Received: 17 February 2016 | Revised: 9 May 2017 | Accepted: 10 May 2017

DOI: 10.1111/geb.12608

RESEARCH PAPERS

WILEY Global Ecology and Biogeography A Journal of Macroecology

Functional response to food limitation can reduce the impact of global change in the deep-sea benthos

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Editor: Amanda E. Bates

Funding information
Marine Ecosystem Restoration in Changing European Seas, Grant Number: 689518

Abstract

Aim: A key paradigm of deep-sea ecology is that the ocean interior is a food-limited environment, which limits the faunal growth. Here, we estimated the efficiency of deep-sea fauna in exploiting resources to assess the potential response of deep-sea organisms to changes in the food inputs expected with global change.

Location: Mediterranean Sea.

Time period: 1989–2010.

Major taxa studied: Viruses, prokaryotes, meiofauna, macrofauna and megafauna.

Methods: Using the largest data set spanning from microbes to megafauna produced synoptically so far, we investigated patterns of abundance, biomass and ecosystem efficiency across depth-related and longitudinal gradients of food availability in both Western and Eastern Basins of the Mediterranean Sea.

Results: Our results revealed that prokaryotes dominated benthic biomass at depths > 2,000 m. Contrary to what has been reported at a global scale, meiofaunal biomass decreased with increasing water depth more rapidly than macrofauna and megafauna. Meiofauna showed a significant negative log-linear relationship with increasing water depth in the whole Mediterranean Sea, whereas the other benthic components, from viruses to megafauna, did not decrease significantly, decreased or even increased (e.g., prokaryotes) with increasing water depth. Taking all components together, the efficiency of benthic ecosystems in exploiting organic carbon (OC) inputs increased with increasing depth, in both mesotrophic and ultra-oligotrophic conditions of the deep Mediterranean Sea.

Main conclusions: Changes in ecological efficiency in exploiting the energy available in food-limited conditions suggest that deep-sea ecosystems can show a responsive adaptation to changes in OC inputs from the photic zone. Our results contribute to explaining the high efficiency of resource exploitation by consumers in limited trophic conditions and allow us to hypothesize that the consequences of a potential reduction of food supply in deep-sea ecosystems induced by global changes could be less severe than expected.

KEYWORDS
benthic biota, deep sea, ecosystem efficiency, macrofauna, megafauna, meiofauna, prokaryotes, viruses

