EGU21-2924
https://doi.org/10.5194/egusphere-egu21-2924
EGU General Assembly 2021

Unraveling seasonal carbon-limitation of benthic nitrate-reduction in the coastal Baltic Sea

Dana Hellemann[1,2], Sanni-Leea Aalto[3], Eero Asmala[1,2], Tom Jilbert[1], Mikko Kiljunen[4], Boris Koch[5], Joanna Norkko[1,2], and Alf Norkko[1,2]

[1]Ecosystems and Environment Research Program, University of Helsinki, 00014 Helsinki, Finland
[2]Tvärminne Zoological Station, University of Helsinki, 10900 Hanko, Finland
[3]National Institute of Aquatic Resources, Technical University of Denmark, 9850 Hirtshals, Denmark
[4]Department of Biological and Environmental Science, University of Jyväskylä, 40014 Jyväskylä, Finland
[5]Section Ecological Chemistry, Alfred Wegener Institute for Polar and Marine Research, 27570 Bremerhaven, Germany

Excess bioavailable nitrogen (N) is the key driver of coastal eutrophication, thus knowledge on the fate of N in coastal systems is imperative for improving eutrophication mitigation measures. In the coastal Baltic Sea, benthic heterotrophic denitrification, the main process of bioavailable N-removal from a coastal system, has recently been suggested to be seasonally limited by labile organic carbon (OC) availability[1] - despite the system´s richness in labile organic matter from long-term eutrophication. This challenges our common understanding of the intrinsic link between C- and N-cycling, and highlights the need for a more advanced concept of OC availability. Hence, in this project, we (i) extensively characterized the biochemical composition of coastal OC beyond traditional descriptors of 'lability', applying techniques such as isotopic fingerprinting and Fourier transform ion cyclotron resonance mass spectrometry, and (ii) concurrently quantified benthic nitrate reduction rates both with and without addition of easily degradable OC (glucose), to ultimately confirm and understand proposed OC-limitation of denitrification in coastal sediments. All measurements were done in high temporal and spatial resolution at the southern coast of Finland, covering a three-month period from late winter to early summer that included the peak annual input of fresh organic matter to the benthic system by the phytoplankton spring bloom. First results will be presented and their implications for understanding seasonal N turnover and coastal eutrophication dynamics will be discussed.

[1]Hellemann D, Tallberg P, Aalto SL, Bartoli M, Hietanen S (2020) Seasonal cycle of benthic denitrification and DNRA in the aphotic coastal zone, northern Baltic Sea. Mar Ecol Prog Ser 637:15–28