12 Ind/L). However, the utmost copepodite population was the record at inception (Table 4).
The study noted that copepodites were also most distributed and abundant across the studied Ponds (Table 4 and 5). In rotifera; *Brachionus quadridentalus* was widely distributed as well as in number while *Platyias quadricornis* increased in distribution but not in bounty (9 inds/ml, only) in Ponds 1 to 3. Contrary, *Anuraeopsis fissa* though widely distributed (Table 4) but not in number (Table 5). Others including the genera Testudinella, Trichocerca, Lecane, Euchlanis, Eothinia Asplanchna, Polyarthra, Keratella and Proales showed sporadic distribution.
The zooplankton annals (Table 4) furnished 20 species excluding copepodites in the present study. These species were classified into four taxa; Rotifera Copepoda, Protozoa and Cladocera. Rotifera documented the highest number of identifiable species (80 %) with 16 species out of the cataloged 20 species in the present study. Next on line was copepoda with only 2 species (10 %) but with bounty juveniles, followed by a single species (5 %) each apportioned to cladoceran (*Diaphanosoma sp*) and Protozoa (*Arcella discoides*).

Table 4: Spatial status of zooplankton during this research from April through May in Aghalokpe wetland

Group	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6
Cladocera						
Diaphanosoma sp (Fischer 1850)		*				
Copepoda						
Nauplii juvenile	*	*	*	*	*	*
Thermocyclops sp	*		*			
Mesocyclops sp	*	*	*			
Protozoa						
Arcella discoides (Ehrenberg)			*			
Rotifera						
Asplanchna brightwelli (Gosse)		*	*			
Asplanchna priodonta(Goosse)					*	*
Anuraeopsis fissa (Gosse)	*		*	*	*	*
Brachionus quadridentatus (Herman 1783)	*			*	*	*
Cephalodella gibba(Ehrenberg)				*	*	*
Eothinia elongata (Ehrenberg 1932)	*	*	*			
Euchlanis dilatata (Ehrenberg)	*					
Keratella australis (Berzins)	*	*	*			
Lecane levistyla (Olofsson 1917)			*			
Platyias quadricornis(Ehrenberg)				*	*	*
Polyarthra dolichoptera (Idelson 1925)	*		*			
Proales sp (Ehrenberg 1886)	*	*	*			
Testudinella patina (Herman 1783)	*		*			
Testudinella emarginula (Stenroos 1898)	*					
Trichocera similis (Wierzejski 1893)		*				
Trichocerca flagellata (Hauer)	*					

The study shows that Cladocera comprised of a single genus and species; Diaphanosoma sp., Copepoda comprised of 2 genera Thermocyclops sp and Mesocyclops spp and unidentifiable Nauplii juveniles while Rotifera was more abundant with 15 genera which aggregated 16 species as shown in Tables 4 and 5, the most dominant amongst them include *Brachionus quadridentalis*(31.07 %) and *Platyias quadricornis*(24.27 %). The weekly temporal distribution of the copious zooplankton species in Figure 3 could be described as oppositional. Ponds 1, 2, and 3 had greater number of copepods than Ponds 4, 3 and 5 and vice versa. The associations between water properties and zooplankton taxa are presented in Table 6 while the species descriptive diversity indices are shown in Table 7. All diversity indices exerted on the zooplankton taxa, had generally low outcome ranging from 0.4437 to 1.76. Rotifers indexed the highest Shannon- index (1.76) followed by the copepods (1.406).

Table 5: Zooplankton denomination and number (relative abundance %) in Aghalopke wetland during the present study

