Macroinvertebrate Fauna in Streams Draining Ajenjua Bepo and Mamang River Forest Reserves, Eastern Region, Ghana

Authors: Samman, James, and Amakye, Joseph S.

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Chapter 5

Macroinvertebrate fauna in streams draining Ajenjua Bepo and Mamang River Forest Reserves, Eastern Region, Ghana

James Samman and Joseph S. Amakye

SUMMARY

In streams like those draining the Ajenjua Bepo and Mamang River forest reserves, available organic matter is processed by organisms including macroinvertebrates. Since different groups of invertebrates react differently to changes in habitat caused by deforestation, erosion, poor water quality, etc., the presence or absence of different invertebrate groups can illustrate the extent of degradation within study areas. The two forest reserves surveyed are located in watersheds which are tributaries of the Pra River. Among the three sites associated with Mamang River, the highest number of taxa (19 families) was found at Site 1 (Mamang at Mamanso). Of the sites associated with Ajenjua Bepo, the highest number of taxa (19 families) was recorded at Site 4 (Afosu at Afosu). The most common families in the survey were the Chironomidae, Baetidae and Dytiscidae. Some species recorded were those adapted to polluted waters. The occurrence of the families of Gastropoda in streams associated with the two reserves is of medical importance as some species of these families are hosts of schistosomiasis in Southern Ghana. Sanitation in nearby settlements should be improved and dense vegetation cover of headwaters must be maintained to insure that streams, to the extent possible, flow throughout the year to enable inhabitation by species of Plecoptera, Trichoptera, Tricorythidae, etc. which were not seen during the present study.

INTRODUCTION

In the aquatic environment, macroinvertebrates are the taxon most commonly used in assessing water quality (Wiederholm 1980, Abel 1989). They are appropriate for rapid assessment because their basically sedentary nature allows effective spatial analyses of pollutants or perturbations *(*Abel 1989). Also, they are very common and can therefore be affected by environmental perturbations in many different types of aquatic systems and in habitats within those waters (Lenat et al. 1980). Furthermore, their relatively long life cycles compared to other invertebrate groups allow elucidation of temporal changes caused by disturbance or habitat degradation (Lenat et al. 1980).

Nutrient processing in an aquatic ecosystem involves complex physical and biological interactions (Merritt et al. 1984). In streams like those draining Ajenjua Bepo and Mamang River, the available organic matter (allochthonous input) coming from the forest vegetation is processed by organisms including macroinvertebrates. The macroinvertebrates, as secondary producers, therefore contribute to community energy flow in the aquatic environment. Macroinvertebrates are eaten by certain species of fish and adult aquatic insects also contribute to food webs within the terrestrial community. Aquatic macroinvertebrates are an integral part of the river environment and, as such, require protection. Macroinvertebrates are a diverse group of organisms whose constituent sub-groups react differently to changes in the habitat caused by deforestation, erosion, poor water quality, etc. As a result, the presence or absence of different invertebrates can be used to understand the extent of degradation within a study area.

The macroinvertebrate biodiversity of the streams in Ajenjua Bepo and Mamang River in the Eastern Region of Ghana were assessed in August 2006. The purpose of the study was to collect data on the status of macroinvertebrate species of the study area in order to make recommendations on their protection and management.

METHODS

Study sites

The two forest reserves are watersheds for tributaries of the Pra River. These tributaries include the Mamang, Aprapong, Afosu, Akrawasu and Aboabo streams. During the study period, macroinvertebrates were collected at selected sites on these streams. The majority of the headstreams in the two reserves were dried up. Thus, samples could only be collected downstream. During the sampling period, the streams were either stagnant or slow-flowing at the survey sites. The bed at each site was muddy with some allochthonous material (dead leaves, twigs, etc.). The streams were shaded by forest vegetation in most parts and they appeared to receive organic pollutants. With the exception of Site 7 which was deep (> 1.0 m in midstream) the streams were wade-able (up to 0.3 m deep) at the study sites.

The GPS Coordinates of the sampling sites are as follows:

Mamang River Forest Reserve

Site 1	(Mamang at Mamanso)	6° 19'N 0° 59'W
Site 2	(Mamang at Nkwateng)	6° 15'N 1° 4'W
Site 3	(Aprapong at Ntronang)	6°20'N 1° 4'W

Ajenjua Bepo Forest Reserve

Site 4	(Afosu at Afosu)	6° 21'N 1° 0'W
Site 5	(Akrawasu at Abodom)	6° 23'N 1° 3'W
Site 6	(Akrawasu at Anikawkaw)	6°22'N 1° 2'W
Site 7	(Aboabo)	6°20'N 1° 2'W

Sampling Methods

With regard to macroinvertebrates, several methods have been proposed for use in water quality monitoring programs over the past several decades and many new methods have been developed specifically for rapid assessment approaches (Resh and Jackson 1993).

