

Determining the possible application value of diatoms as indicators of general water quality: A comparison with SASS 5

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Abstract

The applicability of a European numerical diatom index, the Specific Pollution sensitivity Index (SPI), was tested in a river system where the SPI scores were compared both to chemical water quality and to scores yielded using a macro-invertebrate index of riverine health namely the South African Scoring System (SASS 5). This investigation showed that the SPI reflects certain elements of water quality with a high degree of accuracy. Due to the broad species base of SPI, few problems were encountered when using this system in the Southern Hemisphere. The conclusion is that SPI or a similar diatom index will provide a valuable addition to the suite of biomonitoring tools currently in use in South Africa.

Keywords: biomonitoring, diatoms, SASS 5, SPI diatom index, general water quality

Introduction

We live on a subcontinent recognised for its unpredictable rainfall. South Africa is a semi-arid country, and the decline in the quality of available water is one of the major problems currently facing the country (Davies and Day, 1998). There are several factors that contribute to the decline in water quality, the most important being industry, intensive and careless agricultural practices and the population explosion, which increases the demand for domestic water supply. The National Water Act 36 of 1998, repealed and replaced over 100 previous acts. The preliminary section of the Act, states, "...water is (to be) protected, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons ..."

Under Act 36 of 1998, activities that pollute or degrade water resources require a licence issued by the Department of Water Affairs and Forestry (DWAF). The Act stipulates that "...an applicant may be required to provide an assessment of the likely effect of the proposed activity on the resource quality...". Licences will not be issued for periods longer than 40 years. Provision is made for the periodic review of the licence at intervals that must not exceed 5 years. The important component of this periodic review is that quality monitoring forms an essential part of the conditions of many such water licences.

Biological monitoring techniques have been introduced as part of routine monitoring programmes due to certain shortcomings in standard physical and chemical methods. Because of the difficulty and cost of chemically analysing every potential pollutant in a sample of water, and of interpreting results in terms of impact severity, it makes sense to monitor aquatic biota. Results from biological monitoring are cost effective and the results can be obtained rapidly. The main advantage of a biological approach is that it examines organisms whose exposure to pollutants is continuous. Thus species present in riverine ecosystems reflect both the present and past history of the water quality in the river, allowing

detection of disturbances that might otherwise be missed (Eekhout et al., 1996).

Biological communities reflect the overall ecological integrity by integrating various stressors, thus providing a broad measure of their synergistic impacts. Aquatic communities, both plant and animal, integrate and reflect the effects of chemical and physical disturbances that occur over extended periods of time. These communities can provide a holistic and an integrated measure of the integrity or health of the river as a whole (Chutter, 1998).

Numerous methods have been developed for the bioassessment of the integrity of aquatic systems. Some of these are based on one or other aspect of a single species, but most are based on the attributes of whole assemblages of organisms such as fish, algae or invertebrates. Although methods have been available for many years, biomonitoring has only as recently as 1996 become a routine tool in the management of South Africa's inland waters (Hohls, 1996).

Benthic macro-invertebrates are recognised as valuable organisms for bioassessments, due largely to their visibility to the naked eye, ease of identification, rapid life cycle often based on seasons and their largely sedentary habits (Dickens and Graham, 2002). Currently, the backbone of the National River Health Programme is SASS (South African Scoring System), a macro-invertebrate index developed by Chutter (1998). The SASS system has undergone several refinements to suit all conditions; the most recent of these modifications is SASS 5 (Dickens and Graham, 2002). However, Round (1991) lists several reasons why animal components of an ecosystem may not provide a satisfactory index system:

- Animals have complex reproductive cycles which are often linked to the seasons,
- Animals are largely motile and this may cause difficulty during sampling,
- Animals may have many different life stages and may undergo metamorphosis,
- Animals have specific habitats and niches;
- They are actively grazed; and closely linked to flow conditions and thus will not usually be evenly distributed from headwaters to estuaries, and

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