

Distant effects of nature-based solutions: Impact of marine sand extraction on epibenthos and fish

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Nature-based solutions (NBS) promote the sustainable management and use of nature for tackling societal challenges such as climate change and flooding. The dune-in-front-of-dike principle has great potential in protecting against coastal flooding while, at the same time, sustaining and even restoring natural ecosystems at the Belgian coast. However, in order to be sustainable, NBS must not only produce ecosystem services, but must also minimize negative impacts which may be generated in areas that are distant from where the NBS is constructed. This includes potential impacts on the marine ecosystem caused by sand extraction activities.

Within the scope of the SUSANA project, we investigate how epibenthos and demersal fish communities are affected by sand extraction. To this end, long-term beam-trawl data (2004-2023) collected in the framework of the monitoring program for evaluating sand extraction effects within the Belgian part of the North Sea have been analysed. Preliminary results from univariate and multivariate analyses show effects of long-term sand extraction disturbance on epibenthos and demersal fish communities. Epibenthic opportunistic predators and scavengers thrive at sites from which high cumulative volumes of sand have been extracted within the decade preceding sampling. Examples of affected epibenthic species are the starfish (*Asterias rubens*), green sea urchin (*Psammechinus miliaris*), and harbour crab (*Liocarcinus depurator*). Furthermore, local elevations in total demersal fish biomass, as well as specific generalist fish such as hooknose (*Agonus cataphractus*), dab (*Limanda limanda*), and sole (*Solea solea*) were observed. These results hint at indirect cascading effects of sand extraction through the food web where benthic generalist fish have taken advantage of the higher prey availability on impacted sites.

Many epibenthos and demersal fish species are commercially valuable and, hence, play key roles in ecosystem services provided by the marine environment. Our results will be part of an overarching analysis within SUSANA that aims to balance trade-offs between offshore sand extraction and its onshore use for the development of NBS.

Keywords

Nature Based Solutions; Dune-in-front-of-dike; Sand Extraction; Epibenthos; Demersal Fish