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A Survey of Zooplankton Community Structure in Taylor Creek, Zarama Axises, Bayelsa State, Nigeria

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ABSTRACT

A survey of Zooplankton community structure in Taylor Creek, Zarama axises, Bayelsa State was studied during the month of March 2018. Four (4) sampling stations reflecting different land use patterns of the adjacent catchment were selected and studied. This was done in order to determine how land use patterns affect zooplankton dynamics. Results from the study reveal the presence of seven (7) taxa represented by forty seven (49) species: Station 2 showed the highest diversity and the lowest in station 1. Simpson dominance was highest in Station 4 and lowest in Station 3. The dominance of protozoa in all stations of the creek indicates that the creek is polluted with sewage discharge. It may be concluded that inputs from land based activities affect primary productivity of the creek. Therefore action needs to be urgently taken to protect the creek ecosystem and its fishery.

1.0 INTRODUCTION

Bayelsa State is blessed with a myriad of creeks, rivers and seas. Its people are so intricately associated with its waters that it will be unimaginable to live without it. These water bodies serve the people as source for fishing, domestic uses, agriculture and transportation. Sadly, due to this dependence, most of our waters are subjected to perennial pollution. Pollution of these waters has resulted in the destruction and distortion of aquatic ecosystems.

Zooplanktons are important biological component in any aquatic ecosystem. Zooplanktons are small, free-floating aquatic microorganisms including crustaceans, rotifers, open water insect larvae and aquatic mites. Their main function is to act as a primary and secondary links in the food chain and they play a vital role in energy transfer of aquatic ecosystem (Rahkola-sorsa, 2008). Zooplanktons constitute the food source for primary consumers organism and play an invaluable role in all aquatic dynamics. Their presence is so vital and has become the most valuable indicator of trophic status (Sanyogita *et al,* 2011).

Zooplankton can also be used as bio-indicator for water pollution studies because they respond to changes under adverse environmental condition (APHA, 2003), including being an indicator that determines water quality, pollution and the state of eutrophication (Salar, 2004) and for understanding the health status of the water bodies.

Taylor creek is one of the water bodies in Bayelsa State that human activities have greatly affected its ecosystem. There is an acute need therefore to study its zooplankton characterization in order to determine the pollution status of the creek.

This will serve for the protection of the creek ecosystem and its fishery.

2.0 MATERIALS AND METHOD

2.1 Description of Study Area

Taylor creek is a lotic non-tidal fresh water environmental unit. It stretches from Besini clan to Gbarain in Yenagoa Local Government area of Bayelsa state in Niger Delta. The creek lies between longitude 006^0, 21' E and latitude 05^0 01' to 05' 05N. The location of the sampling sites for this study is at Ikrama-Okordia, Kalaba-Okordia, Akumoni-Okordia and Agbobiri Community.

2.2 Sampling Sites

Four (4) sampling sites were selected for the purpose of the study based on different land use adjacent the creek. These stations are as follows;

2.2.1 Station 1 (Ikrama): It is located at longitude 00 $\mathbf{6^0}$ 27' 39.0" E and latitude 05^0 09' 21.6" N. The station has an elevation of 7m. This station has notable features such as floating aquatic weeds and vegetation in the adjacent catchment.

2.2.2 Station 2 (Kalaba-Okordia): It is located at longitude 006" 26' 33.5 "E and latitude 05^0 08' 34.6" N. The station has an elevation of 7m. This station is characterized by the presence of a Piggery farm. Waste from the farm wash directly into the creek.

2.2.3 Station 3 (Akumoni-Okordia): it is located at longitude 006^0 25' 46.9" E and latitude 05^0 08 14.9" N. This station has an elevation of 5m. The activities in this station are bathing and washing. The creek is relatively small at this point.

2.2.4 Station 4 (Agbobiri Community): it is located at longitudes 006^0 25' 11.6" E and latitude 05^0 07' 10.7" N. In this station are fishing, alongside farming, palm oil production and Garri production.

