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Impact of hydrodynamics of porous and non-porous structures on upstream fish passage performance[1] STEPHANIE MUELLER, ELIZABETH FOLLETT, CATHERINE WILSON, PABLO OURO, JO CABLE, Cardiff University — Flow visualization and velocity measurements using ADV were used to assess upstream and wake flow characteristics of non-porous and porous structures made of wooden dowels. Upstream of the structure, flow becomes diverted towards the bed with higher downwards vertical velocities for the non-porous case. A turbulent wall jet formed beneath, showing higher flow acceleration with decreasing porosity, leading to stronger turbulent momentum exchange along the shear layers in the wake. Behind the non-porous structure a larger recirculation area formed. At the downstream edge of the structure, turbulent kinetic energy (TKE) was larger for the non-porous case, with highest levels found approximately at mid-structure height. In the porous cases, two peaks in TKE occurred at the trailing edge of the lowest dowel, due to inter-dowel wake effects. Swimming behavior observations of rainbow trout (Oncorhynchus mykiss) revealed fish spent time beneath the structure, likely to avoid the high momentum jet. With increasing structure porosity, fish preferred to swim in the structure's wake due to reduced mean velocities and turbulent fluctuations near the bed. These observations indicate that porous and non-porous structures create heterogeneous habitats, influencing fish behavior.

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