Experimental approach towards the understanding of food web interactions in an offshore wind farm environment under different climate and aquaculture scenarios

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Coastal areas are under an increasing pressure originating both from local and global sources. On a local scale, the pressures are often induced by a local human activity. The installation of offshore wind farms (OWFs) in the Belgian part of the North Sea (BPNS) results in a large change in the marine environment. The introduced artificial hard substrates (AHSs) are rapidly colonised by large quantities of fouling fauna, which are expected to modify the local food web by introducing new trophic links. Modifications of this local food web will possibly affect the stability and resilience of the trophic network. The planned aquaculture activities within the wind farms will further increase change in the local food web by affecting both trophic-and non-trophic links. In addition to these local changes, coastal ecosystems are also challenged by global climate change stressors, such as ocean warming and acidification.

The aim of the PERSUADE (ExPERimental approaches towards Future Sustainable Use of North Sea Artificial HarD SubstratEs) project is to investigate ecosystem-wide responses to combined global and local stressors by quantifying interactions between biotic and abiotic compartments in the OWF environment. To this end, a large-scale mesocosm experiment was conducted, using the EMBRC tank facilities at VLIZ (Ostend). Both fouling fauna harvested from an artificial hard substrate garden and the sediment community collected in the vicinity of OWFs were incubated in the mesocosms, together with area-typical mobile predators, under three conditions: (1) a “control” treatment reflecting the current situation, (2) a “Climate Change” treatment with an elevated temperature and lowered pH according to the IPCC 2100 scenario, and (3) a “Climate Change + Aquaculture” treatment reflecting the scenario where blue mussel aquaculture takes place within an OWF under a future climate setting.

The carbon flow through the three experimental food webs was quantified by means of a pulse-chase experiment and bio-deposition of organic matter by the fouling fauna on the benthic community was determined using sediment traps. By investigating the carbon flow through the food web, an understanding of the effect of global and local stressors on the coastal carbon budget will be obtained.

Keywords: Climate change; Aquaculture; Food webs; Wind farm; North Sea; Biodiversity-Ecosystem functioning