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Towards investigating the effect of fining and hardening of marine coastal areas on ecosystem functioning in the Belgian part of the North Sea (BPNS)

Sediments and the inhabiting macrofauna play an important role in the functioning of coastal marine environments. Human activities in these environments result in two obvious pressures on the sediment: hardening from the installation of offshore wind farms (OWFs) and fining in the vicinity of sand extraction sites and in OWFs. This study is part of the FaCE-It project and aims at understanding the impacts of those pressures on biogeochemical cycling and on the food web structure.

In order to understand benthic ecosystem functioning in different types of sediment, we will measure nutrient fluxes in closed-core incubations sampled along a gradient from fine to coarse sediments, including sediments subjected to fining. Bio- and physical irrigation will be quantified by adding a bromide tracer to the overlying water and following the decreasing concentration over time. With those data, we will estimate the total flux of degradable organic carbon deposited at the sediment surface, its degradation rate and transformation and assess the effect of bioturbation and bio irrigation on benthic ecosystem functioning.

Along the same sediment gradient, we will study the macrobenthic food web using stable isotope analysis. Furthermore, the overall food web will be investigated at 3 stations characterized by fine sediment, coarse sediment and an OWF to compare the food web complexity in areas with and without OWFs. These data will finally be used to build a quantitative food web using linear inverse modeling (LIM). To constrain this model, individual respiration rate measurements and pulse chase experiments will be conducted. This combined approach will allow assessing the effect of fining and hardening of marine coastal areas on important ecological processes on the scale of the BPNS.

Keywords: bioirrigation, ecosystem functioning, linear inverse model, macrobenthos, nutrients fluxes, oxygen consumption, stable isotopes