

Efficiency of the SASS4 rapid bioassessment protocol in determining river health: A case study on the Mhlathuze River, KwaZulu-Natal, South Africa

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Abstract

The purpose of the study was to verify the ability of the South African Scoring System version 4 (SASS4), to assess the health of aquatic ecosystems. The macroinvertebrate community attributes of the Mhlathuze River (KwaZulu-Natal, South Africa) were studied by applying the SASS4 rapid bioassessment method. In testing the effect of spatial and temporal variability in community structure on SASS4 scores it was found that there was a stronger spatial than a temporal effect. It was determined that of the indices used in association with SASS4, the biotic indices (average score per taxon, total score and number of taxa) reflected changes in community structure, but the abiotic habitat quality index did not. It was found that qualitative family-level data provided an adequate classification of sites for use in routine biomonitoring. Ambiguous results were obtained with respect to the importance of measuring abundance during routine biomonitoring. No definite conclusion with respect to the ability of the SASS4 to reflect physical-chemical water quality changes could be drawn from the results obtained in this study. SASS4 was able to reflect the effect of the tidal push from the Mhlathuze Estuary, but this marine influence probably masked less pronounced effects exerted by the remainder of the physical-chemical variables that were investigated.

Introduction

For the past few years, national attention has been focused on establishing a national biomonitoring programme for aquatic ecosystems. This has led to the establishment of the River Health Programme (RHP), as it is currently known. River or ecosystem health refers to the ability of ecosystems to function in a way comparable to that system in its natural state, and any reduction in this ability leads to a decrease in integrity (Roux et al., 1999). A healthy ecosystem would be able to:

- resist external pressures (resistance) and
- recover from unpreventable pressures (resilience) (Roux and Everett, 1994).

The SASS4 rapid bioassessment method forms an integral part of the RHP (Roux et al., 1999).

SASS4 was developed by Chutter (1994) as a quick, cost-effective method for assessing river health (Dallas, 1997). The SASS4 protocol is essentially a biotic index of the condition of a river, based on the resident macroinvertebrate community, whereby each taxon is allocated a score according to its level of tolerance to river health degradation (Dallas, 1997). The advantage of SASS4 is that it has the potential for significantly reducing the labour and time factors confronting freshwater ecologists, since the number of habitats examined and the replicated sample units taken per site are reduced (Chutter, 1994). Dallas (1995, 1997) addressed some of the uncertainties associated with SASS4 and concluded that it has enormous potential as a rapid assessment tool for river health and that the widespread application of this method necessitates the founding of SASS4 on a sound scientific base.

Dallas (1997) identified some research needs aimed at addressing the founding of SASS4 on a sound scientific base. This paper attempts to address some of these needs through the formulation of

the following objectives, namely, to investigate:

- The effect of spatial and temporal variation on the accuracy of SASS4 in reflecting changes in macroinvertebrate community structure.
- The ability of the indices used in association with SASS4 to reflect changes in macroinvertebrate community structure.
- The effect of taxonomic resolution and quantification on the accuracy of SASS4 in representing macroinvertebrate community structure.
- The ability of SASS4 to reflect changes in physical-chemical water quality.

The SASS4 scores are affected by the availability and condition of habitat as well as changes in physical-chemical water quality. Thus, an integrative approach, which included physical-chemical, habitat and biological assessments, was followed to provide increased accuracy.

Limitations associated with the study included the scarcity of appropriate taxonomical keys and the fact that habitat indices existing at the time of sampling (HQL, HAM and HABS1) failed to provide an adequate estimation of habitat quality. MacMillan (1998) has since developed an alternative habitat index (IHAS) for use in conjunction with SASS4. Other limitations included the absence of site-specific data on certain important physical-chemical variables, such as flow and turbidity, the lack of truly quantitative data and the absence of separate datasets for each biotope.

Materials and methods

Description of the Mhlathuze River catchment

The Mhlathuze River is one of the larger rivers draining the Zululand Coastal Plain (Meyer and Godfrey, 1995). It originates in the foothills of the Babanango Mountain, approximately 1 500 m a.s.l., 110 km north-west of Richards Bay. The total length of this perennial river is 208 km (Anonymous, 1983). The catchment, occupying an area of 4 238 km², has a storage capacity

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