Climate change modifies faunal effects on seafloor nutrient cycling and metabolism

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Seawater warming and acidification related to marine climate change challenge coastal ecosystems. For example, both processes are predicted to influence seafloor communities and how their populations of burrowing animals contribute to ecosystem services, such as biogeochemical cycling. Sediment particle mixing and burrow ventilation performed by seafloor invertebrates rework the seafloor, altering sediment physical structure and chemical composition, and facilitating microbial activity; but how climate change affects such biodiversity-mediated ecosystem functioning is not well understood. In this research the combined effect of changes in seawater pH, temperature, and the presence of two burrowing invertebrates on seafloor nutrient cycling and aerobic metabolism was investigated to estimate the combined effects of species loss and climate change on sediment biogeochemistry.

Sediment microbial communities from the Belgian Part of the North Sea were incubated in microcosms under four different climate conditions during 7 weeks: ambient pH and temperature, elevated temperature, decreased pH, and a combination of elevated temperature and decreased pH. The sandmason *Lanice conchilega* and the white furrow shell *Abra alba* were added to the microcosms at natural densities for the Belgian Part of the North Sea in two separate experiments. Similar to previous research, the presence of both species increased the sediment metabolism by, on average, 48-66 % under ambient summer conditions of seawater pH and temperature (Braeckman et al., 2010). However, a reduction in seawater pH of 0.3 units increased that effect, on average, by 59 % for *L. conchilega*, while a small reduction of 10 % was found for *A. alba*. Predicted ocean warming of 3°C did not influence the benthos-mediated ecosystem functioning. Because sediment oxygen uptake did not vary between climate conditions in the absence of *L. conchilega* and *A. alba*, the found effect that ocean acidification modifies how burrowing invertebrates affect sediment functioning should primarily be ascribed to species-specific changes in behaviour that have cascading effect on microbial communities.

Reference

- Braeckman, U., Provoost, P., Gribsholt, B., Van Gansbeke, D., Middelburg, J., Soetaert, K., Vincx, M., Vanaverbeke, J., 2010. Role of macrofauna functional traits and density in biogeochemical fluxes and bioturbation. Mar. Ecol. Prog. Ser. 399, 173–186. https://doi.org/10.3354/meps08336

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