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# The Abundance and Diversity of Aquatic Invertebrates in Uwa - West / Ikot Ebak River, Essien Udim, Akwa Ibom State, Nigeria

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## Abstract

This study was conducted to evaluate the diversity and abundance of aquatic invertebrates in Uwa - west / Ikot Ebak River, Akwa Ibom State. Samples were collected twice in a month from September through November 2012, using standard entomological methods. A total of 306 individuals representing 11 orders were encountered. The most dominant insect order was Orthoptera, followed by Hemiptera with a relative abundance of 90 (29.4%) and 78 (25.5%) individuals respectively, while the least abundant groups Odonata, Lepidoptera, Diptera, and Plecoeptera accounted for less than 2% each. The community structure, species diversity and abundance of the indigenous aquatic insects may give a clue on the ecological integrity of this river, which could be qualified as one maintaining moderate ecosystem integrity.

## Keywords

Aquatic Invertebrate, Abundance, Diversity, Ecosystem

## 1. Introduction

It is estimated that about 4, 500 species of insects are known to inhabit the diverse freshwater ecosystems (Balaram, 2005). This is because aquatic insects are of great importance and their presence serves various purposes such as, food for fishes and other aquatic invertebrates, and as vectors through which disease pathogens are transmitted to both man and animals (Foil, 1998; Ward, 1992; Chae *et al*., 2000).

Aquatic insects are among the most directly affected and vulnerable organisms with regards to surface water pollution (Edegbene and Arimoro, 2012; Compin and Céréghino 2003). Their structure and species composition are often used in assessing the ecological integrity of aquatic habitats (Arimoro and Ikomi, 2009). That is why, certain taxa such as Ephemeropterans, Plecoepterans and Trichopterans (EPT) have been tagged pollution intolerant and are only found in clean, fresh and pollution - free aquatic habitat (Bauernfeind and Moog 2000), Whereas, pollution tolerant insect taxa have been identified with Chironomids and Culicids larvae (Arimoro and Ikomi, 2009). The composition, distribution and diversity of aquatic insects can be affected by the nature of the stream bed, macrophytes, canopy covers and water velocity at different levels and the physico - chemical variables (Arimoro and Ikomi, 2009; Edegbene and Arimoro, 2012).

Most water bodies are continuously subjected to increasing pollution loads and the resultant change is often seen in the simultaneous shift in the water quality variables such as temperature, dissolve oxygen, alkalinity, pH, phosphate, nitrates and metallic concentrations (Abowei and Sikoki, 2005; Asonye *et al.*, 2007). Hence the use of aquatic insect community for assessing water quality provides a clue for environmental management and quality decision making towards accurate and justifiable actions in regards to the state and quality of water ecosystems

## 2. Material and Methods

Study area: Uwa – west / Ikot Ebak River is located in Afaha Ikot Ebak community in Essien Udim Local Government area, Akwa Ibom State. It lies between 7° 32'

North of latitude and 5° 404' East of longitude (Fig 1). The River flows from Ekpenyong/Mkpatak Rivers and empty into the Etim Ekpo water channels. The area is marked by two seasons; rainy, which starts from April and dry seasons which starts from November. Temperature is always high with slight variations between 27°C and 29°C, while relative humidity ranges from 60 - 90%. The river is subjected to various anthropogenic activities such as bathing and waste disposal.

Sample collection: Aquatic invertebrate were collected twice in a month between September and December 2012 from the hours of 8.00 to 10.00 a.m. Aquatic Invertebrate were collected with the use of sweep nets by hauling at least 5 minutes from three sampling stations on the river and kick sampling methods. Samples collected were preserved with 90% alcohol and taken to Department of Zoology Laboratory, University of Uyo, Uyo, Nigeria for sorting and identification with the help of a dissecting microscope of (4x) objective lens and an appropriate taxonomic key guide, such as provided by of Pennak, (1978), Gerber and Gabriel, (2002) and Danladi *et al*., (2013). The numbers were counted.

