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The abiotic environment of the interstitial of a small Swiss river in the foothills of the Alps and its influence on gravel spawning brown trout (Salmo trutta L.)

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The hyporheic zone can be characterized by multiple abiotic parameters (e.g. bulk density, texture, temperature, oxygen, ammonium, nitrate) which are all influenced directly or indirectly by the exchange processes between surface water and groundwater. These processes can vary both in time and space and are mainly driven by river discharge, ground water level and flow patterns. The input of fine sediment particles can change water-riverbed interactions through river bed clogging potentially affecting the embryonal development and survival of gravel spawning fish, such as brown trout (Salmo trutta L.). With our investigations we aim to understand these complex interactions spatially and temporally on a relevant small scale, i.e. within individual artificial brown trout redds.

We designed an experimental field setup to directly investigate i) the influence of the abiotic river and redd environment on brown trout embryo development and ii) the hydrological dynamics affecting the abiotic environment in artificial brown trout. Additionally, our setup allows investigating the temporal dynamics of i) fine-sediment infiltration into the artificial redds and ii) embryo survival to two distinct developmental stages (i.e. eyed stage and hatch)
The experiment was conducted in three sites of a typical Swiss river (Enziwigger, Canton of Luzern) with a strongly modified morphology. Individual sites represented a high, medium and low fine-sediment load. In each site, six artificial redds (18 in total) were built and data were collected during the entire incubation phase. Redds were located in places where natural spawning of brown trout is present. We adapted multiple established methods to the smaller scale of our river to study the dynamics of the most relevant abiotic parameters potentially affecting embryo development: Oxygen content and temperature was monitored continuously in different depths, fine sediment (bedload, suspended sediment load and its input in the river bed) was measured weekly and water samples for DOC and nitrogen components analysis were collected regularly. In addition, all redds were equipped with mini piezometers to measure the hydraulic gradient through the redds. Finally, water stage and turbidity were monitored continuously.
Results of the first spawning season will be presented. Dynamic of abiotic parameters and their influence on spawning of brown trout will be discussed.