

Scientific Report of AMBER subproject WP B.3

Isotopic signature in nitrate for source identification

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The aim of subproject WP B.3 is the characterization of the isotopic signature of the river nitrate in relation to the land use through the sampling of the Oder, Nemunas, and Kalix.

Sampling was conducted in 2009 and 2010 (Tab. 1, Fig. 1).

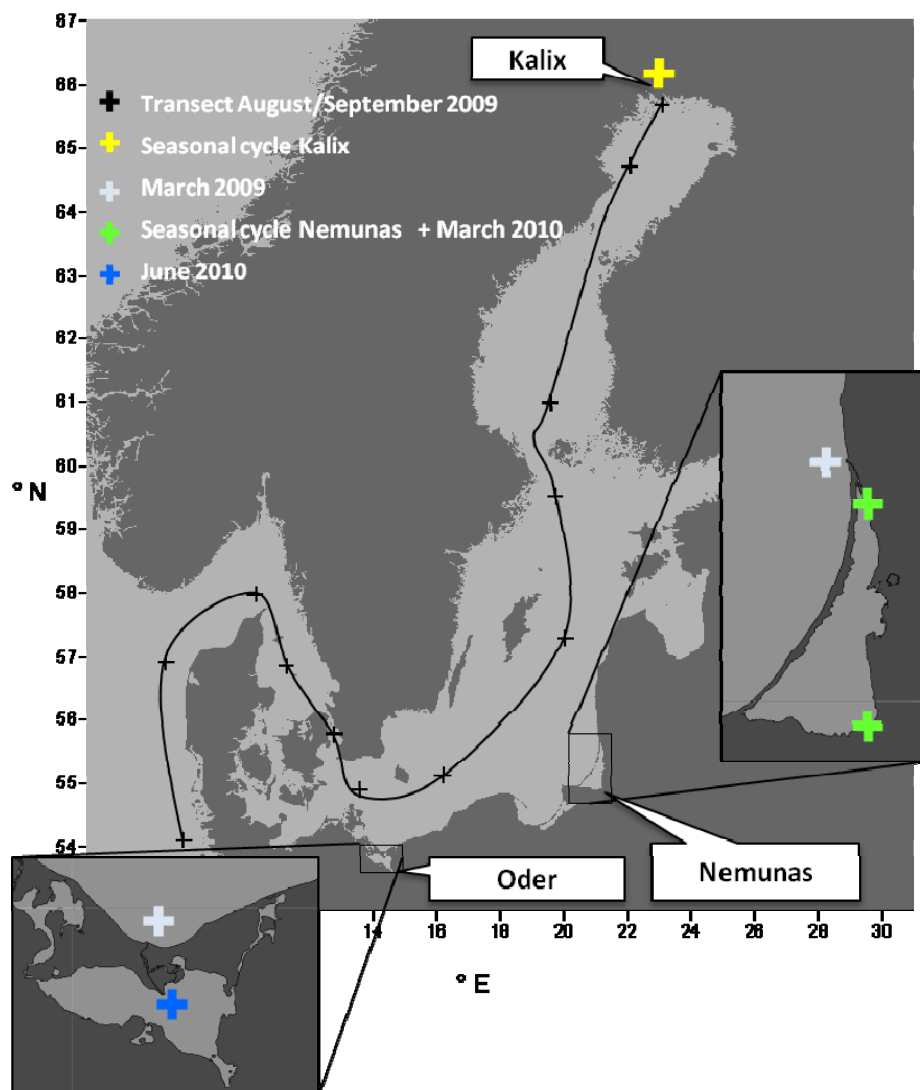


Figure 1: Map with all sites where 2009 and 2010 samples have been taken and experiments were performed for WP B3. Black crosses denote the transect sampled in August/September 2009. Green and yellow crosses show the stations of the Nemunas and Kalix annual cycle, respectively. The blue cross denotes the sampling stations in the Szczecin lagoon (June 2010). White crosses are stations where samples have been taken in March 2009 during a cruise.

The outflow of the Szczecin and Curonian lagoon were sampled in March 2009 during a cruise with the RV “Professor Albrecht Penck” for nutrients and the isotopic signature of nitrate ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$). Also nitrate uptake experiments were performed to gain a better understanding of the dynamics of nitrate in the river outflows during peak outflow. First results of the isotopic signature of nitrate are presented in Figure 2.

