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Do nematode and macrofauna assemblages provide similar ecological assessment information?

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ABSTRACT

Do nematode and macrofauna assemblages provide similar ecological assessment information? To answer this question, in the summer of 2006, subtidal soft-bottom assemblages were sampled and environmental parameters were measured at seven stations covering the entire salinity gradient of the Mondego estuary. Principal components analysis (PCA) was performed on the environmental parameters, thus establishing different estuarine stretches. The ecological status of each community was determined by applying the Maturity Index and the Index of Trophic Diversity to the nematode data and the Benthic Assessment Tool to the macrofaunal data. Overall, the results indicated that the answer to the initial question is not straightforward. The fact that nematode and macrofauna have provided different responses regarding environmental status may be partially explained by local differentiation in microhabitat conditions, given by distinct sampling locations within each estuarine stretch and by different response-to-stress times of each benthic community. Therefore, our study suggests that both assemblages should be used in marine pollution monitoring programs.

1. Introduction

The introduction of biological features in the assessment of environmental quality is one of the innovations of recent monitoring programs, as required by the Water Framework Directive of the European Union (WFD, 2000/60/EC). Regarding communities of benthic invertebrates, those of macrofauna have been traditionally used to assess and evaluate ecological integrity. In fact, organisms comprising the benthic macrofauna are considered to be good indicators of coastal and estuarine ecological conditions for several reasons (see Pinto et al., 2009 for detailed references), including their taxonomic diversity and the abundance of many taxa, their wide range of physiological tolerance to stress and the variability of their feeding modes and life-history strategies. These traits allow the benthic macrofauna to respond to a wide range of environmental changes. Moreover, these organisms are relatively sedentary and thus cannot easily escape unfavorable conditions, which makes them reliable indicators of local pressure. In addition, some taxa are relatively long-lived and thus reflect the effects of environmental conditions integrated over longer periods of time. In terms of their study, benthic macrofauna are relatively easy to sample quantitatively and, compared to other, smaller sediment-dwelling organisms, they have been fairly well studied scientifically, with taxonomic keys available for most groups.

Specific indicators that can be used to determine macrofaunal abundance, diversity, and the presence/absence of sensitive species were proposed and subsequently tested in assessments of the environmental quality of coastal and estuarine systems (e.g., Borja et al., 2004; Bald et al., 2005; Simboura et al., 2005; Muxika et al., 2007; Rosenberg et al., 2004; Teixeira et al., 2009). Nevertheless, it may well be the case that meiofauna can also suitably reflect the ecological conditions present in a particular system. In fact, meiofaunal communities, namely, those of nematode, have generated considerable interest as potential indicators of anthropogenic disturbances in aquatic ecosystems (e.g., Coull and Chandler, 1992; Gheskiere et al., 2005; Gyedu-Ababio and Baird, 2006; Heip et al., 1988; Hoess et al., 2006; Lee and Correa, 2007; Moreno et al., 2008; Schratzberger and Warwick, 1999; Schratzberger et al., 2004; Shaw et al., 1983; Steyaert et al., 2007; Warwick, 1993). For instance, Kennedy and Jacoby (1999) maintained that meiofauna has several potential assessment advantages over macrofauna, such as small size, high abundance, ubiquitous distribution, rapid generation times, fast metabolic rates, and the absence of a planktonic phase, resulting in a shorter response time and higher sensitivity to

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