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(RESEARCH ARTICLE)



The diversity of fresh water snail fauna in Kiri dam, Adamawa State, North Eastern Nigeria

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Abstract

Freshwater Snails are crucial in assessing the ecological status of water bodies, besides their economic, public and veterinary health importance. Hence, the need to study the occurrence, and diversity of freshwater snails in Kiri dam where there is paucity of such information becomes imperative. Accordingly, this study was carried out between December, 2016 and July, 2018. Snails were searched for in the five contact sites identified using long handle metal scoop nets in accordance with standard procedure. Snails recovered were examined for natural infections. Eleven (11) different fresh water snail species were encountered including *Bulinus globosus*, *Bulinus truncatus*, *Biomphalaria pfeifferi*, *Lymnaea natalensis*, *Lanistes ovum*, *Lanistes varicus*, *Pila ovata*, *Melanoides maculata*, *Melanoides tuberculata*, *Bellamya unicolor* and *Gabiella tchadiensis* of the eleven different snail species examined, only *Bulinus globosus*, *Bulinus truncatus* and *Biomphalaria pfeifferi* shed schistosome cercariae. The other 8 species did not have any natural infections. The study revealed that Kiri Dam harbours diverse species of fresh water snails including those of public health importance. The presence of naturally infected snails indicates that the people engaging in various activities in the dam, are predisposed to infections harboured by these snails.

Keywords: Freshwater snails; Kiri Dam; Adamawa State

1. Introduction

The development and management of dams has numerous social and economic benefits such as irrigation, power generation, fishing, transportation and tourism. However, damming of rivers and streams to build such reservoirs gives rise to significant modification in the natural ecology of the original water bodies [1]. It creates new biotopes which are conducive for breeding of fresh water snails. Some of these snails have been known to play significant roles in medical and veterinary health spheres because they serve as intermediate hosts for helminth parasites that cause diseases such as schistosomiasis, fascioliasis, paragonimiasis, and angiostrongylosis among others. The transmission of these infections takes place only in places where fresh water snail intermediate hosts are present, and where there are contact between the population and the infected water. Disease transmission is therefore facilitated by availability of surface water throughout the year and this is provided by dams.

Several studies in Nigeria have associated increase in prevalence of schistosomiasis and other snail borne infections with provision of dams. Some of these include those of Akogun and Akin [2] at the Savannah Sugar plantation staff village in Adamawa State, Adamu *et al.*, [3] at Piro village near Gubi Dam in Bauchi State, Abdulkadir *et al* [4] at Gimbawa Dam, Kaduna State, Timothy *et al.*, [5] at Zobe Dam, Dutsin-Ma, Katsina State and Sunday *et al.*, [6] at Dadinkowa man-made reservoir in Gombe State. All of these reports have observed an increased trend in transmission of snail borne

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parasitic infections or the occurrence of freshwater snail intermediate hosts of parasites of public health importance where they hadn't been earlier observed.

There is currently paucity of information on diversity, distribution and disease transmission potential of freshwater snails in the Kiri Dam. This information is none the less vital in planning any future intervention should the need arise. We therefore report here the freshwater snail fauna in Kiri Dam, Adamawa State, North Eastern Nigeria.

2. Material and methods

2.1. Description of study area

The study was carried out in Kiri Dam located in Shelleng Local Government Area of Adamawa State. (Fig.1) Shelleng is situated along latitude $9^{\circ} 53'51''N$ and longitude $12^{\circ} 0'32'' E$ Greenwich meridian, with population of 148, 490. The dam was constructed in the year 1982, on the river Gongola. It is 1.2 km long, having 20 m high zone embankment with internal clay blanket. It has a maximum depth of 10 m and an effective storage capacity of 615 million litres. It lies between the coordinates of $9^{\circ}50'N$ $12^{\circ} 00' 51''E$. The area has sedimentary rocks, limestone and Ignite. The landforms of the area are characterized by extensive floodplains and swamps. Most of the locations are liable to flooding, water logging or swamps. Kiri has marked dry and rainy seasons typical of tropical climate. The rainy season last from April to October, but sometimes May to September. The mean annual rainfall is between 759-1011 mm. The driest and coldest months are December and January with relative humidity of 13%. Although temperature varies from place to place due to altitude, the average minimum and maximum temperatures is $25^{\circ}C$ and $40^{\circ}C$ respectively.