Group	Species	SAMPLING PERIOD										
		10/4/15	15/4/15	18/4/15	23/4/15	28/4/15	5/5/15	7/5/15	9/5/15	12/5/15	14/5/15	**Total**
Cladocera	Diaphanosoma sp (Fischer 1850)	1	-	-	-	-	-	-	-	-	-	1(100)
Total		**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
Copepod	Nauplii juvenile	40	2	3	11	17	14	8	11	2	12	120(95.24)
	Thermocyclops sp	1	1	-	-	-	-	-	-	-	-	2(1.59)
	Mesocyclops sp	1	2	1	-	-	-	-	-	-	-	4(3.17)
Total		**40**	**3**	**1**	**9**	**15**	**11**	**7**	**11**	**2**	**12**	**126(100%)**
Protozoa	*Arcella discoides* (Ehrenberg)	-	1	-	-	-	-	-	-	-	-	1(100)
Total												
Rotifera	*Asplanchna brightwelli* (Gosse)	-	-	-	8	-	-	-	-	-	-	8(**7.77**)
	Asplanchna priodonta	-	-	1	-	-	1	-	-	-	-	2(**1.94**)
	Anuraeopsis fissa (Gosse)	1	2	3	1	1	-	1	-	-	-	9(**8.74**)
	Brachionus quadridentatus (Herman 1783)	2	5	4	3	3	4	4	5	2	-	32(**31.07**)
	Cephalodella gibba(Ehrenberg)	-	-	-	1	-	1	1	-	-	-	3(**2.91**)
	Eothinia elongata (Ehrenberg 1930)	-	-	-	-	1	5	-	-	-	-	6(**5.83**)
	Euchlanis dilatata(Ehrenberg)	-	1	-	-	-	-	-	-	-	-	1(**0.97**)
	Keratella australis (Berzins)	-	-	-	2	1	-	-	-	-	-	3(**2.91**)
	Lecane levistyla (Olofsson 1917)	1	-	-	-	-	-	-	-	-	-	1(**0.97**)
	Platyias quadricornis(Ehrenberg)	2	2	3	4	4	5	2	1	1	1	25(**24.27**)
	Polyarthra dolichoptera (Idelson 1925)	-	1	3	-	-	-	-	-	-	-	4(**3.88**)
	Proales sp (Ehrenberg,1886)	-	2	-	-	-	1	-	-	-	-	3(**2.91**)
	Testudinella patina (Herman 1783)	-	1	1	-	-	-	-	-	-	-	2(**1.94**)
	Testudinella emarginula (Stenroos 1898)	-	-	-	-	-	1	-	-	-	-	1(**0.97**)
	Trichocerca similis (Wierzejski1893)	1	-	1	-	-	-	-	-	-	-	2(**1.94**)
	Trichocerca flagellate (Hauer)	-	-	-	-	-	1	-	-	-	-	1(**0.97**)
	Total	**7**	**14**	**16**	**19**	**10**	**19**	**8**	**6**	**3**	**1**	**103(100)**

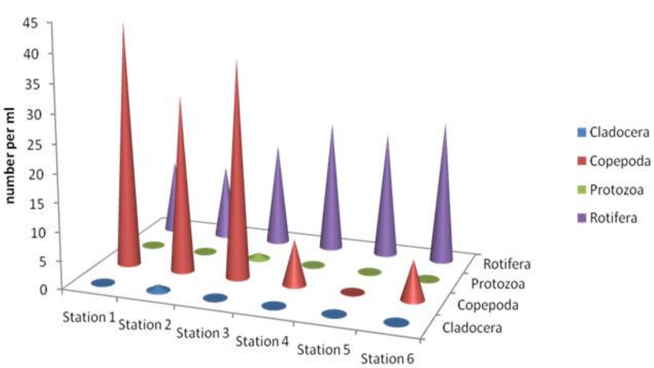

Fig. 3: Percentage composition of zooplankton in Aghalopke wetland

Discussion

Water quality results in the present study indicate that Aghalopke wetland showed favourable limnological conditions for aquatic lives but for low oxygen levels (0.05- 3.5 mg/L). The dissolved oxygen of the studied sites shows that the water is not well mixed or well aerated. This could be attributed to the lack of swift flow in the sites as well as decomposing leaves associated with the bottom causing oxygen deficient. One of the important factors that drive water quality in the present study is its oxygen content. This is evident in its pronounced significant associations with parameters (alkalinity, conductivity, turbidity, phosphate, carbon dioxide, copepods and rotifers) (Abolude *et al*., 2012). The anaerobic nature noted in the present study could be a probable factor for low phosphate values by limiting the redox reactions responsible for nutrient conversions in wetlands sediments(r=-0.5842). Nutrient modulation nullified the desired/ expected increase in dissolved oxygen evident from its positive association with air (r=0.6208) and water (r= 0.5737) temperatures.

The agency of air and water temperatures as prime factors underlining the performance of water properties is also noted in the present study and further confirmed by their vastly significant associations with/and or other water properties and the chief zooplankton groups in the present study (Table 6)(Bureau of Reclamation 2013).

