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Ecosystem-based design rules for marine sand extraction sites in the north sea and beyond

Maarten de Jong
Institute for Marine Resources & Ecosystem Studies, The Netherlands

The demand for marine sand is still increasing. To guarantee sufficient supply of marine sand in the intensively used Dutch coastal zone, the authorities continue promoting sand extraction depths over 2 m. Effects of deep sand extraction, however, are still largely unknown. Therefore, we studied short-term effects of a deep borrow pit used for the construction of the 2000 ha seaward harbor enlargement Maasvlakte 2 of Port of Rotterdam. Macrozoobenthic assemblages are linked with sediment and hydrodynamic variables. To predict changes due to sand extraction information on sediment characteristics are not present on beforehand. Bed shear stress, however, can be calculated with extraction depth and depth-averaged peak flow velocity. Depending on the bed shear stress, two assemblages can be expected, *Abra alba* and *Eteone* sp. -S. bombyx assemblage. The first occurs at shear stress values below 0.37 Nm^{-2} and the second at bed shear stress values above 0.49 Nm^{-2}. We propose ecosystem-based sand extraction design rules resulting in the highest biodiversity when the time-averaged bed shear stress values are around 0.35 Nm^{-2}. For the Maasvlakte 2 borrow pit excavation depth would be around 4-8 m. The ecosystem-based borrow pit design rules can also be used for comparable regions but ecological data from sites with low shear stress values such as abandoned borrow pits or dredged shipping lanes may be prerequisite.

Biography

Maarten de Jong is a marine ecologist and is currently finishing his PhD project "Modelling the ecological potential of sand extraction". The project is a part of the Dutch EcoShape/Building with Nature program and focuses on the short-term impacts of large-scale and deep sand extraction and ecological landscaping on organisms onthe seabed, bottom fish and the change of sediment characteristics, bathymetry and hydrodynamics. He is a member of Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT) of the International Council for the Exploration of the Sea (ICES). He has published papers high-ranking scientific journals and others are on the verge of publication. He is now looking for postdoc or consultancy functions in the field of ecology and hydrodynamics in all climate regions.

maarten.dejong@wur.nl

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