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Model estimates of the impact of bioirrigation activity of MARENZELLERIA SPP. on the Gulf of Finland ecosystem in a changing climate

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Abstract

Drastic changes have occurred in the Eastern Gulf of Finland ecosystem after recent invasion and establishment of polychaete *Marenzelleria* spp. Possible mechanisms of these changes are explored with the help of three-dimensional ecosystem model SPBEM. Relative significance of bioirrigation activity is studied by results' comparing of two climate change scenario simulations, which include or disregard *Marenzelleria* effects. The novel results obtained with this approach demonstrate that on a system level biogeochemical consequences of both implemented climate changes scenario and polychaete activity are equivalent to a weakening of "vicious circle" of the Baltic Sea eutrophication. The eutrophication-mitigating effects of the *Marenzelleria* invasion into the Eastern Gulf of Finland, revealed by the long-term field measurements, are explained by simulation-based considerations.

Highlights

3D ecosystem model SPBEM was modified to account for bioirrigation by *Marenzellaria*.
Scenarios for the Gulf of Finland ecosystem in the future climate with- and without invaders.
Increasing oxygenation of sediments was projected in both scenarios.
Decreased denitrification and increased phosphorus sediment P retention.
Pelagic DIN/DIP increase resulted in decreasing cyanobacterial nitrogen fixation.

Key words: Biogeochemical cycles, Gulf of Finland, *Marenzelleria*, modelling