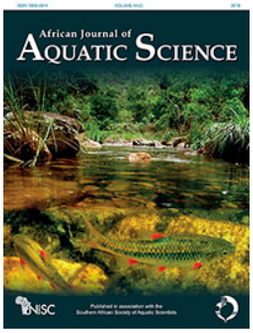

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Review Article

Taxonomic challenges associated with identification guides of benthic macroinvertebrates for biomonitoring freshwater bodies in East Africa: A review

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Although biomonitoring of freshwater bodies is important in East Africa as a result of increasing environmental threats, the identification guides of benthic macroinvertebrates used to generate data for developing metrics for this purpose are mainly not regionally specific. This casts doubt on the reliability and utility of generated data, given varying macroinvertebrate taxa in biogeographical regions. This review examined literature on freshwater macroinvertebrate studies and focused on the types of identification guides that are in use in East Africa, with a view of developing local ones for the region, to enable reliable and effective data collection and usage. The literature examined included peer-reviewed papers, books, dissertations, and un-refereed reports. Currently, it is mainly macroinvertebrate identification guides from temperate and other regions that are used in East Africa. Therefore, there is a need to develop identification guides that are based on local benthic macroinvertebrate species of East Africa. To achieve this, both lotic and lentic freshwater macroinvertebrates in various localities of East Africa should be collected through standardised protocols, taxonomically characterised and documented. Molecular phylogenetic tools, coupled with creation of a database should be considered to aid species identification of macroinvertebrates and freshwater biomonitoring in East Africa.

Keywords: biodiversity conservation, database, freshwater management, molecular identification, standardised protocol, taxonomic characterisation

Introduction

Aquatic macroinvertebrates are invertebrates whose body size exceed 0.5 mm, making them large enough to be seen with the naked eye. Most of them dwell within bottom sediments of water bodies, such as rivers, lakes and ponds, and hence are often referred to as benthic macroinvertebrates or macrobenthos. Macrobenthos include species of Mollusca and Annelida, which spend their entire lifetime in water, and aquatic insects of the orders Ephemeroptera, Diptera, Trichoptera and Plecoptera, whose immature stages (i.e. eggs, larvae and pupae) are aquatic, whereas corresponding adult stages are terrestrial (Jacobsen et al. 2008). Other aquatic macroinverterbates include some families of the order Coleoptera (beetles) and Hemiptera (bugs). Aquatic beetles usually lay eggs in water (e.g. on submerged substrates) from where the full-grown larvae crawl out and pupate near the water's edge; enabling the pupae to develop into adults (Stals and de Moor 2007). Hemiptera have both terrestrial and aquatic families. Both the immature and mature stages of their aquatic families are adapted for aquatic existence (de Moor et al. 2003b).

Some species of benthic macroinvertebrates have aquatic life stages that last for either a few weeks, several months or years. Adult stages of aquatic insects usually last from days to only a few weeks, whereas their larval or nymphal stages may last for a few months to a year or two, depending on the variation of several environmental factors (Jacobsen et al. 2008). Benthos are used as bioindicators, to monitor the quality of aquatic ecosystems (Wenn 2008; Li et al. 2010; Kripa et al. 2013; Martínez-Sanz 2014), offering several advantages: the sensitivity of the life stages of benthic macroinvertebrates (Hutchinson et al. 1998), and their relatively long life span enable them to integrate the effects of short and long-term environmental variations, accordingly providing biorecords of changes (Pratt and Coler 1976). In addition, they consist of very diverse species, with a wide range of trophic levels and pollution tolerances (Cook 1976; Kripa et al. 2013), and limited movement and quick response to pollutants, such as excess nutrients, sediment, metals, and other environmental stressors (Muralidharan et al. 2010). Therefore, changes in their community structure, such as reduction in species diversity and dominance by particular species, owing to ecosystem disturbances form the basis for developing biocriteria to evaluate anthropogenic, environmental and climatic impacts.

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