

FLUXMAP: an ecosystem functioning map of the Belgian part of the North Sea

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The European Marine Strategy Framework Directive urges member states to establish and implement coordinated monitoring programmes for the assessment of the environmental status of their marine waters. These monitoring programmes need to be rooted in the currently best knowledge on our marine areas. The Belgian part of the North Sea (BPNS) is one of the best documented of such marine areas. Many maps exist on the physico-chemical properties of sediment and water, the biodiversity of their inhabiting biological communities and the variety of users of the sea and its sediments.

The biological value of a specific area of the sea floor is often based on biodiversity maps. However, the value of the benthic ecosystem involves more than biodiversity: it also encompasses ecosystem functioning. In coastal systems, a close coupling between the pelagic and the benthic ecosystem exists. As such, the phytoplankton dynamics are dependent on the nutrient release from the benthic part and the productivity of the benthic system is influenced by the amount of organic matter that arrives from above. The oxygen consumed during organic matter mineralization at the sea floor and the release of nutrients to the overlying water column characterize these mineralization processes. In addition, the maximum oxygen penetration depth in the sea floor indicates areas sensitive to seasonal hypoxia. Alkalinity generation in sediments informs us about the actual CO₂ uptake capacity of the overlying water, and is thus related to ocean acidification. Macrobenthos influences these ecosystem functions through their bioturbation and bio-irrigation activities. Based on the motility and sediment reworking properties, the Bioturbation Potential of the community (BPC) can be calculated, which establishes an easy link between the mineralization processes measured and the organisms influencing these functions.

In the project FLUXMAP, we sampled 10 sediment types representative of the range in sediments and macrobenthic communities on the BPNS on a monthly basis during the year 2011. Cores were incubated in the lab and oxygen, nutrient and alkalinity fluxes at the sediment-water interface were measured. The sediment was further profiled in terms of oxygen and pH. Macrobenthos was retrieved from the sediments and the Bioturbation Potential of the community was calculated.

Based on our flux measurements, we will be able to produce a full coverage ecosystem functioning map of the sea floor of the BPNS. Linking our flux data with macrobenthic data will enable linking ecosystem functioning with macrofaunal diversity on BPNS scale. This, together with the existing biodiversity maps, enables policy makers to make scientifically sound decisions on which areas to protect and how to ensure their protection. In addition, our results can provide a basis for the evaluation of descriptor 6 (Seafloor integrity) in the MSFD framework.