Considering the low water levels of the streams, the only sampling method that could be employed was the use of a pond net with a diameter of 25 cm and a mesh size of 300 um. A set of three samples was collected from each site. For each sample, an approximately 4-m stretch of the stream was sampled with the net for about three minutes. Large twigs and leaves collected in the sample were removed and discarded in order to reduce the sample volume. The samples were preserved in 70% alcohol and were later examined in the laboratory under a dissecting microscope. A few of the samples that were largest in volume were sub-sampled and 50% of the entire sample examined. Under the microscope the various organisms in each sample were identified to family and wherever possible to genus level and counted. It must be noted that despite the extensive investigations done on West African rivers, particularly during the Onchocerciasis Control Programme (OCP), there are still problems with the identification of the immature stages of most groups of aquatic macroinvertebrates. In the OCP, identification was limited to the family and genus levels.

RESULTS AND DISCUSSION

Appendix 4 shows the mean number of macroinvertebrates found in samples from each of the seven sites. Among the three sites associated with Mamang River, the highest number of taxa (19 families) was found at Site 1 (Mamang at Mamanso) and the lowest number (13 families) at Site 3 (Aprapong at Ntronang). Of the sites associated with Ajenjua Bepo, Site 4 (Afosu at Afosu) appeared to be rich in macroinvertebrates And 19 families were collected at this site.

The most common families in the survey were the Chironomidae, Baetidae and Dytiscidae which were all found at each of the sites sampled. Chironomidae and Baetidae were the most common taxa recorded in the rivers of the Volta Basins in West Africa (Samman and Pugh Thomas 1978, Samman and Amakye 1988). These families contributed a great deal to river productivity.

In the survey, the Decapoda (*Caridina* sp.) represented the main shredders while the Gastropoda were the scrapers in the stream environment. The predators were the Odonata, Hemiptera and some Coleoptera. The gathering collectors were mostly the Chironomidae and the Baetidae (*Cloeon* sp.). Of all the biotic and abiotic conditions in the streams, stream flow and water quality were expected to most greatly influence the occurrence and distribution of the invertebrates in the study area. Some of the invertebrates encountered were those that can adapt to polluted waters.

Hydrobiological monitoring work undertaken in the rivers of the Volta Basin in Ghana has shown that rivers and streams in the basin were more diverse in invertebrates because the rivers were relatively unpolluted (Samman et al. 2002). In this survey, *Cloeon* sp. was found in streams draining both reserves (at all the seven sites) while *Eristalis* sp. was seen at one site in Ajenjua forest stream (Akrawasu at Abodom). These species occur in the polluted Odaw stream system that drains Accra (Baa-Poku 2006) but are absent in the comparatively unpolluted White Volta, Black Volta, Oti and Pru rivers in Ghana.

In the OCP, macroinvertebrates that were considered to be threatened or sensitive to changes in the river environment were *Caridina* sp., *Neoperla* sp., Oligoneuriidae and Tricorythidae. Only *Caridina* sp. was found in the streams draining the two reserves studied.

Based on known distributions, none of the taxa encountered in the study seemed to be endemic to the two reserves. However, the occurrence of several families of Gastropoda in streams associated with the two reserves is of medical importance. Some species of these families are hosts of schistosomiasis in Africa including Southern Ghana.

Generally few macroinvertebrate families were recorded in both areas because the streams appeared stagnant, dry, or polluted due to human activities, particularly poor sanitation. Further pollution (primarily human and animal waste) could result in fewer taxa and this must be avoided. Sanitation in the settlements in the area must be improved. Dense vegetation cover of the headstreams must be maintained so that the streams are able, to some extent, to flow through-

out the year, enabling inhabitation of species of Plecoptera, Trichoptera, Tricorythidae, etc. which were not observed in the present study.

The majority of the aquatic macroinvertebrates encountered in the survey are insects which have flying adult stages, some with long flight ranges. The Pra River and streams other than those associated with these two reserves could be refugia for most of the aquatic insects were the survey area to be impacted.

It must be noted that the study was undertaken in August when the headstreams were dried up and the streams were stagnant downstream. Further studies must be undertaken during the peak of the rainy season (June/July) when the streams are flowing to more completely ascertain the diversity of macroinvertebrates in the two forest reserves.

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