



Comparative water quality study in Finnish and Scottish river catchments

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Anthropogenic disruptions have been gradually increasing their harmful influence on the nutrient cycle and unbalancing freshwater ecosystems worldwide. This research aims to improve the understanding of the factors driving river catchment responses to such disturbance within a context of similar/dissimilar catchment behavior (ie catchment 'typologies') in Finland and Scotland. This will help to elucidate risk areas of nutrient pollution and reasons underpinning differentiated catchment responses.

The study was based on comparative analysis of national water quality monitoring data in Finland and Scotland. Due to their importance for water quality and freshwater ecology and the availability of routinely measured monitoring data in Finland and Scotland we focused on the following water quality determinants: nitrite, nitrate, pH, silicate, suspended solids and total phosphorus.

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We investigated the dynamics of stream-flow and concentrations in 18 catchments in Finland (area 357–4923 km², daily discharge, water quality monitoring frequency 2-35 times/year from 1985 to 2017) and 47 catchments in Scotland (area 10-1772 km², daily discharge, and monthly water quality data from 1987 to 2016).

We used indices to describe variability in distribution (interquartile ratio) and seasonality (Pardé coefficient) of both stream-flow and concentrations as well as streamflow oscillation (Richards-Baker flashiness index). The relationships between stream-flow and concentrations were assessed in terms of both chemodynamic vs. chemostatic behaviour (by comparing the coefficients of stream-flow and concentration variation according to Musolff 2017) and enrichment vs. dilution behavior (according to the slope of fitted power-law concentration-discharge relationships). To be able to objectively compare the dynamics of stream-flow and concentrations between catchments we performed a hierarchical cluster analysis based on z-scored indices for stream-flow and concentration of each determinant.

The clusters of stream-flow and concentration dynamics were visualised in maps. We found that catchments in Western Finland and Eastern Scotland are similar in stream-flow dynamics which can be attributed to similarities in precipitation patterns.

We found similarities in the pattern for chloride and total phosphorus in southwestern Finland and north-eastern coast of Scotland. The distribution of pH follows a similar sequence in Finnish western coast and from north to south in Scottish eastern. The patterns of suspended solids, silicates and nitrate present greatest similarities between both countries especially in middle latitudes. Future research will focus on the analysis of land use, land management and physical catchment characteristics to explain the differences/similarities.

Musolff, A., Fleckenstein, J.H., Rao, P.S.C., Jawitz, J.W., 2017. Emergent archetype patterns of coupled hydrologic and biogeochemical responses in catchments. *Geophys. Res. Lett.* <https://doi.org/10.1002/2017GL072630>