Table 1: Location of sample station

Station	Longitude	Latitude		Description and notable features
1 Ikrama- Okordia,	006° 27' 39.0'' E	05° 09'21.6'' N	7m	Floating aquatic weeds
2 Kalaba-okordia	006° 26' 33.5''E	05° 08'34.6'' N	7m	Piggery farm
3 Akumoni-okordia	006° 25' 46.9''E	05° 08' 14.9''N	5m	Laundry activities
4 Agbobiri community	006° 25' 11.6''E	05°07' 10.9''N	7m	Make-shift building used for palm oil and garri production

2.3.1 Water collection

Samples of Zooplanktons were collected using plastic cans dipped 20cm below the surface of the water. The can was held slightly dipped into the water and allowed to full. The procedure was repeated for each sampling station. Each sample was fixed with 3ml formalin.

2.3.2. Zooplankton Analysis

Analysis for zooplankton samples were done at the Niger Delta University Bayelsa State.

The samples were allowed to stand for 46 hours before 50ml of pipetted concentrated sample volume were obtained. A sub sample of 1ml was then taken and transferred into a sedge-wick rafter counting chamber (Slides).

Identification and enumeration to the species level was done using a leitzwetzlar binocular dissecting microscope at a magnification of 20-400 for zooplankton for each sample station using standard keys.

3.4 Data Analysis

Means were calculated for zooplankton parameters. Their indices were used to estimate species diversity. Shannon-Weiner diversity index given by formula

(1.1) $\sum_{i=1} s(ni/n)$ in (ni/n)

Evenness by the formula

(1.2) E=H"/Ins

Species richness by Margalef (1951)

Formula:

(1.3) d = (s-1)/Inn

Where:

H" = species diversity, s = number of families

N, = total number of animals

Ni = number of each family

T - Test statistics was employed to determine the relationship and source of variability between stations in the determined parameters of zooplankton.

3.0 RESULT

Table 2. Distribution of zooplankton in stations in Taylor creek

Species/taxa	1	2	3	4
PROTOZOAN				
Tintinnidum sp.	1	-	-	-
Difflugia globutosa	1	-	-	-
Naeglaria sp	1	-	-	-
Strombidinopsis acumination	1	-	-	-
Litonotus sp	1	1		-
Sacry otor	3	5	-	2
Amoeba proteus	1	6	2	13
Pelomuxa sp	1	-	-	-
Paramecium caudatum	2	4	1	3
Cucurbitella sp	1	-	-	-
Volvox sp	1	-	-	-
Actinosphaerium sp	2	2	-	-
Diffulgia constricted	-	1	-	-
Oikomonas sp	-	1	-	-
Holophyra vesiculosa	-	1	-	-
Tintinnius sp	-	1	-	-
Stylonychia sp	-	1	-	-
Frontonia sp	-	2	1	1
Chilodonella uncinata	-	1	-	-
Arcella mitra	-	1	-	-
Paranema sp	-	1	1	-
Pteropoda	-	-	1	2
Acanthamoeba sp	-	1	-	-

Table 2. Continues

Species/taxa	1	2	3	4
NEMATODA				
Pletus sp	1	-	-	1
Tripiva sp	1	-	-	1
Bunonema sp	-	1	-	-
Hemicycliophora sp	-	2	-	-
Helicotylenchus sp	-	3	2	-
Dolichodorus sp	-	1	-	-
				-
ROTIFERA				
Monostyla obluse	1	-	-	-
Branchionus budapestiensis	1	-	-	-
Kellicottia longispina	1	1	-	-
Sinantherian socialis	1	-	-	-
Notholca sp	-	-	2	-
Monostyla sp	-	-	1	1
Lacane sp	1	-	-	-
ANNELIDA				
Dero sp	1	5	1	-
Limnodrilus sp	1	1	1	-
Tubifex sp	1	2	-	2
Nias sp	1	1	-	-
Herpobdella sp (leech)	-	1	-	-
Enchytraeus sp	-	-	1	-
INSECTA				
Egg of culex mosquito	1	2	2	-
Ochrotripicha sp	-	1	-	-
PORIFERA				
Ephydanta sp	-	1	-	-
Spicula of sponge	-	-	-	1
CRUSTACEAN				
Cylops sp	-	4	-	2

