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Source identification and impact of micropollutants on surface water quality at the catchment-scale

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Micropollutants and nutrients from a range of sources are well-known stressors that may cause a decline in groundwater and surface water quality and biodiversity of freshwater ecosystems. Effectively reducing cumulative impacts on groundwater-dependent aquatic ecosystems clearly requires an understanding of the different pressures that can be present in a particular catchment. Ecosystem stressors include physical habitat degradation (e.g. channelization), diffuse sources (pesticide and nutrient applications on agricultural fields), sewage effluents (micropollutants, organic matter, nutrients) including urban discharges from scattered settlements, contaminated sites (xenobiotic compounds and other pollutants) and water abstraction.

The purpose of this study was twofold: to (1) identify the main stressors at catchment scale, and if possible discriminate sources from each other; (2) evaluate the chemical impact and stream ecosystem status represented by benthic macroinvertebrates. The study was conducted on first-order stream reaches within the Hove study catchment near Copenhagen, Denmark. For the purpose of this study, sewage effluents and water abstraction could be disregarded since only one sewage treatment plant was present and the water abstraction areas were located on third and fourth-order stream segments, respectively. Ecological indicators investigated were benthic macroinvertebrates. Stressor parameters investigated from early spring until late summer include presence of pesticides from storm events (diffuse run-off), assessment of physical stream properties (habitat survey), general water chemistry, as well as presence of xenobiotics originating from both diffuse and point sources. A total of 13 sampling locations were broken into three categories of sites: 6 contaminated sites, 4 urban discharges and 3 diffuse agricultural sites. Additionally, 6 undisturbed first-order streams were included as reference conditions. GIS tools are applied for source identification and multivariate statistics approach is applied to rank-order the impact of each examined stressor on benthic macroinvertebrates.

The results for diffuse run-off after a storm event (sampling occurred 4 times between mid-may and mid-august) revealed that the sampling campaign successfully captured the early spring application of metamitron, a pesticide sprayed typically only during early spring. 2-methyl-4-chlorophenoxyacetic acid (MCPA), trichloroacetic acid, 2,6-dichlorbenzamide (BAM) and 4,6-Dinitro-o-cresol (DNOC) were found to dominate the pesticide results for all four sampling campaigns. These pesticides are not related to immediate spraying, but originate from groundwater inflow to the streams. In at least two cases, the presence of xenobiotics/pesticides in the stream could be linked to the contaminated sites. The assessment of the large amount of data collected during this comprehensive field campaign is on-going.