Air and water temperature affected the distribution and abundance of copepoda(r= 0.81543); protozoa (r= 0.6) and rotifer(r= -0.6309). Therefore, Air and water temperatures play important roles in aquatic environment. The range of water temperature in this study is between 25 - 34°C, this range observed is usually for tropical water that are not thermally polluted and similar ranges have been reported by (Arazu & Ogbeibu, 2017). Air and water temperature(r= 0.9839), is governed by local climate condition (Bello *et al*., 2017; Teck-Yee *et al*., 2017).

One would have expected high free carbon dioxide with the enormous leaf litter in such a tropical rainforest wetland. The utilization (photosynthesis) or conversion (carbonic acid) of produced carbon dioxide would have been responsible for its non-accumulation resulting in low carbon dioxide values as noted in the present study. The later reason could go for high acidity and acidic pH (5.57-5.58) waters in this study. The range recorded in this study was within same limits recorded in the fresh water bodies in Nigeria and other African water bodies (Bello *et al*., 2017).

The highest value of acidity recorded in Pond 3, may be due to anthropogenic activities (farmland, pond preparation, free grazing) in study sites in addition to the already mentioned reason. The highest value of alkalinity recorded in Ponds 1 and 2 could also be due to anthropogenic activities. The proportions of these duos confirm the buffering attributes of this wetland (Odulate *et al*., 2018) and will beat disturbing human activities on the wetland. This underlines the various associations between alkalinity and (conductivity r = 0.9682, turbidity r = - 5784, phosphate r= -0.6316, carbon dioxide r = -0.8754); acidity and (total dissolved solids(r= -8049), conductivity(r= - 0.5442), found in the present study to prevent consequential leaps and bounds from natural and human activities. These properties depict the wetlands ionic concentration, nutrient (phosphate), dissolved, amorphous and particulate organic matter (TDS, Turbidity), decomposition (carbon dioxide).

The catenation of most of the water properties revealed the complexity of the study sites by correlation analysis supports the connectivity of wetlands activities and presence of hydric soils evident from anoxic encounters (Abdulwahab & Rabee, 2015).

Zooplankton data revealed low zooplankton diversities, unusual for riverine wetlands (Chaparro *et al*., 2018) an indication of less heterogeneous wetland (Karpowicz 2016). However, tropical waters have been noted for simplified low densities zooplankton communities (Sousa *et al*., 2013; Abdulwahab & Rabee, 2015) to confirm the specificity and variations of water bodies in space and time (Caramujo & Boavida, 2010). The present study confirmed the influence of water properties on the zooplankton number (Table 6).

The outburst of copepodites in the phylum Copepoda at all Ponds could be explained out by trio options; the first is selective grazing by fishes (Atindana *et al*., 2016; Mbonde *et al*., 2017) and secondly due the food sufficiency enhancing their reproductive capacity (Dela Paz *et al*., 2018) or finally a strategy to overcome stiff environment (Hairston & Bohonak 1998; Kiorboe, 2011).

The superfluity of juvenile copepodites and rotifers suggest their overwhelming contributory power to food chain /trophic status functions of this wetland (Ansa *et al*., 2015; Abdulwahab & Rabee, 2015). The outburst of these organisms could also be attributed to a healthy environment or habitat with associated food sources or energy for these individuals.

The numerical dominance of copepods observed in this study is strikingly different from Ogbuagu & Ayoade (2012) from Imo River, Iloba & Ruejoma (2014) in Ekpan River, Delta State, Arazu & Ogbeibu, 2017, of River Niger at Onitsha stretch, all in Niger Delta, noted cladocera as prominent, the study compares with the study of Imoobe & Ogbeibu(1996) from Jamison River, a tributary of Ethiope River, Ekwu & Sikoki (2005) in the lower Cross River Estuary, although with contrary cladocerans and thus did not show faunistic similarity of the region(Shelthy *et al*., 2015). The preponderance of rotifers has been indicted as pollution indices as in this study (Kar & Kar 2016) and also expressed by the different diversity indices outcome.

The study also noted that the wanting nature of cladocera and protozoa is unique, thus their inconsequential or non-utility role in these sites. The numbers could not be tagged absent or disappearance since no previous information exists. However, the only genus identified are known for their ability to survive varieties of water (trophic and water temperature) (Dela Paz *et al.,* 2018). The fail of the only encountered genus Diaphanosoma of cladocera known for enhanced survival in calm, stable habitat, is an indicator of a turbulent and unstable wetland.