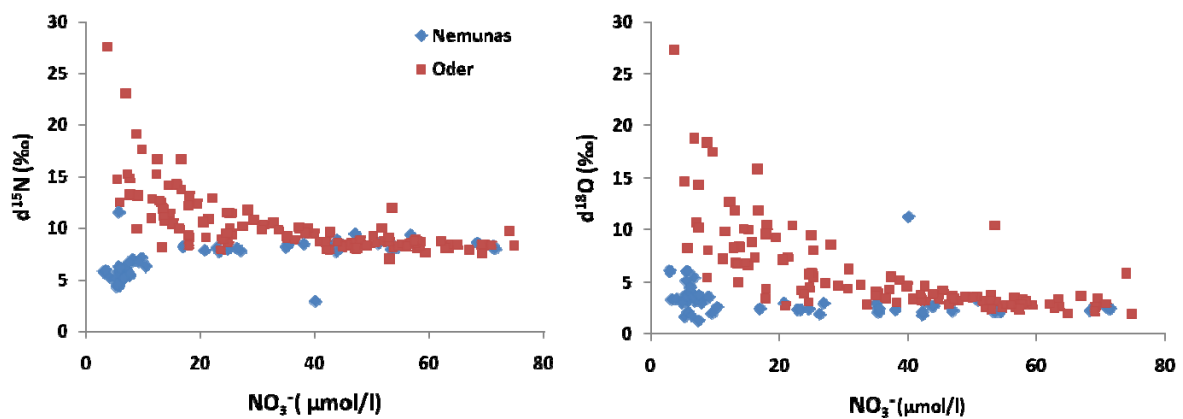


Figure 2: Isotopic signature of nitrate ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ (‰)) as a function of nitrate concentrations ($\mu\text{mol/l}$) for the outflow of the Szczecin (Oder) and Curonian (Nemunas) lagoon.

Additionally, Lithuanian colleagues took samples for a full seasonal cycle at two stations, one located in the Nemunas River and the other in Klaipeda, close to the outflow of the lagoon (Figure 1). From these 24 samples, nutrients and the isotopic signature of nitrate have been measured. In March 2010 dissolved inorganic nitrogen (DIN) and dissolved organic nitrogen (DON) uptake rates were measured at the two stations where the seasonal cycle was taken.

In June 2010 at three stations in the Szczecin lagoon, samples were taken for nutrients and the isotopic signature of nitrate. Additionally, DIN and DON uptake in the water column together with N removal rates in the sediments were measured. We do not have a seasonal cycle of the Oder but from 2000–2002 two stations (one located at the main outlet of the lagoon and the other in the river) were sampled biweekly within the project SIGNAL (Significance of

anthropogenic nitrogen for central Baltic Sea N-cycling 2000–2003). We have access to this dataset (see meta data: <http://www.io-warnemuende.de/amber-metadata.html>). Measurements involved nutrients and the isotopic signature of nitrate and are published (Voss et al. 2010).

Samples for a seasonal cycle from the Kalix River were started to be taken in September 2009 but due to the long ice period in 2009/2010 sampling is in delay. Already 10 out of 12 samples have been taken. Nutrient and isotopic analysis are therefore underway. In August/September 2009 uptake rates of DON were measured along a transect from the North Sea to the Baltic Sea (Fig. 3, black crosses). This was also done at a station which was influenced by the outflow of the Kalix River. A manuscript with the results from this cruise will soon be submitted.

All meta data sets from all samplings have been published on the AMBER homepage.

References:

- Voss, M., Deutsch, B., Liskow, I., Pastuszak, M., Schulte, U., and Sitek, S., (2010): Nitrogen retention in the Szczecin Lagoon, Baltic Sea. *Isotopes in Environmental and Health Studies*, Vol. 46, No. 3, 355–369
- Korth, F., Deutsch, B., and Voss, M.: Uptake of dissolved organic nitrogen by heterotrophic bacteria and phytoplankton along a salinity gradient from the North Sea to Baltic Sea. In prep.

River	Date	Location	Cruise	N uptake experiments	Measured parameters					
					NO ₃ ⁻	NO ₂ ⁻	NH ₄ ⁺	PO ₄ ³⁻	d ¹⁵ N	d ¹⁸ O
Nemunas	March 2009	Transects in the outflow of the Curonian lagoon	Cruise with the RV Professor Albrecht Penck	NO ₃ ⁻ uptake	✓	✓	✓	✓	✓	✓
Oder	March 2009	Transects in the outflow of the Szczecin lagoon	Cruise with the RV Professor Albrecht Penck	NO ₃ ⁻ uptake	✓	✓	✓	✓	✓	✓
Nemunas	March 2010	One station in the river and the other in Klaipeda	Sampled with a small Lithuanian boat	DIN and DON uptake	✓	✓	✓	✓	✓	✓
Oder	June 2010	Stations in the Oder lagoon	Sampled with the Polish boat Stynka II	DIN and DON uptake	✓	✓	✓	✓	✓	✓
Nemunas	Seasonal cycle: March 2009-March 2010	One station in the river and the other in Klaipeda	Taken by Lithuanian colleagues	-	✓	✓	✓	✓		
Kalix	Seasonal cycle: September 2009-ongoing	Station in the river	Taken by Swedish colleagues	-						
Transect of the Baltic Sea	August/September 2009	12 stations along a transect of the North Sea/Baltic Sea	Cruise with the RV Maria S. Merain	DON uptake	✓	✓	✓	✓	-	-

Table1: Summary of sampling locations, dates, cruises and measured parameters. Check marks denote whether samples have been analysed, open field means that measurements are underway