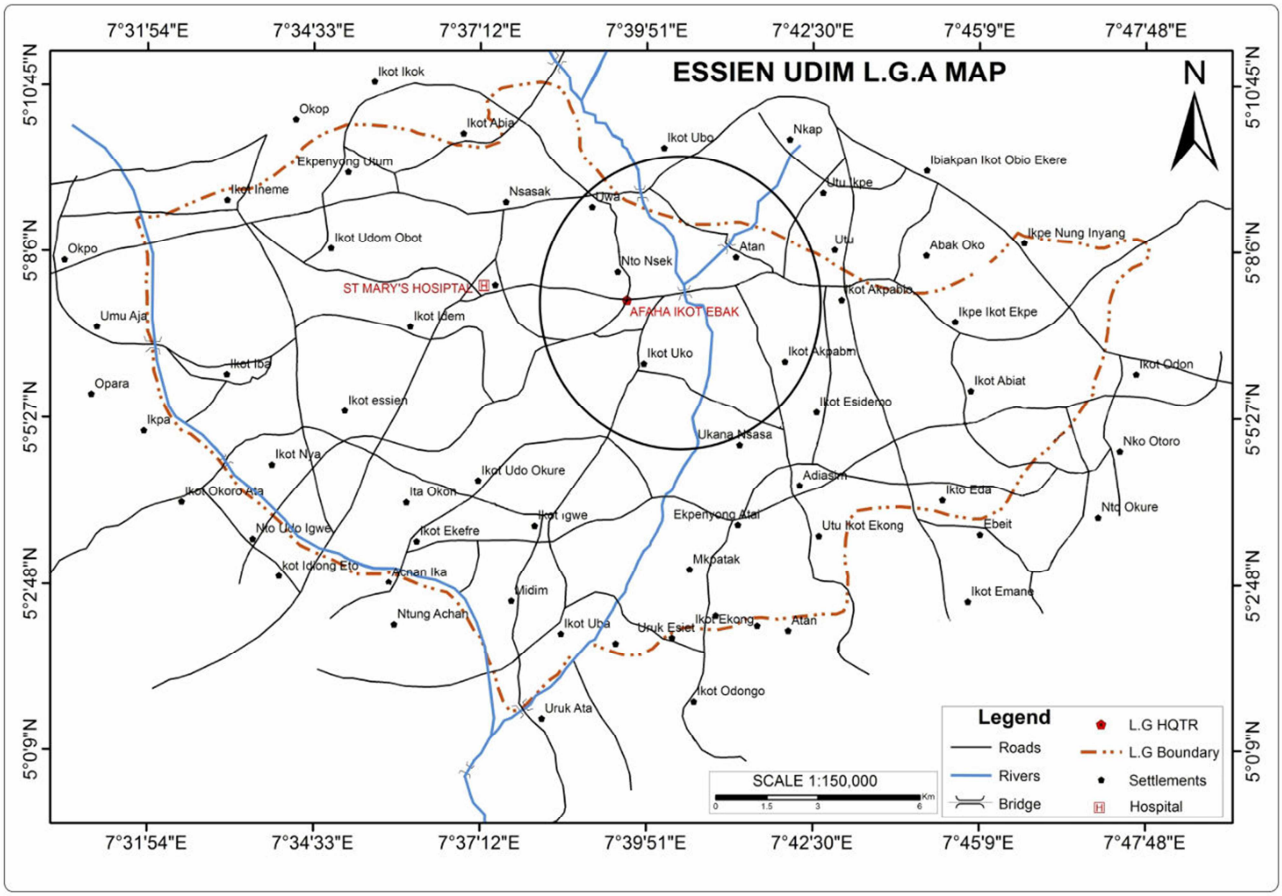


***Fig. 1.*** *Map of study area showing the river.*

Data analysis: Microsoft excel (2007) was used for Data analysis to determine the numerical and percentage abundance, while version 3 of PAST Software Design was used to determine the Diversity index of the aquatic invertebrate composition.