The inconsequential presence of cladoceran has further confirmed the dynamic nature of the wetland. The structured oppositional nature/existence of cladocera and rotifers in this wetland is also not farfetched from grazing effects of copepods on rotifers.

The dominance of copepods was unexpected because Jeje & Fernado (1985) alluded to the fact that rotifers are the most dominant zooplankton group in Nigerian and tropical aquatic ecosystem (Ansa *et al*., 2015; Abdulwahab & Rabee 2015; Kar & Kar 2016; Kar *et al*., 2018).

The difference in the number of zooplankton species in this study is vividly presented and is attributable to the prevailing conditions of water and period of sampling. Differences in distributions of zooplankton in space and time are ideal and natural to the dynamic nature of aquatic systems (FAO 2006). The composition and abundance of zooplankton in any aquatic ecosystem are crucial in water quality monitoring. They could be threatened or impacted on due to anthropogenic activities such as domestic (sewage disposal), agricultural (runoff manure and fertilizers) as noted in the present study (Yang *et al*., 2017). Zooplankton are thus important in the structuring of dynamics of aquatic environments and productivities. Extensive research on the zooplankton of this wetland is paramount to develop quality control engineering tool for sustainable fisheries development and its future preservation.

Table 6: Linear correlation between water properties and identified zooplankton properties of Aghalopke wetland.

Parameters	**Air Temperature**	**Water Temperature**	**Dissolved Oxygen**	**Alkalinity**	**Acidity**	**Total Dissolved Solids**	**Conductivity**	**Turbidity**	**Phosphate**	**Carbon dioxide**	**Potassium**	**Cladocera**	**Copepoda**	**Protozoa**	**Rotifera**
Air Temp	0	0.0004													
Water Temp	0.9839*	0													
D.O	0.6208*	0.5737*	0												
Alkalinity	0.9018*	0.8677*	0.8343*	0											
Acidity	-0.7872*	-0.8016*	-0.2885	-0.4985	0										
TDS	0.6215*	0.6711*	0.13093	0.4302	-0.8049*	0									
Conductivity	0.9125*	0.8598*	0.7152*	0.9682*	-0.5442*	0.5233*	0								
Turbidity	-0.3173	-0.2397	-0.8961*	-0.5784*	-0.0215	0.3022	-0.4322	0							
Phosphate	-0.3182	-0.2058	-0.5842*	-0.6316*	-0.2287	0.1247	-0.6589*	0.5703*	0						
Carbon Diox	-0.7768*	-0.7143*	-0.9399*	-0.8754*	0.4681	-0.1648	-0.7866*	0.8401*	0.5189*	0					
Potassium	-0.2103	-0.3283	-0.4692	-0.3669	0.1222	-0.3631	-0.2123	0.2272	-0.0198	0.2494	0				
Cladocera	0.43818	0.4608	-0.2	0.33224	-0.3106	0.6547*	0.4964	0.5341*	-0.2142	0.1343	-0.0142	0			
Copepoda	0.9176*	0.9281*	0.81543*	0.946*	-0.6543*	0.5630*	0.8794*	-0.5108*	-0.3658	-0.8506*	-0.5421*	0.2629	0		
Protozoa	0.4381	0.3480	0.6*	0.42084	-0.5863*	0.3928	0.4460	-0.4978	-0.1947	-0.6210*	-0.0142	-0.2	0.4500	0	
Rotifera	-0.7688*	-0.7921*	-0.6309*	-0.8943*	0.3452	-0.5163*	-0.8679*	0.2998	0.5636*	0.5956*	0.5719*	-0.5678*	-0.8602*	-0.094	0

Table 7: Zooplankton species diversity Indices

Diversity Indices	Cladocera	Copepoda	Protozoa	Rotifera
Individuals	1	127	1	114
Dominance_D	1	0.2708	1	0.177
Simpson_1-D	0	0.7292	0	0.823
Shannon_H	0	1.406	0	1.76
Evenness_e^H/S	1	0.8158	1	0.9686
Menhinick	1	0.4437	1	0.562
Margalef	0	0.8257	0	1.056
Equitability_J	0	0.8735	0	0.9822

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