

Impacts on the marine environment by long term use of a deposit site in the German Bight

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Introduction: Increased sediment accumulation requires an intensified dredging in the Port of Hamburg since the year 2005. As the use of a nearby deposit site is seasonally limited, and furthermore would intensify sediment cycles, a part of the moderately contaminated dredged material is deposited in the German Bight. The constraints for this activity are set by the Environmental Ministry of the Federal State of Schleswig-Holstein/Germany within a licensing procedure. Intensive monitoring of environmental impacts associated with long-term deposition of dredged material from Hamburg in the German Bight is a crucial element of this licence. On the basis of the monitoring results for the period 2005 to 2015 with an overall quantity of 9.5 million m³ dredged material up to 2015, existing impacts were investigated and future impacts for continued use of the site until 2021 estimated.

Methods: Spatial and temporal distribution of deposited dredged material is investigated by analysing particle size and contaminant concentrations in sediments and biota on a station grid with sampling stations up to a distance of 12 km from the deposit site. Fish fauna and macrobenthos community structure are also studied at the deposit site and the surrounding area. Acoustic multibeam data allowed verifying the destination of large quantities of dredged material. Additionally, the short-term transport of suspended particulate matter released from the deposited sediments was recorded by using acoustic doppler current profiler [1] at different relocation campaigns. Results were supplemented by applying a numerical model [2]. In addition, investigations were carried out to assess the impact on oxygen and nutrient contents in the water phase. All available results of the monitoring program 2005 to 2015 were taken into account for the assessment of future impacts of the planned further deposition of dredged material in the German Bight from 2016 to 2021 and on deciding on the position and size of future deposit areas.

Results: Measurable effects on the marine environment remain restricted to a near-field and short-term scale [2,3]. Existing levels of contamination of dredged material from the port of Hamburg resulted in a local increase of contaminants in sediments and a

shift to a sandy substrate at the deposit site which can be located up to 1.5 km distance of the centre of the site. Bioassay tests revealed low ecological stress levels of the sediments. Elevated concentrations of organotin and DDX compounds were found at the deposit centre in snail tissue lasting for a couple of years. During a 4 years period without depositing sediments, a decrease of bioaccumulation was observed [3]. In fish liver and muscle tissue, no elevated contaminant concentrations were observed. Adverse effects on the investigated organisms could not be detected in the context of bioaccumulation. However, depositing of dredged material resulted in a decrease of number and abundance of macrobenthos species predominantly due to a shift to sandy grain size fractions in the centre of the deposit.

Discussion: Short-term predictions of the fate of particle plumes released by the depositing process are reliably documented whereas their long-term behaviour remains ambiguous. Although monitoring results indicated a spread of large amounts of fine particles released during the relocation activities, results of model calculations do not indicate implications for protected zones close to the deposit site [2]. Directly at the deposit site, the dredged material forms a sandy elevation with increasing proportions of fine-grained sediments towards the edges caused by sorting effects during deposition. An impact of the deposit activities on sediment quality and biota is detectable up to 1.5 km distance of the centre of the site. As long as sandy sediments prevail at the deposit site, changes in the macrobenthos community will remain. The further use of the deposit site will probably result in an increase in the area affected, however effects in the wider surroundings are not yet observed on a larger temporal and spatial scale [3] expecting no occurrences in the future [2]. Nevertheless, to survey and assess possible impacts on the marine environment caused by future use of the deposit site, the monitoring programme was adapted.

References: [1] DRL – Dredging Research Ltd: (2005), Unpubl. Rep., pp.89, [2] BfG - Fed. Inst. of Hydrology, (2016), Report 1899, pp.71. [3] BfG - Fed. Inst. of Hydrology (2013), Final Rep. 2011, pp. 280. – Report 1775.