



## **Refill processes and regeneration potential after marine aggregate extraction in the German Bight (SE North Sea)**

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Considering the sea-level rise and the global change predicted for the near future, especially sandy shorelines may get under increasing pressure. To counteract the loss of material at eroding coastlines, soft coastal protection measures such as beach nourishment are regarded as a relatively affordable and environmentally friendly approach which is used all over the world. This resulted in a higher demand of suitable sediment in the last decades. Frequently, the material for compensation is consisting of medium to coarse sand and is extracted from the near-shore seafloor. In order to explore the long- and short-term morphological changes of such mining, as well as the potential for natural regeneration, the largest extraction area in the German Bight (Westerland Dredging Area, established in 1984) was investigated in this study. Several measurement campaigns were conducted between the years 1994 and 2018 using a set of hydroacoustic devices such as singlebeam/multibeam echosounders, sidescan sonars and sediment echosounders. For ground truthing, sediment samples and underwater videos were taken. The measurements revealed that up to 20-m-deep pits with diameters of particularly more than 1 km were dredged into the seafloor through the years. The depressions caused by the sand mining are still detectable more than 30 years later and only weak refill processes are observable. Shortly after the mining, the fresh dredging pits slightly smoothed within a few months. Our investigations show that slope failures, mainly consisting of fine sand, flattened the formerly steep rims and also the deep pits. However, after approximately 1 year, muddy sediments most likely of terrigenous origin dominated the deposition. Since the sedimentation rates are slow, a complete backfill of the post-dredging pits is likely to take many decades. A natural regeneration towards the former seafloor conditions is only visible at the shallow rims of the oldest dredging pits. Moreover, the investigation showed that the muddy sediment was readily settled by e.g. brittle stars, which normally occur in vastly lower abundances on the surrounding sandy seafloor.