Nitrogen and phosphorus in the sediments and waters in rivers of Kocinka catchment

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Introduction: Eutrophication is one of the greatest threats to the Baltic Sea environment. Poland's contribution to the total nitrogen load to the Baltic Sea is high, because nearly all Polish rivers discharge to the Baltic Sea with agriculture being the dominant source of nitrogen and phosphorus. The Soils2Sea project (*Reducing of nutrient loadings from agricultural soils to the Baltic Sea via groundwater and streams*) in the International Programme for the Baltic Sea BONUS-185[1] aims at proposing new methodologies for planning of differentiated regulations concerning application of nitrogen and phosphorus in agriculture. These regulations will take into account differences in the effectiveness of retention processes, transformation, and dilution of nutrients on their way to the surface of the soil, through groundwater and rivers. The Polish project case study is the Kocinka river catchment. This work presents results of the analyses of bottom sediments and water of the river relevant to characterization of retention processes in the river and of interaction processes between groundwater and surface water.

Methods: Samples were taken between 31 July and 1 August 2014 in the Kocinka and four other watercourses in the catchment. In each of thirteen localizations one sediment sample and one water samples were taken. The electrolytic conductivity (EC) and pH in water were measured *in situ*. Concentrations of nitrogen in water (sum of NO_3^--N, NO_2^--N, NH_4^+-N) were determined by Spectrophotometer DR 2800 (Hach Lange, Germany). Samples of sediments were taken from depth range from 0 to 10 cm. Particles >2 mm were removed before analyses. Sediment pH was measured in KCl and H_2O solution (electrometric method, ratio 1:5). Total carbon and sulfur were determined by dry combustion in ELTRA CS 500 elemental analyzer. Total Nitrogen was estimated by Kjeldahl Method (wet digestion). Carbonates were determined by Scheibler volumetric method. Extraction of available phosphorus was performed by the Egner-Riehm method. In sediment samples electrolytic conductivity (EC) and loss of ignition at 550°C were also measured. All measurements and data are gathered, processed and archived using ArcGIS.

Results: EC in river water was between 380 and 508 µS/cm while EC in sediment was much lower (19.8 - - 108 µS/cm). Water samples had pH between 7.3 and 7.91. Sediment samples had pH from 7.0 (in KCl solution) and 7.3 (in H_2O solution) to 7.7 and 7.9 Concentrations of nitrogen in water was between 2.36 and 75.28 mg/l. The total carbon and sulfur level in sediment was from 0.08 to 1.1% and from 0 to 0.029%. Total Nitrogen (by Kjeldahl) was between 0.01 and 0.08%. Carbonates were detectable in only three samples and was from 0.12 to 1.6%. Phosphorus (as available phosphorous P_2O_5) was between 0.002 and 0.008%. The C:P ratio exceeded 300 in in two sediments samples being below 200 in other samples. Similarly, the C:N ratio only in one sample exceeded 30, in other samples being below 20.

Discussion: Low C:N and C:P ratios found in the sediments derived from test means that content of mineral form of nitrogen and phosphorus in sediment will be growth on account of advantage of mineralization. Plants taken up $H_2PO_4^-$, HPO_4^{2-}, NO_3^- and NH_4^+ ions. The remaining unused part of nutrients are leached out from sediments. This has an obvious effect on the concentration of nitrogen and phosphorous in river water and in eutrophication process. Between Kocinka and its tributaries are differences. The highest values of C_{org}%, C:P, C:N and EC in sediments occurred in a sample from a drainage ditch, which flow to Kocinka. This data will be used to recognize nutrient transport and migration processes in the river network and in the modeling research.

References:

[1] *http://www.soils2sea.eu/about_uk/main.html*