## 3. Results

A total of three hundred and six (306) individuals of aquatic invertebrate representing eleven (11) orders were encountered during the study period. These included; Orthoptera, Hemimptera, Coleoptera, Ephemeroptera, Neuroptera, Hymenoptera, Megaloptera, Odonata, Lepidoptera, Diptera, Plecoeptera and Collembola. The most dorminant order was Orthoptera, with a relative abundance of 90 (29.4%) individuals followed by Hemimptera 78 (25.5%) individuals, while the least abundant taxa included: Odonata, Lepidoptera, Diptera and Plecoeptera each with percentage abundance less than 2% (Table 1).

The spatial distribution of these Aquatic insects varied across the sampling stations. One hundred and thirty four (134) individual aquatic invertebrate were recorded in Station 2, accounting for 43.8% of the total abundance, followed by Station 3 with 107 individuals accounting for (34.97%) and Station 1 with 65 individuals accounting for 21.2%. The order, Orthoptera accounted for the most diverse and abundant group in Station 1 and 2. In Station 1, the pattern of abundance was as follows, Orthoptera accounted for 52.3% > Coleoptera 24.6% > Hymenoptera (9.2%) > Hemiptera (6.15%), while the rest taxa were less than 5% respectively. In Station 2, Orthoptera accounted for 29.9% > Hemiptera (25.4%) > Ephemeroptera (16.4%) > Megaloptera (11.1%) >

and Coleoptera (10.5%) respectively, while the rest were less than 10% respectively. In Station 3, Hemiptera accounted for (37.38%) > Neuroptera (19.62%) (Found only in station 3) > Orthoptera (14.95%) > Coleoptera (13.08%). The rest were less than 10% respectively (Table 2). Table 3 shows the checklist of Aquatic Invertebrate encountered during the study period.

***Table 1.*** *Percentage abundance of aquatic insect orders encountered during the study period.*

| S/N | Insect order | Occurrence (N) | Percentage abundance (%) |
|---|---|---|---|
| 1. | Orthoptera | 90 | 29.4 |
| 2 | Hemiptera | 78 | 25.5 |
| 3. | Coloeptera | 44 | 14.4 |
| 4. | Ephemeroptera | 22 | 7.2 |
| 5. | Neuroptera | 21 | 6.9 |
| 6 | Hymenoptera | 17 | 5.6 |
| 7. | Megaloptera | 15 | 4.9 |
| 8. | Odonata | 5 | 1.6 |
| 9. | Lepidoptera | 5 | 1.6 |
| 10. | Diptera | 5 | 1.6 |
| 11. | Plecoeptera | 4 | 1.4 |
| | | ∑N = 306 | |

Richness index was observed across the stations in the following order: Station 2 (0.38%) > Station 3 (0.37%) > Station 1 (0.32%) (Table 2).

***Table 2.*** *Diversity index of Aquatic insect encountered during the study period.*

| | | Station 1 | | | Station 2 | | | Station 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| S/N | Insect Order | N | R | E | N | R | E | N | R | E |
| 1. | Orthoptera | 34 | 0.52 | 0.34 | 40 | 0.20 | 0.32 | 16 | 0.17 | 0.30 |
| 2 | Hemiptera | 4 | 0.06 | 0.17 | 34 | 0.24 | 0.51 | 40 | 0.41 | 0.52 |
| 3. | Coloeptera | 16 | 0.25 | 0.35 | 14 | 0.10 | 0.23 | 14 | 0.13 | 0.27 |
| 4. | Ephemeroptera | - | - | - | 22 | 0.16 | 0.29 | - | - | - |
| 5. | Neuroptera | - | - | - | - | - | - | 21 | 0.10 | 0.23 |
| 6. | Hymenoptera | 6 | 0.09 | 0.22 | 4 | 0.03 | 0.11 | 7 | 0.07 | 0.19 |
| 7. | Megaloptera | - | - | - | 15 | 0.11 | 0.24 | - | - | - |
| 8. | Odonata | 3 | 0.05 | 0.15 | - | - | - | 2 | 0.02 | 0.08 |
| 9. | Lepidoptera | - | - | - | 5 | 0.04 | 0.10 | - | - | - |
| 10. | Diptera | - | - | - | - | - | - | 5 | 0.05 | 0.15 |
| 11 | Plecoptera | 2 | 0.02 | 0.11 | - | - | - | 2 | 0.02 | 0.08 |
| | TOTAL | N=65 | | | N=134 | | | N=107 | | |

