Original Research Article

AssessmentofZooplanktonin Calabar Great Kwa River

ABSTRACT

Aim: Zooplanktons in the Calabar Great Kwa River were studied to assess the effect of pollution from human activities around the river on their respective abundance.
Place and Duration of Study: Samples were collected at the Esuk Atu and Esuk Atimbo stations of the Calabar Great Kwa River. Identification of Zooplanktons was carried out at the Laboratory of the Department of Genetics and Biotechnology, University of Calabar, Calabar, Nigeria.
Methodology: Collected samples were preserved, transferred to the laboratory, identified using a dissecting microscope and classified according to their different taxonomical groups.
Results: The Results showed that zooplankton abundance and distribution recorded in the stations were low due to pollution and interference from high human activities around the river such as domestic solid wastes, sewage waste waters, industrial effluents, pesticides, sand mining activities, hydrocarbons and other toxic substances. In Esuk Atu, the total abundance of zooplanktons in the periods of sampling were 12, 6, 3 and 11, while the numbers of taxa represented in the periods of sampling were 4, 3, 1 and 4. In Esuk Atimbo, the total abundance of zooplanktons in the periods of sampling were 7, 5, 9 and 10 while the numbers of taxa represented in the periods of sampling were 3, 3, 3 and 2. The zooplankton taxa identified in station 1(Esuk Atu) are *Cladoceran* (38%), *Ostracoda* (22%), *Copepoda* (19%), *Rotifera* (12%), *Lepidoptera* (6%) and *Protozoa* (3%). The zooplankton taxa identified in station 2 (Esuk Atimbo) are *Copepoda* (26%), *Cladoceran* (23%), *Nemata* (23%), *Lepidoptera* (16%), *Rotifera* (6%), *Polycheata* (3%) and *Paguridae* (3%).
Conclusion: These findings necessitate the need for the regulation and control of pollution from human activities around the Calabar Great Kwa River so as to ensure that the river is free from harmful contaminants thereby preserving the zooplanktons and other relevant organisms.

Keywords: Zooplankton; Abundance; Calabar Great Kwa River; Taxa; Occurrence; Pollution; Environments.

1.INTRODUCTION

Zooplanktons encompass an array of macro and microscopic animals and comprise representatives of almost all major taxa particularly the invertebrates. They are a group of aquatic organisms and are important as they constitute essential biotic components which influence the efficiency of an aquatic ecosystem such as energy flow through various trophic interactions [1].

Zooplankton (Greek: Zoon, animal; planktos, wanderer) are myriads of diverse floating and drifting animals with limited power of locomotion and majority of them are microscopic, unicellular or multicellular with sizes ranging from a few microns to a millimeter or more and the most characteristic feature is their variability over space and time in any aquatic ecosystem [2].

They play an important role to study the faunal bio-diversity of aquatic ecosystems. They include representatives of almost every taxon of the animal kingdom and occur in the pelagic environment either as adults (holoplankton) or eggs and larvae (meroplankton). By sheer abundance of both types and their presence at varying depths, they are utilized to assess energy transfer at secondary trophic level. They feed on phytoplankton and facilitate the conversion of plant material into animal tissue and in turn constitute the basic food for higher animals including fishes, particularly their larvae [2].

They are also used as bio-indicators to help in the detection of pollution load and also in ameliorating polluted waters [3]. Species of zooplankton vary in their susceptibility to environmental stressors, such as exposure to toxic chemicals, acidification of the water, eutrophication and oxygen of the water, eutrophication and oxygen depletion or changes in temperature.

The Calabar Great Kwa River is one of the major tributaries of the cross river estuary. It is a typical fresh water ecosystem, it is lotic water, and it is a semidiurnal flow of water and it is also an estuary. The Great Kwa River takes its course from the Oban Hills in Aningeji, Cross River State Nigeria which flows southwards and discharges into the Cross River estuary around latitude $4^0$45'N and longitude $8^0$20'E. The lower reaches of the river drain the eastern coast of the Calabar municipality, the capital of Cross River State of Nigeria [3].

Due to increasing population and industrial activities expanding rapidly into the freshwater and mangrove swamps of the Calabar Great Kwa River, wastes are washed into the river during torrential rainfall which puts increasing pressure on the self-purification capacity of the river with negative consequences on most water uses [4].

It has earlier been reported that high human activities around a station in the Calabar Great Kwa River and the release of wastes was responsible for the poor species richness in the area [5]. Ekpo *et al.* [6, 7] reported the distribution and seasonal variation of Zooplanktons in the Calabar Great Kwa River, also suggested that the river could be under pollution stress and also recommended that laws are enforced to control the disposal of effluent and other waste products. Base-line information on the pollution levels and physiochemical properties of the river has also been reported [8]. It has also been shown that when at a clean state, Zooplanktons had high species diversity in the Calabar Great Kwa River [3].

