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The interaction between macro and micro-organisms affects biogeochemical cycles in coastal sediments

Interactions between organisms of different sizes can affect biogeochemical cycling in marine sediments. Macrofaunal organisms rework the sediment and introduce oxygen in deep sediment layers by bioturbation and bio-irrigation. This alters the physico-chemical properties of the sediment and affects the microbial communities involved in key ecosystem processes. Coupled nitrification/denitrification is such an important ecosystem process as it provides the water column with inorganic nutrients while it partly removes N as N2 from the marine ecosystem, alleviating eutrophication. We investigated how the macrofauna-microbe interaction affects the marine benthic N-cycle in coastal intertidal and subtidal sediments. We focused on the diversity of ammonia-oxidising and/or denitrifying bacteria and Archaea, by assessing how macrofaunal activities affect their diversity at the community level or functional gene level. We show that the diversity of metabolically active ammonia-oxidising bacteria (OAB) and Archaea (AOA) affected nitrification and N-mineralisation. Separate models demonstrated a significant and independent effect of macrofaunal activities on community composition and richness of total bacteria, and diversity indices AOA. Diversity of AOB was significantly affected by macrofaunal abundance. In the intertidal, the patterns in denitrifying bacteria were similarily affected by the bio-irrigation activity of the polychaete Lanice conchilega. In general, we conclude that the activities of the macrofauna increase the spatial complexity in space and time, thereby modulating the link between microbial diversity and ecosystem functioning in marine sediments.

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