



Background nitrogen concentrations in fresh waters in Denmark

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Quantitative information on the background loading of nitrogen is important when establishing the pressure-impact pathway for Danish springs, streams, lakes and estuaries. The background nitrogen loading thus determines present day lowest nitrogen loadings without influence from point sources and agriculture but includes present day atmospheric deposition of nitrogen compounds. We have mapped the background concentration of nitrogen in Danish soil water, springs and streams based on monitoring in one soil water station (1990-2010), 11 springs, 7 small streams draining undisturbed catchments (1990-2010) and 19 streams draining small undisturbed catchments (2004-11). The concentration of ammonium-N (NH_4^+) and organic N was found to be nearly constant within six major landscape types in Denmark, respectively, $0.05 \text{ mg} \pm 0.06 \text{ mg N L}^{-1}$ and $0.53 \text{ mg} \pm 0.29 \text{ mg N L}^{-1}$. On contrary, the concentration of nitrate-nitrite-N ($\text{NO}_3^- + \text{NO}_2^-$) was found to vary between $0.06\text{--}0.83 \text{ mg N L}^{-1}$ within the six landscape types. We have also time series of background total nitrogen concentrations from 7 small undisturbed catchments covering the period 1990-2010. No significant trends have been observed for total nitrogen concentrations from these streams during the period 1990-2010. The measured average nitrate-N concentrations in streams has been modelled against dominant landscape geology and a $5 \times 5 \text{ km}$ grid map of Denmark showing background concentrations of nitrate-N and total N has been produced. This map has been used during the implementation of the EU Water Framework Directive as a baseline for estimating background nitrogen losses to surface waters in Denmark. Thus, the average annual background loss of total nitrogen amounts to 13,000 tonnes N or 20% of the total loading of nitrogen from the Danish land to sea during the period 2005-2009.