2. MATERIAL AND METHODS

2.1 Study Site

Two stations of the Calabar Great Kwa River, Esuk Atu by the University of Calabar and Esuk Atimbo along Akpabuyo Bridge were used in this study.

2.2 Sample Collection and Processing

Samples were collected from the two (2) stations at 4 different intervals by throwing method using plankton net with a mesh size of 55µm into the river. The zooplanktons collected were emptied into sampling bottles and 2% buffered formalin solution was used to preserve them. At each interval, they were transferred to the laboratory for identification.

2.3 Identification of Samples

Zooplankton samples collected from the two stations were placed on clean grease free microscopic slides and viewed under a dissecting microscope. They were identified and classified according to their different taxonomical groups [2].

2.4Determination of % abundance of zooplanktons and their respective taxa

The abundance of zooplanktons and their taxa was determined as a percentage ratio of their abundance to the total number of samples identified in the stations of study. The formula below was used:

$$\% \text{ Abundance} = \frac{\text{Total number of individuals in a taxonomic group}}{\text{Total number of individuals in the entire taxonomic groups}} \times \frac{100}{1}$$

3. RESULTS AND DISCUSSION

The results showed the distribution of Zooplanktons that are present in the Calabar Great Kwa River. In station A, Esuk Atu, 15 species of zooplankton belonging to 6 taxa were identified (Table 1). They are *Copepoda* which included *Bryocamptus birsteinii, Copepod nauphis, Mesocyclops leucarti* and *Metacyclops minutus*; *Protozoa* such as *Trinema enchelys*; *Rotifera* which included *Iecane luna, Colurella uncinata* and *lecane ungulate*; *Cladoceran* which included *Moinadaphnia macleayi*, *Cladoceran nauphius, Daphinia lacustris,* and *Cladoceran leg*; *Ostracoda* which included *Chlamydotheca unispinosa* and *Candona*; and *Lepidoptera* such as *Lepidoptera larvae*.

In station B, Esuk Atimbo, 17 species of zooplankton belonging to 7 taxa were identified (Table 2). They are *Lepidoptera* which included *Lepidoptera* and *Lepidoptera larvae*; *Cladoceran* which included *Daphnia lacustris, Moina, Bosmina longirostris*; *Copepoda* which included *Bryocamptus birsteinii, Copepod nauphius, Metacyclops minutus, Mesocyclops bodanicola* and *Parastica*; *Nemata* such as *Anonchus monhystera, Rhabdolaimus minor, Pangrolaimus sub-elongatus* and *Pangrolaimus stenurus*; *Rotifera* such as *conechilpides dossuarius*; *Polycheata* such as *Sponoidlatelarva*; and *Paguridae* such as *Pagurus prideauxi*.

Table 3 shows the total percentage abundance of Zooplanktons in station 1 (Esuk Atu). *Cladoceran* taxon has the highest occurrence with a total of 38%, *Ostracoda* has a total occurrence of 22%, *Copepoda* has a total occurrence of 19%, *Rotifera* has a total occurrence of 12%, *Lepidoptera* has a total occurrence of 6% and *Protozoa* with the least occurrence of 3%. The total percentage occurrence of zooplanktons in station 1 (Esuk Atu) from the four different sampling periods is 38%, 19%, 9% and 34%.

Table 4 shows the total percentage abundance of Zooplanktons in station 2 (Esuk Atimbo). *Copepoda* taxon has the highest occurrence with a total of 26%, *Cladoceran* and *Nemata* have a total occurrence of 23% each, *Lepidoptera* has a total occurrence of 16%, *Rotifera* has a total occurrence of 6%; *Polycheata* and *Paguridae* with the least occurrence of 3% each. The total percentage occurrence of zooplanktons in station 2 (Esuk Atimbo) from the four different sampling periods is 23%, 16%, 29% and 32%.

Table 5 shows the summary of the occurrence of zooplanktons and the number of taxa sampled in the two stations. In Esuk Atu (Station 1), the total occurrence of zooplanktons in each of the 4 sampling periods are 12, 6, 3 and 11 while the number of taxa represented in the sampling periods are 4, 3, 1 and 4. In Esuk Atimbo (Station 2), the total occurrence of zooplanktons in each of the 4 sampling periods are 7, 5, 9 and 10 while the number of taxa represented in the sampling periods are 3, 3, 3 and 2.

