The effects of increased flow and fine sediment on hyporheic invertebrates and nutrients in stream mesocosms (Jones et al. 2015) [1]

1. River regulation and altered land use are two common anthropogenic disturbances in rivers worldwide. Alteration of the stream bed, through processes such as siltation, or of hydrology through river regulation, are likely to modify hyporheic processes or clog interstitial space and thereby affect both hyporheic invertebrates and nutrient dynamics.

2. We tested the separate and combined effects of increased flow and increased fine sediment on hyporheic water quality and invertebrates in flume mesocosms.

Each mesocosm contained two bed sediment types: clean sediment in the upstream section and experimentally colmated (EC) sediment (10% by weight of fine sediment) in the downstream section. Two flow rates were established, a higher flow rate to create turbulent flow in six mesocosms and a lower flow rate to create a transitional flow between turbulent and laminar flows in the remaining six mesocosms. Invertebrates and physicochemistry were sampled after 30 days at three depths (5, 11 and 18 cm), and the flows in six of twelve mesocosms were switched. The experiment was concluded after sampling invertebrates and physicochemistry on day 70.

3. The addition of fine sediment to the mesocosm bed generally increased ammonium and decreased nitrate and soluble reactive phosphorus concentrations, decreased oxygen penetration and altered invertebrate assemblage structure. Increased flow rates generally lowered ammonium concentrations, increased soluble reactive phosphorus concentrations, increased oxygen penetration and altered invertebrate assemblage structure. Our hypothesis that higher flows would ameliorate any effects of added fine sediment was generally supported for oxygen penetration and nitrate concentration. However, we observed no differences in interaction effects of flow regime and sediment type either on other nutrient concentrations or invertebrate assemblage structure.

4. The rates of flow used in our mesocosms did not appear to reach the threshold required to remove fine sediment. It is generally recognised that river hyporheic restoration requires a set of objectives against which the outcomes can be measured yet this is often overlooked. Our research provides preliminary guidelines that small amounts of fine sediment can have deleterious ecological effects. However, further research is required to evaluate whether lower percentages of bed fine sediment result in ecological impairment and to determine what flow rates are required to ameliorate colmation impacts.

Keywords: colmation, hyporheos, invertebrates, river regulation, sedimentation

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http://dx.doi.org/10.1111/fwb.12536 [2]

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[1] https://reformrivers.eu/effects-increased-flow-and-fine-sediment-hyporheic-invertebrates-and-nutrients-stream-mesocosms
[2] http://dx.doi.org/10.1111/fwb.12536

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