Table 3: Relative composition of zooplankton in Taylor creek in all station

Taxa	Station 1	Station 2	Station 3	Station 4
Protozoa	16	29	6	21
Nematode	2	7	2	2
Rotifera	5	1	3	1
Annelida	4	10	3	2
Insect	1	3	2	-
Porifera	-	1	-	1
Crustacean	-	4	-	2
Total number of species in station (Abundance)	28	55	16	29
Shannon diversity index	1.01	1.36	1.2	1.06
Evenness	0.03	0.02	0.07	0.03
Simpson dominance index(c)	0.36	0.32	0.19	0.52

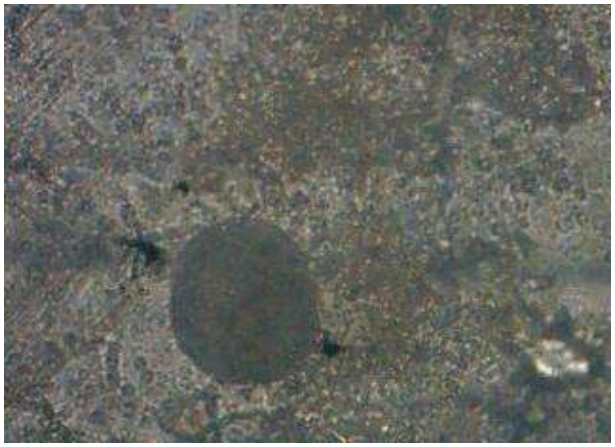
Plate 1-6: Crustaceans, Rotifera, and Insecta and Protozoa In Taylor Creek.

CRUSTACEANS *(CYCLOPS Sp)*

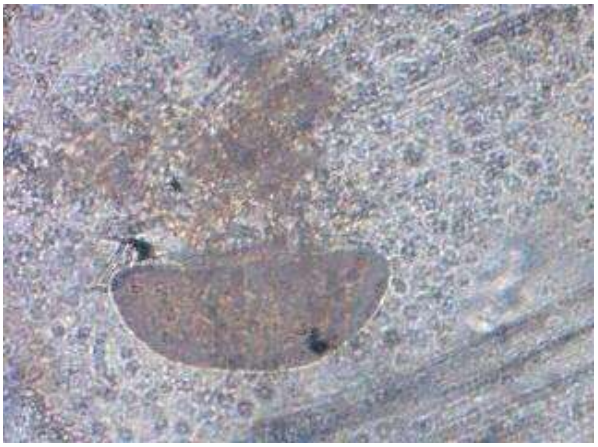
Rotifera *(Sinantherina Socialis)*

ROTIFERA *(NOTHOLCA SP)*

INSECTA (*Culex Egg*)



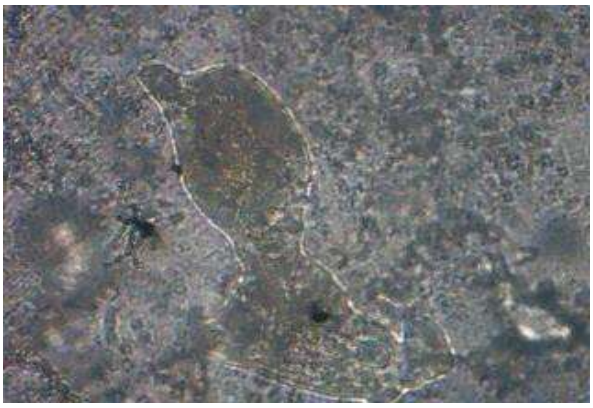
PROTOZOAN (*Volvox Sp*)



Protozoan (*Chilo Donella Uncinata*)

Plate 7-10: Protozoa And Crustaceans In Taylor Creek.

