

Nutrient regeneration and benthic fluxes in the Coastal Baltic and North Sea

Kirstin Dähnke, Andreas Neumann, Tina Sanders

Introduction and Background:

- Sediments in the coastal ocean can play an important role in nutrient regeneration, but this function, depends on physical characteristics, but also on biological traits like fauna composition and activity.
- In January 2017, water and sediment samples were taken on the Maria S. Merian cruise MSM 50 along a North Sea – Skagerrak – Baltic Sea gradient.
- Our goal was to evaluate benthic nutrient regeneration in the region.
- As a snapshot of the present situation, we analysed stable nitrate isotopes, and, to evaluate faunal effects, compared the benthic fluxes of DIN and O₂ in the study region to a larger annual data set.

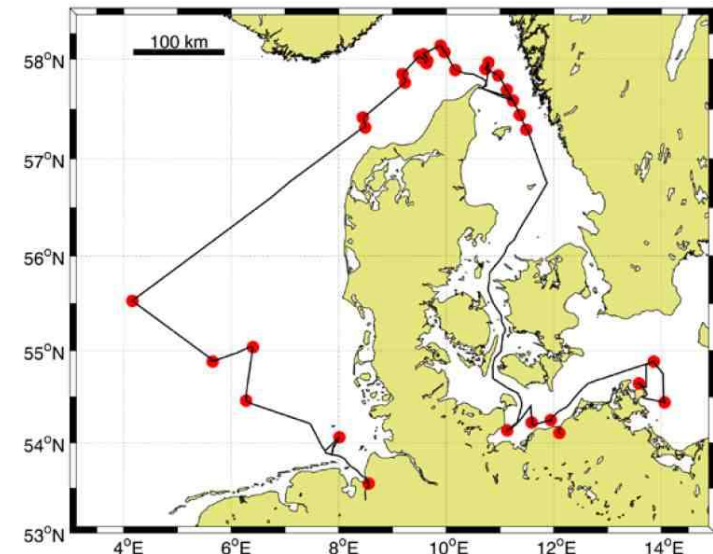


Fig. 1: Cruise track of the MSM 50 cruise.

Source: U. Bathmann, Cruise Report MSM50, 2016

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Nitrate and its stable isotopes along the cruise transect

- Nitrate stable isotope values follow sedimentary values indicative of remineralisation / nitrification
- This supported by low $\delta^{18}\text{O}_{\text{NO}_3}$, especially in the Kattegat region

