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Who really matters: Influence of German Bight key bioturbators on biogeochemical cycling and sediment turnover

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Abstract:

Loss of bioturbating key species from marine sediments has been shown to strongly reduce benthic biogeochemical cycling and ecosystem functioning. It is thus of paramount importance to identify key bioturbators and quantify their effect on biogeochemical processes. To do so trait based community and species bioturbation potential (BP_c and BP_i) was mapped for 423 North Sea stations in the German Bight. Mapping of BP_c and BP_i identified *Amphiura filiformis*, *Echinocardium cordatum* and *Nucula nitidosa* as major bioturbating species in the German Bight. The effects of these species on benthic nutrient flux (i. e. changing concentrations of silicate $\Delta[SiO_2]$, ammonium $\Delta[NH_4^+]$, nitrate $\Delta[NO_3^-]$ and nitrite $\Delta[NO_2^-]$) were quantified in laboratory experiments together with their bioturbation rate (D_b) and bioirrigation activity. The experiments indicated that mapped species bioturbation potential (BP_i) may be a poor tool for identifying key bioturbators while calculated experimental BP_i ($^{exp}BP_i$) was a good indicator for species impact on biogeochemical cycling. Out of the three investigated species only *E. cordatum* significantly influenced biogeochemical cycling, whereas the effect of *A. filiformis* remained inconclusive potentially because arm damage and regeneration may affect the bioturbation activity of many individuals. The bivalve *N. nitidosa* showed only little impact on biogeochemical cycling, although this species was found to be an active bioturbator. Accordingly, *E. cordatum* may be considered one of the most important contributors to biogeochemical cycling at the sediment-water interface in the German Bight.

Keywords: Bioturbation potential, sediment reworking, bioirrigation, *Amphiura filiformis*, *Echinocardium cordatum*, *Nucula nitidosa*