

TITLE: The importance of benthic?pelagic coupling for marine ecosystem functioning in a changing world

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ABSTRACT:

Benthic-pelagic coupling is manifested as the exchange of energy, mass, or nutrients between benthic and pelagic habitats. It plays a prominent role in aquatic ecosystems, and it is crucial to functions from nutrient cycling to energy transfer in food webs. Coastal and estuarine ecosystem structure and function are strongly affected by anthropogenic pressures; however, there are large gaps in our understanding of the responses of inorganic nutrient and organic matter fluxes between benthic habitats and the water column. We illustrate the varied nature of physical and biological benthic-pelagic coupling processes and their potential sensitivity to three anthropogenic pressures - climate change, nutrient loading, and fishing - using the Baltic Sea as a case study and summarize current knowledge on the exchange of inorganic nutrients and organic material between habitats. Traditionally measured benthic-pelagic coupling processes (e.g., nutrient exchange and sedimentation of organic material) are to some extent quantifiable, but the magnitude and variability of biological processes are rarely assessed, preventing quantitative comparisons. Changing oxygen conditions will continue to have widespread effects on the processes that govern inorganic and organic matter exchange among habitats while climate change and nutrient load reductions may have large effects on organic matter sedimentation. Many biological processes (predation, bioturbation) are expected to be sensitive to anthropogenic drivers, but the outcomes for ecosystem function are largely unknown. We emphasize how improved empirical and experimental understanding of benthic-pelagic coupling processes and their variability are necessary to inform models that can quantify the feedbacks among processes and ecosystem responses to a changing world.

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