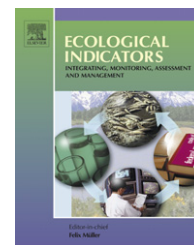




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Review

Review and evaluation of estuarine biotic indices to assess benthic condition

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ABSTRACT

Recently there has been a growing interest and need for sound and robust ecological indices to evaluate ecosystem status and condition, mainly under the scope of the Water Framework Directive implementation. Although the conceptual basis for each index may rely on different assumptions and parameters, they share a common goal: to provide a useful tool that can be used in assessing the system's health and that could be applied in decision making. This paper focuses mainly on benthic community-based, biotic indices. We supply a general overview of several indices premises and assumptions as well as their main advantages and disadvantages. Furthermore, an illustrative example is provided of a straightforward application of benthic index of biotic integrity and benthic condition index. As a reference, their performance is compared to the Portuguese-benthic assessment tool. Limitations of the tested indices are discussed in context of the Mondego estuary (Portugal) case study.

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1. Introduction

1.1. Ecological indices—general definitions

Indicators are designed to provide clear signals about something of interest, to communicate information about the current status, and, when recorded over time, can yield valuable information about changes or trends (NRC, 2000). Furthermore, ecological indices are used as quantitative tools in simplifying, through discrete and rigorous methodologies, the attributes and weights of multiple indicators with the intention of providing broader indication of a resource, or the resource attributes, being assessed (Hyatt, 2001). A clear distinction between indices and indicators must be done. Hereafter, it is considered as an indicator any measure that allows the assessment and evaluation of a system status (descriptive indicators, environmental quality indicators and performance indicators), as well as of any management actions for conservation and preservation that occur in the ecosystem (Dauvin, 2007). By its turn, indices are considered as one possible measure of a system's status. As so, they are

often used to evaluate and assess ecological integrity as it relates to a specific qualitative or quantitative feature of the system. Indices are very useful tools in decision-making processes since they describe the aggregate pressures affecting the ecosystem, and can evaluate both the state of the ecosystem and the response of managers. They can be used to track progress towards meeting management objectives and facilitate the communication of complex impacts and management processes to a non-specialist audience. Indicators and indices, therefore, can and should be used to help direct research and to guide policies and environmental programs.

1.2. Biotic indices—concepts and descriptions

Selection of effective indicators is a key point in assessing a system's status and condition. Several criteria have been listed and defined as crucial points in order to develop and to apply ecological indices accurately. The difficult task is to derive an indicator or set of indicators that together are able to meet these criteria. In fact, despite the panoply of ecological indicators that can be found in the literature, very often they

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