Burrowing macrofauna modifies climate change effects on sediment metabolism

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Along the Belgian coast, coastal areas are under an increasing pressure both from local and global sources. On a global scale, climate change challenges the ecosystem, while aquaculture and the increasing amount of offshore windfarms create challenges on a local scale. The PERSUADE project (ExPERimental approaches towards Future Sustainable Use of North Sea Artificial HarD SubstratEs) investigates the combined effect of those stressors on the coastal area. Climate change stressors such as ocean warming and acidification challenge coastal ecosystems. They can influence benthic communities and the way in which they contribute to ecosystem services such as biogeochemical cycling. Macrofauna reworks the sediment, altering physical structure and chemical composition through bioturbation and bio-irrigation, facilitating microbial activity. In this research the combined effect of different climate scenario's and the presence of macrobenthos on benthic processes and sediment metabolism was investigated to estimate the effects of climate change and possible species loss on the functioning of the benthic environment.

In two long term experiments, sediment was incubated under four different climate scenario's; a control environment, a scenario with elevated temperature, a scenario with decreased pH and a scenario with elevated temperature and decreased pH combined, to mimic climate change. *Lanice conchilega* and *Abra alba* respectively were added to the microcosms in the two experiments in natural densities. Similar to literature findings, a stimulating effect of the presence of macrofauna on sediment metabolism was found in both experiments (Braeckman *et al.*, 2010; Mermillod-Blondin *et al.*, 2004). The magnitude of this effect differed between the two experiments as the irrigation behaviour *of L.conchilega* facilitates benthic respiration more than the bioturbation behaviour of *A. alba*. Oxygen consumption doubled in cores with *L. conchilega* and was 1/4Th higher in cores with *A. alba*, compared to empty cores. A lower pH was the only climate factor influencing benthic respiration; higher respiration was observed with decreasing pH in the *L. conchilega* experiment. The difference in benthic respiration was larger in cores containing *L. conchilega* individuals, indicating the modifying effect this species. In the experiment with *A. alba* there was an opposite effect on the sediment metabolism observed. Data from further experiments investigating changes in macrofauna behaviour under the different climate conditions to link them with the observed effect on metabolism respiration is under analyses.

References

- 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
- Mermillod-Blondin, F., Rosenberg, R., François-Carcaillet, F., Norling, K., Mauclaire, L., 2004. Influence of bioturbation by three benthic infaunal species on microbial communities and biogeochemical processes in marine sediment. Aquat. Microb. Ecol. 36, 271–284. https://doi.org/10.3354/ame036271

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