Isotopic signatures of eelgrass (Zostera marina L.) as bioindicator of anthropogenic nutrient input

Schubert PR1, Karez R2, Reusch TBH1, Dierking J1
1Helmholtz Center for Ocean Research Kiel, 2State Agency for Agriculture, Environment and Rural Areas Schleswig-Holstein

Can we use the δ15N ratio of eelgrass leaves to assess sewage input in coastal ecosystems of the Baltic Sea?

Recent use of stable isotope content of macroalgae as a proxy for human nutrient input suggests that eelgrass Zostera marina could be used as biomarker for sewage derived nutrients. Eelgrass is continuously distributed along the German coast of the Baltic Sea. The leaves function as a temporal integrator of nutrient input with a leaf turnover time of about 50-60 days. Sewage derived nitrogen often has a distinctive isotopic signature due to the high prevalence of the heavier 15N isotope caused by nitrification and denitrification processes in wastewater treatment plants. This results in high δ15N values (>12‰) of the outflowing water. Our goal here was to map eelgrass δ15N ratios around a major sewage outfall and then compare the findings with our expectations of nutrient distribution.

Results

1. δ15N values of eelgrass growing downstream of the outfall were significantly higher than upstream
2. Nitrogen isotope ratios were back to normal about 4 km downstream of the outfall
3. No differences in stable isotope signature between deep and shallow eelgrass

Conclusion

Spatial patterns of stable isotope distribution matched our expectations. Hence, stable isotope δ15N ratios of eelgrass leaves seem to be suited as biomarker for anthropogenic nutrient input from wastewater. The next step will be a coastwide screen of 15N from eelgrass to assess the influence of sewage derived nitrogen on coastal ecosystems of the western Baltic Sea.

Contact:
Philipp Schubert
pschubert@geomar.de

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