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Short-term anthropogenic impact of mobile bottom-contact fishing on the biogeochemistry of coastal sediments and its long-term effects on mineral distribution

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The research project MGF-Ostsee deals with the consequences of the exclusion of mobile bottom-contact fishing in the southern Baltic Sea, specifically to assess its effects on the biogeochemistry of surface sediments and across the benthic-pelagic food chain. In Summer 2021, an in-situ monitored experiment was conducted at a coastal site in the region of Warnemünde/Rostock to investigate the short-term impacts of bottom trawling. Herein, we present first results on how this anthropogenic intervention affects biogeochemical processes and associated elemental cycling, as well as the resulting changes in geochemical mineral tracers. We analyzed porewater and sediment, as well as the water column for major, minor and trace elements, and the stable isotope composition (C, S, O) of dissolved and solid carbon and sulfur species. Porewater gradients are combined with lander-based oxygen-consumption- and radiotracer-based microbial sulfate reduction rates to elucidate how the disturbances by the fishing gear affect element (C, P, Mn, Fe, S) and mineral (re)distribution.

The controlled trawling experiment generated a re-suspension plume that reached up to 2 m above the sea floor, with 4 NTU in the lowermost portion. In the central trawled area, short cores were taken with a MUC prior and one to two hours after the experiment, and on the following day. In addition, sediment cores were recovered by divers from furrows and mounds of recent trawl marks. First results suggest that in the trawled area, the coupled Fe-Mn-P cycle reacts most sensitively, as expressed by altered porewater gradients and element diffusion. In the trawl marks, pore waters are affected differently whether sediments are removed, as in trawl furrows (erosion),

or added/topped, as in trawl mounds (burial). In general, the tentative results point towards a Mn loss in the trawling area and in the furrows, whereas in the mounds Mn becomes enriched. The observed short-term changes in geochemical patterns from the experiment in the Warnemünde region are compared to data from a monitored region in the Fehmarn Belt. There, the observed patterns are tentatively associated to meso-scale areas with a history of low or high trawling impact.