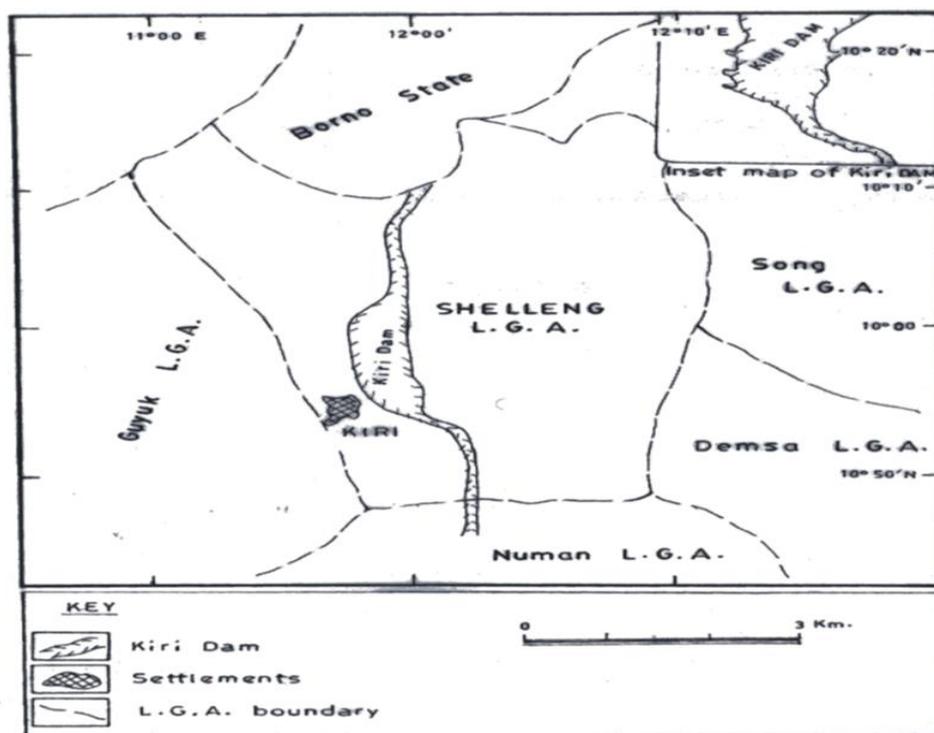


Figure 1 Map of Shelleng Local Government Area showing location of Kiri dam

Source: Ministry of Land and Survey, Adamawa state

2.2. Snail sampling and identification

Snail sampling from the identified water contact sites A-E was done twice a month for a period of 20 months from December, 2016 to July, 2018. On each sampling day, each site was searched carefully for 30 minutes using a long handle metal scoop net as described by [7]. Snails collected were kept in plastic containers and brought to the laboratory and were identified to species level on the basis of their morphological characteristics with reference to the standard keys of [8]. Thereafter, snails were shed for possible natural infections.

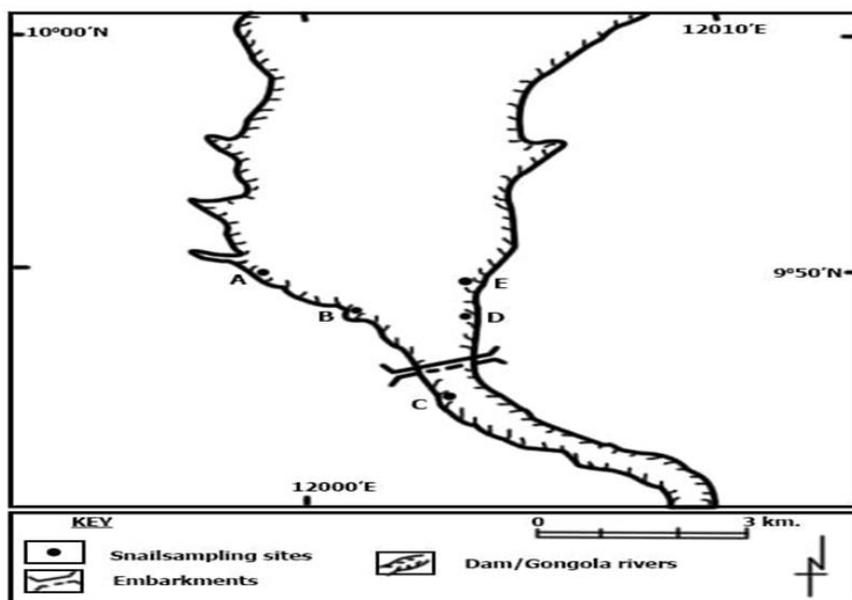


Figure 2 Kiri dam showing location of study sites A – E.

Source: Ministry of Land and Survey, Adamawa State

3. Results

Altogether Eleven (11) different snail species were encountered in the dam. These include *Bulinus globosus*, *Bulinus truncatus*, *Biomphalaria pfeifferi*, *Lymnaea natalensis*, *Lanistes ovum*, *Lanistes varicus*, *Melanoides meculata*, *Melanoides tuberculata*, *Gabiella tchadiensis*, *Bellamya unicolor*, and *Pila ovata*. *Bulinus globosus*, and *Biomphalaria pfeifferi* were very common in all snail sampling sites in the dam, while *Bulinus truncatus* was uncommon (Table 1). Similarly, *Gabiella tchadiensis*, *Lanistes ovum*, *Melanoides tuberculata*, and *Pila ovata* were also common while *Bellamya unicolor*, *Lanistes varicus*, and *Melanoides meculata* were uncommon as well (Table 1). The morphology of the snails encountered is depicted in Fig.3. Of the 11 species found, *Bulinus globosus*, *Bulinus truncatus*, and *Biomphalaria pfeifferi* shed cercariae typical of schistosomes.

