

**Optimization of monitoring and modelling frameworks to mitigate negative effects of aggregate extraction, Belgian part of the North Sea**

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In areas of marine aggregate extraction, an increased system understanding is a necessity to strive towards a sustainable use of the resource. To recommend on mitigation of negative impacts, this research focusses on the optimization of monitoring and modelling frameworks. For the monitoring areas in the Flemish Banks, detailed analysis of depth recordings over time and of a spatio-temporal dataset of extraction allowed quantification of the two main processes affecting seabed morphology: very-large dunes migration and aggregate extraction. Analysing seabed variability beyond these two processes highlighted phenomena occurring in addition to the removal of material. In the most heavily extracted area, a local reorganization of sediments occurred with an accretional trend in the extraction pit while the surrounding very-large dunes presented an erosive pattern. This points to a general flattening of the area, suggesting that the extraction activity can affect depletion and regeneration rates of the seabed, with implications on its recovery potential. In parallel to the analysis of monitoring data, the behaviour of the seabed was modelled over time. Hereby, a 3D geological ‘voxel’ model of the resource (based on cores, seismic profiles, sediment size distributions) was coupled to a hydro- and sediment dynamics model. This provides a modelling framework at an unprecedented level of realism for the initialization and parameterization of the numerical model suite. It allows performing scenarios over time, e.g. to simulate parameters related to the descriptors seafloor integrity and hydrodynamic conditions in the context of the European Marine Strategy Framework Directive.

**Keywords:** monitoring, modelling, resource mapping, management plan, sustainable extraction, Marine Strategy Framework Directive

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