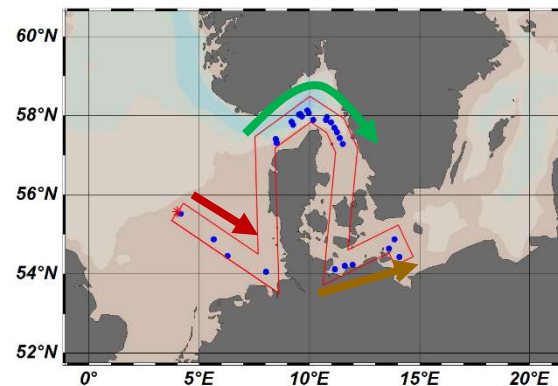
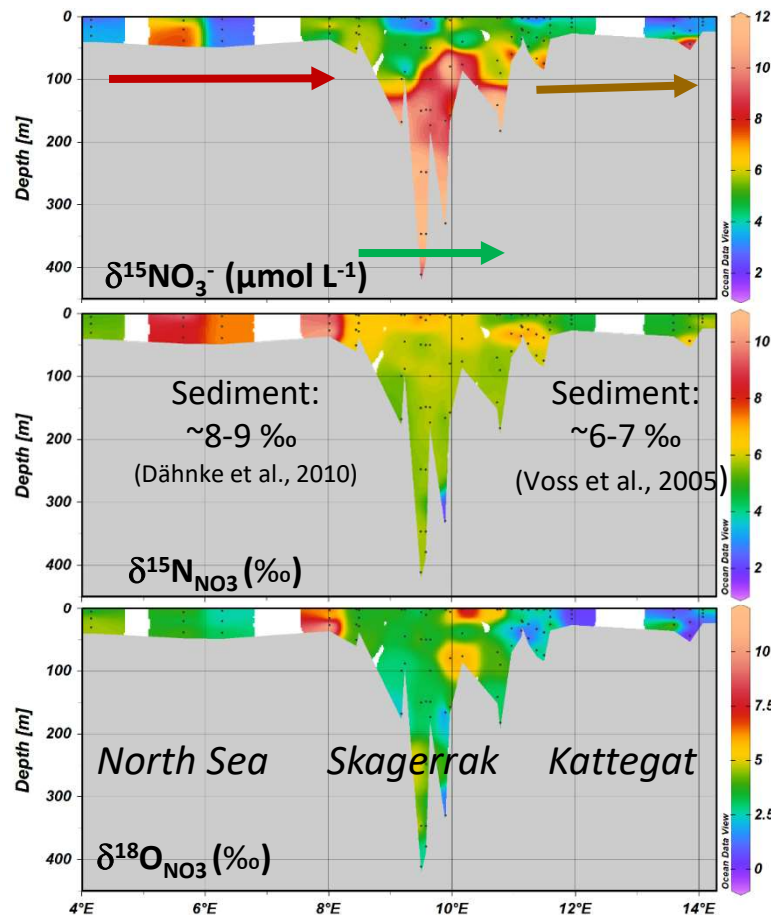
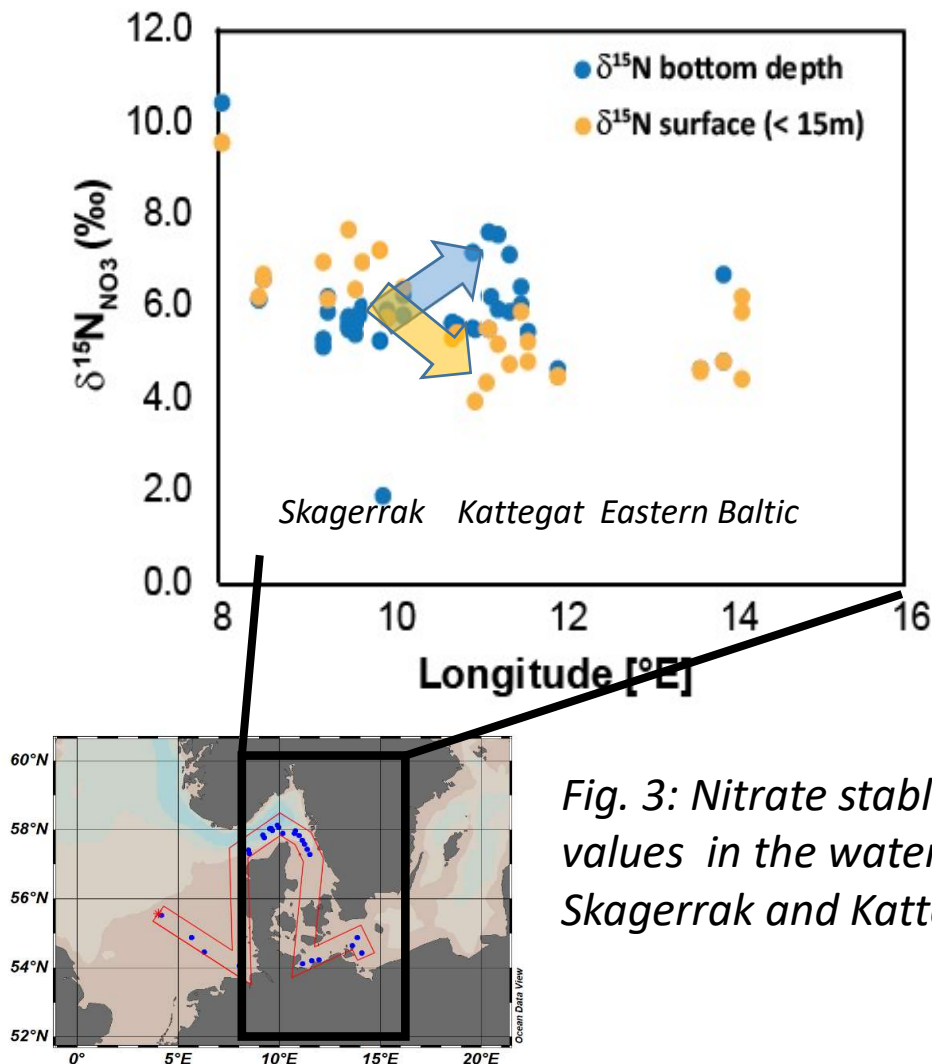


Fig. 2: Nitrate concentration and dual stable isotope values along a cruise transect. Note that changes in latitude are not visible in the transect, arrows are shown for reference.

