



Mean Flow and Turbulence Fields over Three-dimensional Salmonid Spawning Redd: Implications for Interstitial Currents Within Gravel Bed

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Salmonid fish redds (also called nests) consist of an upstream hollow and downstream hump cut in gravel streambeds. Flow over these permeable gravel bedforms maintains interstitial oxygenated flow to fish eggs. Turbulent 3-D flow fields above redds were recorded in a flume. Zones of flow separation, greatest turbulence and shear are identified by root mean square, Reynolds stresses and quadrant event frequency - delineating regions of low and high momentum fluid. The shape of these regions varies with mean flow velocity and the degree of freedom that the flow has to diverge laterally around the redd. High Reynolds stresses at the crossover between the hollow and hump induce downward interstitial flow whilst a wake downstream of the hump promotes upward interstitial flow. Thus these two regions drive the interstitial flow patterns. The results demonstrate that the shape of the redd significantly enhances the pattern of interstitial flow such that the supply of oxygenated water should be enhanced within egg pockets.