Table 1. Identification of Zooplanktons in Station A (Esuk Atu)

Taxa	**Species**
Copepoda	*Bryocamptus birsteinii, Copepod nauphis, Mesocyclops leucarti* and *Metacyclops minutus.*
Protozoa	*Trinema enchelys*
Rotifera	*lecane luna, Colurella uncinata* and *lecane ungulate*
Cladoceran	*Moinadaphnia macleayi*, *Cladoceran nauphius, Daphinia lacustris,* and *Cladoceran leg*
Ostracoda	*Chlamydotheca unispinosa* and *Candona*
Lepidoptera	*Lepidoptera larvae*

Table 2. Identification of Zooplanktons in Station B (Esuk Atimbo)

Taxa	**Species**
Lepidoptera	*Lepidoptera* and *Lepidoptera larvae.*
Cladoceran	*Daphnia lacustris, Moina, Bosmina longirostris*
Copepoda	*Bryocamptus birsteinii, Copepod nauphius, Metacyclops minutus, Mesocyclops bodanicola* and *Parastica*
Nemata	*Anonchus monhystera, Rhabdolaimus minor, Pangrolaimus sub-elongatus* and *Pangrolaimus stenurus*
Rotifera	*Conechilpides dossuarius*
Polycheata	*Sponoidlatelarva*
Paguridae	*Pagurus prideauxi*

Table 3. Total percentage abundance of Zooplanktons from Station A (Esuk Atu)

Taxa	1st Sampling %	2nd Sampling %	3rd Sampling %	4th Sampling %	Total Occurrence	%
Copepoda	3(25)	3(50)	-	-	6	19%
Protozoa	1(8)	-	-	-	1	3%
Rotifera	-	1(17)	-	3(27)	4	12%
Cladoceran	6(50)	2(33)	3(100)	1(9)	12	38%
Ostracoda	2(17)	-	-	5(46)	7	22%
Lepidoptera	-	-	-	2 (18)	2	6%
Total Number of Zooplankton	12(38)	6(19)	3(9)	11(34)	32	100

Table 4.Total percentage abundance of Zooplanktons from Station B (Esuk Atimbo)

Taxa	1st Sampling %	2nd Sampling %	3rd Sampling %	4th Sampling %	Total	% Occurrence
Lepidoptera	2(29)	-	-	3(30)	5	16%
Cladoceran	1(14)	-	6(67)	-	7	23%
Copepoda	4(57)	3(60)	1(11)	-	8	26%
Nemata	-	-	-	7(70)	7	23%
Rotifera	-	-	2(22)	-	2	6%
Polycheata	-	1(20)	-	-	1	3%
Paguridae	-	1(20)	-	-	1	3%
Total Number of Zooplankton	7(23)	5(16)	9(29)	10(32)	31	100

Table 5. Summary of the occurrence of Zooplanktons and the number of Taxa sampled inStation 1(Esuk Atu) and Station 2 (Esuk Atimbo).

Sampling Period	Total Abundance Station 1- Esuk Atu	Number of Taxa	Total Abundance Station 2- Esuk Atimbo	Number of Taxa
1st Sampling	12	4	7	3
2nd Sampling	6	3	5	3
3rd Sampling	3	1	9	3
4th Sampling	11	4	10	2

Zooplanktons in the Calabar Great Kwa River were identified from the two stations. From the study, different species belonging to different taxa were identified from the stations in four sampling periods. The results showed that the abundance of zooplanktons and taxa sampled were low and may be due to pollution from high human activities within the area. This is in line with the study of Uriarte and Villate [9] who studied the effects of pollution on zooplankton abundance and distribution and reported that differences in the patterns of mesozooplankton indicated that they were affected by pollution.

This study is also in conformity with Okorafor *et al.* [5] who reported that high human activities around a station in the Calabar Great Kwa River and the release of wastes were responsible for poor species richness in the area. The findings also corroborated with the work of Bashir *et al*. [10] which recorded low zooplankton populations in water bodies due to pollution from industrial effluents. Abdel-Halim *et al*. [11] disclosed that zooplankton density decreased with increasing pollution from sewage waste water concentration.

Deksne [12] also reported changes in zooplankton taxa in a river due to the influence of pollution from wastewater. Wei *et al*. [13] also in their report suggested that local environmental constraints such as environmental pollution caused by human activities could affect zooplankton community structure.

These findings necessitate the need for regulation of human activities across water bodies which are habitat for zooplanktons and other important organisms.

4. CONCLUSION

Zooplanktons are important in the ecosystem as they connect the primary production and higher levels by being utilized to assess energy transfer at secondary trophic level and among other things, help in monitoring water quality. From the study, it has been proven that zooplankton abundance was affected by pollution from high human activities around the two stations of the Calabar Great Kwa River ranging from domestic wastes, waste waters such as sewage waste water, industrial effluents, pesticides, herbicides, sand mining activities, synthetic plastics, heavy metals, hydrocarbons, and other toxic substances

There is an urgent need for the regulation and control of pollution from human activities around the Calabar Great Kwa River so as to ensure that the river is free from harmful contaminants thereby preserving the zooplanktons and other relevant organisms. Drainage waste water should be treated using advanced methods prior to discharge into the river. Appropriate authorities should also ensure that manufacturers and industries adhere strictly to the set emission standards in order to minimize the effects on aquatic biodiversity of the river. There is also need for continuous monitoring of the general biological and physicochemical state of the river.

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