Water column nitrate isotopes in the Skagerrak and Kattegat region



- To evaluate recycling in the Skagerrak and east of it, we zoom into the Skagerrak/Kattegat region....
- Low surface $\delta^{15}\text{N}_{\text{NO}_3}$ values in the Kattegat may be a sign of increasing importance of N_2 fixation
- In shallower Kattegat water, we see that bottom water nitrate isotopes reflect the sedimentary source (6-7 ‰, Voss et al. 2005)

Fig. 3: Nitrate stable isotope values in the water column in Skagerrak and Kattegat

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What is the role of benthic fauna in the North Sea?

- Evaluation of MSM 50 values in the North Sea to an annual data set of flux measurements
- Bottom water temperature is high, but DIN fluxes cannot keep pace - low values in January despite high temperatures, possibly due to low faunal abundance

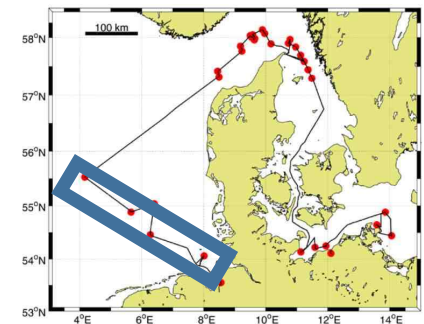
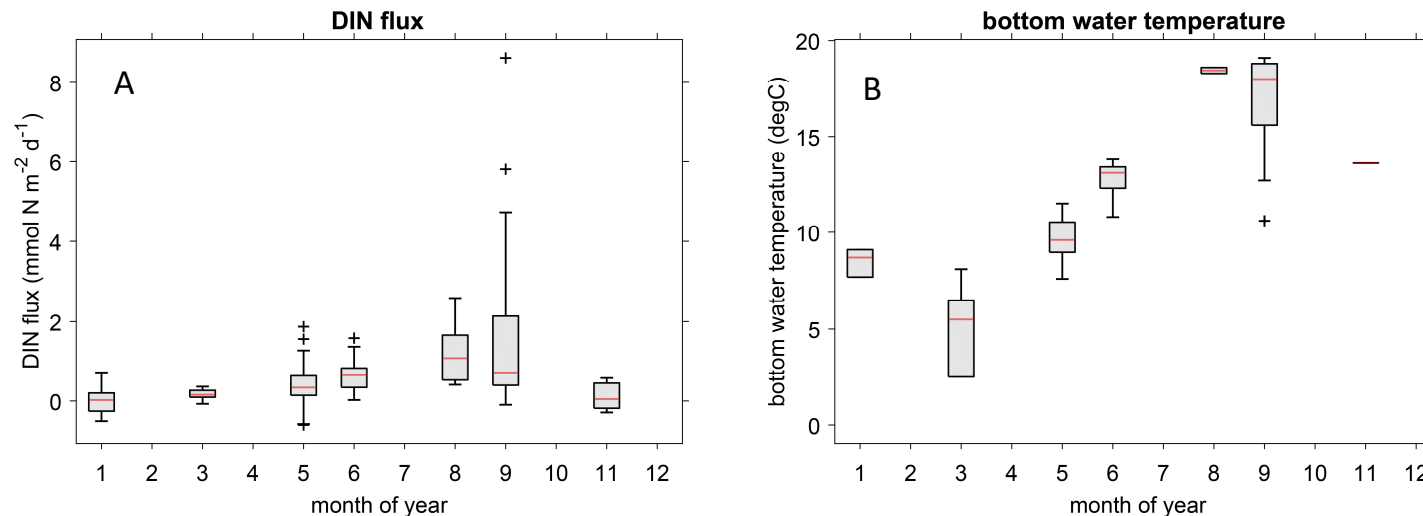


Figure 4: benthic fluxes of DIN at sampling stations in the North Sea (A) in comparison to bottom water temperature (B)

Neumann et al., submitted to Limnology & Oceanography

Summary and Conclusions

- Sediments can be a source of nitrate, so that nitrate isotopes mirror sedimentary N
- Kattegat: sedimentary N-source is visible in relatively high $\delta^{15}\text{N}_{\text{NO}_3}$ in bottom waters, whereas surface water $\delta^{15}\text{N}_{\text{NO}_3}$ is lighter and may be a sign of increasing influence of N_2 fixation
- North Sea: outside the Elbe extended estuary, $\delta^{15}\text{N}_{\text{NO}_3}$ is lighter than an assumed sedimentary source, benthic fluxes appear less important – this may also be due to better mixing in the water column
- Low activity of benthic fauna in the North Sea region may be a cause of lower benthic fluxes