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Identification of sources of nutrients along an intermittent Mediterranean river in contrasted hydrological conditions

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In the Mediterranean basin, many small rivers have a temporary regime that consists in long dry periods cut by flood events. During the dry periods, the riverbed may become completely dry, except in some sections where human inputs (sewage treatment works (STWs), domestic raw waters or industries) contribute to feed the river. Due to this specific hydrological regime, diffuse and point source pollution inputs associated to human activities have harmful effects on the water quality and its evolution along the river. The importance of each pollutant sources depends on the hydrological state of the river. Few data exist in the literature concerning temporary rivers while it is of main interest for the application of the European water framework directive in such environments.

This study addresses the spatial variations of water quality along the Vène River (catchment area of 67 km^2; South of France). The catchment is characterized by three sharply contrasting geology and land use zones: urban zones (3%), agricultural areas (vineyards -21% and permanent crops -13%) and karstic scrubland areas (63%). Data were collected during one-day field campaigns (eleven campaigns from February 2003 to January 2005) in various hydrological conditions (from dry period to floods). Water samples and flow measurements were done along a 12 km stretch of the Vène River, at eighteen points: nine in the main river (from the spring to the outlet) and nine in its tributaries and direct inputs (storm sewers and treatment plants). Water quality was evaluated through in-situ measurements (temperature, pH, conductivity, Eh and dissolved oxygen) and the determination of nutrients (NO2+NO3, NH4, NTK, SRP, TP) and suspended solids concentrations.

On the basis of the observed data, it was possible to show that in dry and low flow conditions, the nutrient loads increased sharply due to the local impact of STW point-source input, but decreased rapidly downstream the input. In fact, the nutrients brought by the STWs were stored in the riverbed in the reaches downstream the input (e.g. about 5 kg-P.day-1 is stored in the river in September) and these nutrients remained available and constituted a source of pollution in high flow conditions. In medium and high flow conditions, the nutrient loads showed a regular increase from the spring to the outlet due to the impact of both diffuse and point-source inputs.

At the catchment scale, the diffuse and point sources of nutrients were also ranked for the main hydrological conditions. In low and medium flow conditions, NO2+NO3 loads were mainly brought by the karstic zones that brought the main part of the discharge at the outlet. But, the whole part of TP and NTK loads were due to the sewage treatment works that only brought 10% of the discharge at the outlet. During flood, the two-third of NO2+NO3 had an agricultural origin and only one-third of TP and NTK were due to STW inputs. The rest of the nutrients came from the storage in the riverbed. Except for NO2+NO3 during the short periods of high flow, agricultural areas had a small impact on the water quality of the river.

The estimation of nutrient storage has a great importance for intermittent river, like the Vène, because these pollutions could be flushed away during floods very rapidly and transferred to the downstream ecosystems, increasing their nutrient loads.