***Table 3.*** *Checklist of Aquatic Invertebrate encountered during the study period.*

| S/N | Insect Order | Station 1 | Station 2 | Station 3 |
|---|---|---|---|---|
| 1. | Orthoptera | Grylloidae | Grylloidae | Grylloidae |
| 2. | Coleoptera | Dytiscidae | Dytiscidae | Dytiscidae |
| 3. | Ephemeroptera | - | Leptophlebiidae | - |
| 4. | Neuroptera | - | - | Sisyridae |
| 5. | Hemiptera | Belostomatidae | Belostomatidae | Belostomatidae |
| 6. | Hymenoptera | Mymaridae | Mymaridae | Mymaridae |
| 7. | Megaloptera | - | Coridalidae | - |
| 8. | Odonata | - | Calopterygidae | Coenagrionidae |
| 9. | Lepidoptera | - | Crambidae | - |
| 10. | Diptera | - | - | Chironomidae |
| 11. | Plecoeptera | Capniidae | - | - |

## 4. Discussion

The community structure and species composition of aquatic insects are often used in assessing the ecological integrity of aquatic habitats. Certain taxa such as Ephemeropterans, Plecopterans, and Trichopterans (EPT) have often been tagged pollution intolerant species found only in clean, fresh and pollution - free aquatic environment, While pollution tolerant insect taxa have also often been identified with Chironomids and Culicids larvae (Arimoro and Ikomi, 2009). The sporadic and lower occurrence of the pollution intolerant species (EPT) across the sampling stations may be an indication of gradual stress input in Uwa - west / Ikot Ebak River.

Representatives of aquatic insect families like Chironomidae, Gyrrinidae and Belostomatidea have often times been considered as an index of pollution for different levels of aquatic perturbation. This result has agreed with the findings of Popoola and Otalekor (2011) on the analysis of aquatic insect community of Awba Reservoir in Ibadan,

Nigeria who advocates that nutrient load is an important ecological factor when assessing the integrity of an aquatic ecosystem. In the present study, it has been observed that nutrient load has direct impact on the distribution and abundance of dipterans (Chironomidae sp) (Popoola and Otalekor, 2011). Arimoro et al., (2007) have further reported that the abundance of Chironomidae sp. in any aquatic ecosystem is attributed to a considerable amount of organic load either from untreated sewage or livestock effluents. However, the lower occurrence 5 (1.6%) of Chironomidae *sp*. in Uwa – west / Ikot Ebak River may be an indication of a lower level of organic load in this river.

Geological characteristics and the presence of riparian vegetation, among other factors, determine the physical and chemical variables of an aquatic environment (Lian - Bo *et al*., 2013). In the present study, certain aquatic and semi - aquatic insect taxa such as; Orthopterans and Hemipterans requires specific habitat type because of their vulnerability to changes in their habitat quality such as fresh raparian vegetation. For the fact that streams with greater integrity offer nearby marginal vegetation, where food, shelter and Oviposition - site can easily be found, represents an optimal living condition for herbivores insects. This may be the reason for the higher abundance of Orthoptera with a relative abundance of 90 individuals accounting for 29.4% of the total population. Furthermore, Arimoro and Ikomi (2009) have also concurred that the abundance of aquatic and semi - aquatic insects may be influenced by the nature of the substrate, macrophytes and canopy cover.

## 5. Conclusion

Although Uwa - west/ Ikot Ebak River may still be maintaining a moderate aquatic ecosystem integrity which could be attributed to the higher abundance of herbivory insect taxa (Orthoptera and Hemiptera) and also in the sporadic occurrence of the pollution intolerant taxa (Ephemeroptera and Plecoeptera); The lower occurrence of certain pollution indexed taxa (Chironomidae and Belostomatidae) still points out to traces of organic load in this river.

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