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Fachgebiet: Marine Biologie

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Nitrogen-related processes in an episodically flooded peatland in NE-Germany and coastal sediments of the Baltic Sea

This dissertation focuses on ammonium leaching and nitrogen (N) cycling in a rewetted peat- land in NE-Germany after seawater flooding, as well as nitrogen fixation in coastal sediments of the southern Baltic.

The first aim of this dissertation targeted heterotrophic N2 fixation in sediments of the southern Baltic coastline to determine if significant sediment-associated N2 fixation enriches the N-pool of pelagic layers during resuspension. Simultaneously, the relative contribution of N2-fixing sulfate reducing bacteria was investigated to determine their importance to this process. The quantification of nitrogen fixation was carried out in the dark with the 15N −N2 bubble method, and the contribution of sulfate reducing bacteria assessed through the sodium molybdate tech- nique. The incubation targeted 0-5cm and 0-10 cm sediment depths simulating weak and strong resuspension events. Sulfate reducing bacteria were the dominant nitrogen fixers and the most active in the 0-5 cm sediment section, but the nitrogen fixation rates were still low. Altogether, organic-matter poor sediment deposits along the southern Baltic coastline were not favourable habitats for nitrogen fixation and did not significantly contribute to the N-pool of the Baltic Sea during resuspension.

The second aim of this thesis was to determine the impact of seawater flooding on microbial ammonium assimilation and nitrification in surface waters of the same peatland. Over the course of one year, dark ammonium assimilation and nitrification rates were continuously quantified with help of the 15N -tracer method. Increased salinity was found to inhibit ammonium assimilation and nitrification, probably since predominantly freshwater mi- crobial species were present and only few halophile communities. Despite low N-cycling rates, no inorganic nitrogen accumulation occurred, which could have caused eutrophication.

s third aim it was determined, whether the seawater-compounds (here sodium) lead to increased ammonium-loss from the peatland (peat and mineral soil) through cation exchange, reducing the quality of ground- and adjacent seawater. With help of a flow- through reactor, the peat and mineral soils were flushed with artificial water of varying salinities (< 1 ppt, 10 ppt, 35 ppt) to quantify the ammonium-loss under the influence of salinity. In addition, the ammonium-loss was related to physical properties of the soils (soil organic matter, bulk densitiy, marco- and total porosity). It was determined, that cation exchange between am- monium and sodium was not a dominant driver of ammonium-loss from the soils. Instead, soil organic matter content associated with N-mineralization favoured nitrogen-loss in mineral soils, whilst other drivers (dissolved organic matter, dual porosity) probably influenced ammonium- loss in peat soils.