The role of environmental monitoring in the scientific understanding of temporal changes of nutrient transports in Swedish rivers

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The national Swedish monitoring programme for river water quality is internationally unique in regard to its continuity and the great variety of sampled rivers. This makes it of particular interest in the scientific discussion of possible causes of long-term trends in water quality and transports of substances from land to sea. The present study was devoted to a thorough evaluation of almost 25 year long time series of nutrient concentration and runoff data for 66 sites in 39 river basins.

Analysis of nitrogen data showed that, after flow normalisation, the interannual variation in nitrogen transports was relatively small for most of the investigated sites. However, the study also provided clear evidence of upward trends in the concentration and transport of nitrate at a set of sampling stations located downstream of lakes. The following causes of these upward trends were considered : (i) increased atmospheric deposition of nitrogen; (ii) time-lagged effects of changes in agricultural practices that took place prior to the onset of the monitoring; and (iii) decreased nitrogen retention in lakes due to decreased emissions of phosphorus or organic matter. For each of the investigated sites, more than one explanation was normally conceivable. However, the combined evidence for all investigated sites strongly indicated that decreased nitrogen retention in lakes was the main cause of observed upward trends.

Due to a nation-wide introduction of tertiary treatment of wastewater in the 1970s, point emissions of phosphorus have decreased dramatically in many of of the investigated river basins. In spite of this, there was only a moderate decrease in the total riverine transport of phosphorus from Sweden to surrounding seas. Closer examination of data for individual river basins revealed that, at several sites, the impact of decreased point emissions on the riverine transport of phosphorus was reduced or eliminated by decreased retention of phosphorus in lakes, particularly in shallow lakes

The identified nitrogen trends as well as the lack of clear phosphorus trends illustrate that environmental monitoring can play a crucial role in the scientific interpretation of changes in environmental quality. Although process-oriented studies have made it plausible that reduced supply of phosphorus and organic matter can reduce the retention of nitrogen in lakes, it would not have been possible to quantify the environmental significance of such processes without access to long time

series of data from a great variety of aquatic environments. The same holds for the water-sediment exchange of phosphorus that evidently may have a substantial influence on the large-scale transport of phosphorus from land to sea.