Protozoan (*Paramecium Candata*)



Protozoan (*Cucurbitella Sp*)

Protozoa (Arcella Mitrata)

Crustacean (Cyclopes)

4.0 DISCUSSION

The result for the investigation of zooplankton in Taylor Creek is represented in Table 2 and Table 3. The study recorded high diversity in plankton communities. Some species of zooplankton occurred across stations while others were absent in some stations. The main groups composing zooplankton communities in the creek are the protozoans, nematoda, rotifer, annelida, insecta, porifera and crustacean. In samples collected from four (4) stations in Taylor Creek for this study, a total of seven (7) taxa and forty nine (49) species were identified. The largest fraction belongs to protozoa and Annelida respectively, while insect, crustacean and porefera have the lowest fractions respectively.

From the result, the species richness and diversity were highest in station 2 as compared to the other stations. All zooplankton genera of different groups were represented at least by 1 or 2 species. Several species occurred at most stations like the protozoa and Annelida. The total number of zooplankton species varied between a minimum of 16 individuals in station 3 and a maximum of 55 individuals at station 2. Protozoans were the most diverse group. And they could be considered as the keystone which affects the total number of zooplankton species over the whole area with 23 species across all station (Table 2).

The density of protozoa showed well marked spatial variation and it had the highest species abundance and species richness in station 2. The Shannon diversity index (H) was found to be the highest at station 2 and the lowest at station 1.

Simpson dominance was found to be the highest at station 4 and the lowest was recorded at station 3 (Table 3). The most interesting result is the inverse correlations between the Shannon index and evenness and the total amount of zooplankton abundance. It means that the lowest amount of evenness shows that the abundance of zooplankton group was not homogenous and some of them were dominant. Also the lowest amount of evenness indicates high pollution. While the lowest Shannon's index indicates that these sampling areas are affected by stress. A similar trend was determined for pelagic zooplankton of coastal waters of Malven (Costa *et al,* 2012).

To explain this trend, it would be reasonable to assume that with reduction of the total amount of zooplankton, the relative amount of the biotope (water

mass) that the species can exploit increases leading to a reduction of inter-specific competition. Under conditions of sufficient resources for each species, most likely evenness in their abundance occurs (Tack *et al,* 2005).

The species diversity observed in this study was impressive. This could mean that there is no excessive nutrient input which normally causes decline in species diversity (Boaden and Seed, 1985). It is a measure of availability of various ecological niches to be occupied by various species of organisms within an ecosystem (Yakub, 2004).

Connell (1978) suggested that with small environmental stress raise, the diversity will be increased because of the decreasing competition, while if the environmental stress increases up to a higher point, the diversity starts to decrease then. Thus, increased eutrophication could lead to either an increase or a decrease in diversity for a certain community. In our study, the four diversity indices of protozoan communities at station 1 were lower than stations 2, 3 and 4, although latter stations were more polluted than the former.

High levels of species richness and low abundance occur in normal water bodies (Madoni and Braghiroli, 2007). The absence of this trend in this study shows that water suffers from pollution inputs.

Finally, the dearth of larger zooplanktons such as crustaceans and insect was observed in this study. This could be as a result of the preponderance of planktivorous fishes in the creek. Planktivorous fish select large zooplankters and can eliminate large cladocerans from lakes. Preys are visually selected, in most cases, on an individual basis, although the gill rakers of certain fishes collect some zooplankton as water passes through the mouth and across the gills. When size selection by fish is not in effect, and when large zooplankters are present, smaller-sized zooplankton are generally not found to co-occur with the larger forms. The cause is likely a result of size-selective predation of smaller zooplankton by invertebrates (copepods, phantom midge larvae, and predaceous Cladocera)

CONCLUSION

The result of the study shows that station 2 has the highest number of species abundance and richness, while station 3 had the lowest. Protozoa was the most dominant zooplankton while insect and crustaceans were the least. The dominance of protozoa may be connected by nutrient enrichment of the creek, while the absence of larger zooplanktons may be connected to unfavourable conditions and the presence of planktivorous fishes. Therefore the creek suffers from sewage and organic pollution thus confirming the assertion that land based activities greatly affect aquatic integrity.

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