Table 1 Diversity of fresh water snails found in Kiri dam, Adamawa state, north eastern Nigeria.

| Sub-Class | Snail species | Sampling sites | | | | |
|-----------------|-------------------------------|----------------|-----|-----|-----|-----|
| | | A | B | C | D | E |
| Pulmonata | <i>Bulinus globosus</i> | +++ | +++ | +++ | +++ | +++ |
| | <i>Bulinus truncatus</i> | + | + | + | + | + |
| | <i>Biomphalaria pfeifferi</i> | +++ | +++ | +++ | +++ | +++ |
| | <i>Lymnaea natalensis</i> | + | ++ | ++ | + | ++ |
| Prosobranchiata | <i>Bellamya unicolor</i> | + | + | + | + | + |
| | <i>Gabiella tchadiensis</i> | ++ | + | ++ | + | ++ |
| | <i>Lanistes ovum</i> | ++ | + | + | + | ++ |
| | <i>Lanistes varicus</i> | + | + | + | + | ++ |
| | <i>Melanoides meculata</i> | + | + | + | + | ++ |
| | <i>Melanoides tuberculata</i> | ++ | + | + | + | + |
| | <i>Pila ovata</i> | ++ | ++ | + | + | + |

Key: - not found, + = uncommon, ++ = common, +++ = very common



Figure 3 Shell characteristics of the 11 snail species encountered in Kiri Dam

Table 2 Infectivity status of fresh water snails encountered in Kiri dam, Adamawa state, north eastern Nigeria

| Snails species | No. examined | No. Infected | %infected |
|-------------------------------|--------------|--------------|-------------|
| <i>Bulinus globosus</i> | 1539 | 394 | 29.7 |
| <i>Bulinus truncatus</i> | 485 | 56 | 11.5 |
| <i>Biomphalaria pfeifferi</i> | 2016 | 358 | 7.8 |
| <i>Lymnaea natalensis</i> | 524 | 0 | 0.0 |
| <i>Bellamya unicolor</i> | 156 | 0 | 0.0 |
| <i>Gabiella tchadiensis</i> | 408 | 0 | 0.0 |
| <i>Lanistes ovum</i> | 609 | 0 | 0.0 |
| <i>Lanistes varicus</i> | 38 | 0 | 0.0 |
| <i>Melanoides meculata</i> | 99 | 0 | 0.0 |
| <i>Melanoides tuberculata</i> | 280 | 0 | 0.0 |
| <i>Pila ovata</i> | 566 | 0 | 0.0 |
| Total | 6720 | 808 | 12.0 |

4. Discussion

The results of this study show that Kiri dam harbours many species of freshwater snails. To the best of our knowledge, this is the first attempt to document the diversity of freshwater snail fauna in Kiri dam. All the 11 species encountered are common freshwater snails which have been reported from various parts of Nigeria [6,9-13]. Thus, no strange snail species were observed. It is interesting that of the 11 species found, only three of them (*Bulinus globosus*, *Bulinus*

truncatus, *Biomphalaria pfeifferi*) shed cercariae. It is therefore no wonder that in a different but related study in the area by the same authors both urinary and intestinal schistosome infections were common. Thus, the occurrence of naturally infected *Bulinus* and *Biomphalaria* species strongly suggest that transmission of both *Schistosoma haematobium* and *S. mansoni* is on-going in the area. A high level of water contact activity was also observed during the study and this is an important epidemiological factor enhancing the transmission of infection.

The occurrence of *Lymnaea natalensis* in the dam is note worthy although they did not carry any natural infections during the study it is a known intermediate host of *Fasciola gigantica*. Since cattle were observed drinking water and grazing along the banks of the dam, there is therefore a high possibility of these snails becoming infected thereby establishing a transmission cycle. Consequently, there is need to clarify whether active transmission of fascioliasis occurs in the area and to elucidate on the transmission pattern.

The presence of *Melanoides* species in Kiri dam is also note worthy. In particular *Melanoides tuberculata* is a known first intermediate host of the lung fluke *Paragonimus africanus* and *P. uterobilateralis*. Although the snail did not shed any cercariae it has the potential of being infected in future. Thus, it should be carefully monitored to determine its transmission status.

Occurrence of *Bellamya unicolor*, *Gabiella tchadiensis*, *Lanistes ovum*, *Lanistes varicus*, and *Pila ovata* in high abundance may be related to human and animal activities in the dam. This agrees with the report of [11] in the Gimbawa dam Kaduna State and that of [12] in Imo State, Nigeria. Even though they are not of any known medical or veterinary importance, they are still important because together with those having economic importance they are herbivores removing vegetative biomass which may affect the standing crop and distribution of primary producers in the aquatic ecosystem.

5. Conclusion

This study has shown that Kiri dam harbours a variety of freshwater snails some of which are known intermediate host of trematode parasites. In light of this, further studies to determine their precise roles in disease transmission as well as transmission patterns is desirable. In addition, snail surveys should regularly be undertaken so as to keep track of species diversity in the dam towards possible control.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

We declare that there are no conflict of interest in connection with this paper.

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