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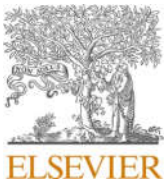

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What makes a better indicator? Taxonomic vs functional response of nematodes to estuarine gradient

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ABSTRACT

Efficient implementation of nematodes-based indices for ecological quality assessment requires fundamental knowledge on their biodiversity and functional patterns along with the drivers that generate these patterns. Though, it is still unclear if nematodes taxonomical attributes are driven by the same environmental drivers as their functional (biological traits) counterparts, or if their taxonomical diversity is also enhanced by their functional diversity. To fill this knowledge gap, we investigated taxonomical (based on nematode genera abundances dataset) and functional attributes: trophic groups (TG) and life history strategies (LHS) of benthic nematodes collected from 35 sampling stations along the Sado Estuary, SW Portugal. Along with biological samples we measured environmental variables in the water and sediments as well as sediment grain size.

Our results demonstrated that taxonomy-based assemblages were mainly structured by the salinity gradient and further by the interplay of granulometry and organic matter content. Contrastingly, trait-based distribution patterns were largely driven by the variations in the above sediment dissolved oxygen concentration. This finding largely draw attention to the role that above sediment dissolved oxygen concentration exerts on nematode assemblages and their functional distribution patterns. Consequently, our results demonstrate that biological traits introduce a new dimensionality in multivariate data that otherwise could not be detected using solely taxonomical information, thereby enhancing our knowledge on ecological gradients existing within an estuary.

Additionally, we found a strong correlation between functional richness (based on the combination of TG and LHS traits) and diversity taxonomic metrics (species richness, Simpson and Shannon diversity), although no correlation was found between taxonomic diversity indices and single nematode ecological indices (ITD index of trophic diversity and MI Maturity Index). Therefore, the combined use of functional traits and its derived metrics was demonstrated to effectively reflect taxonomical diversity presenting reliable and highly complementary information for the assessment and monitoring of marine coastal sediments using benthic nematodes.

1. Introduction

Aquatic ecosystems undergo severe pressures from human induced activities causing unprecedented changes to community structure and affecting whole ecosystem function (Cardinale et al., 2012). In order to understand and mitigate the extent of these human induced activities in aquatic ecosystems, the Water Framework Directive WFD (WFD, 2000/60/EC) and recently also the Marine Strategy Framework Directive MSFD (MSFD, 2008/56/EC) implemented a series of strategic goals to achieve Ecological Quality Status (EcoQ) of coastal and inland waters and a Good Environmental Status (GES) of the European Seas by 2020. The EcoQ is assessed based on the composition, abundance and sensitivity of different biological elements and significant scientific effort has been dedicated to the development of monitoring tools, including several benthic indices (Birk et al., 2012; Reyjol et al., 2014), Until now, macrofauna based indices have received the most scientific attention, particularly in estuarine and coastal ecosystems (Patrício et al., 2012). Recently, meiobenthic nematodes have also increasingly been used to assess the status of ecological quality but, despite the significant effort made to encourage their use as indicators of environmental conditions (Balsamo et al., 2012; Moreno et al., 2011), they are still not considered in the biological compartment of the European Directives framework.

Nematodes have been recognized as efficient indicators of

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