



## **Benthic denitrification counteracts the effect of anthropogenic nitrogen loading into the North Sea**

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Within the last 5 decades nitrogen dumping into the North Sea has increased drastically due to human activities. A large part of this reactive nitrogen is taken up by phytoplankton, exported to the sediment and ultimately released as  $N_2$  by benthic denitrification thus being no longer available for biological cycling.

We hypothesize that during the phase of massive anthropogenic nitrogen loading into the North Sea no significant increase of winter nitrate concentrations took place.

This is supported by sediment cores which do not show any significant gradient of  $\delta^{15}N$  values. In eutrophicated areas of the Baltic Sea such cores clearly reflect the temporal development of anthropogenic nitrogen input by an increase of  $\delta^{15}N$  from the natural background value of 3 per mil to 12 per mil during the last decades.

Our biogeochemical simulations with the model ECOHAM3 for the years 1994-96 strongly support the evidence for massive benthic denitrification in the North Sea: The annual nitrogen loads were 50 - 80 Gmol  $N y^{-1}$  by rivers and diffusive sources with large interannual variations. In the low-precipitation year 1996 with a very low North Atlantic Oscillation Index also nitrogen loading was lowest. The atmospheric deposition was 27 Gmol  $N y^{-1}$  for all years. In 1996 the production and successive export of molecular nitrogen by benthic denitrification compensated the external sources which were mainly of anthropogenic origin. In 1994 and 1995 this nitrogen sink corresponded to about 66% of these sources.