Deep-sea ecosystem shifts and their effects on prokaryotic and micro-eukaryoteic components and trophodynamics: the Porcupine Abyssal Plain case study

Luongo G.[1,3], Dell'Anno A.[2,3,] Tangherlini M.[4], Corinaldesi C.[1,3], Danovaro R.[2,3]

1. Department of Materials, Environmental Sciences and Urban Planning, Polytechnic University of Marche, Via Brecce Bianche, 60131 Ancona, Italy
2. Department of Life and Environmental Sciences, Polytechnic University of Marche, Via Brecce Bianche, 60131 Ancona, Italy
3. National Biodiversity Future Centre, Palermo, Italy
4. Stazione Zoologica A. Dohrn, Fano Marine Center, Fano (Ancona)

Abstract

Assessing the temporal variability of deep-sea ecosystems is essential to gain new insights into benthic deep-sea responses to growing climate-induced threats. Here, we explored the multidecadal variability of benthic deep-sea microbial assemblages including viruses, prokaryotes, and unicellular eukaryotes (microeukaryotes), in relation to change in food availability in the Porcupine Abyssal Plain, at approximately 5000-m depth in the NE Atlantic Ocean. Combining information on water column temperature and ocean productivity from assimilation models, *in situ* sedimentary organic matter contents, and the genetic signatures of detrital algal taxa, we observed an increase in temperature and a declining pattern in photosynthetic productivity in the water column, significant temporal changes in the composition of phytodetritus along with more oligotrophic sedimentary conditions than in past. Together with lower nutrient concentration, we observed a trend of decreasing prokaryotic abundance and an increase of the impact of viral infections. Shifts in phytodetritus inputs were associated with significant changes in the abyssal benthic microbiota. In particular, microeukaryotes displayed evident changes also at high taxonomic levels. Overall, our findings highlight that the abyssal ecosystems are changing significantly during the last decades with a clear decrease of the blue carbon accumulated at abyssal depth and consequent responses of the micro-eukaryotic and prokaryotic compartments.

Keywords: trophic conditions, benthic prokaryotic diversity, benthic microeukaryotes diversity, deep-sea sediments, phytodetritus, climate change.