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Flow simulation and experimental measurements in pool-type fishways

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Fish facilities are structures or systems that enable fish passage through dams or obstructions. Fishways represent the most common fish facilities type worldwide, presenting different geometries and designs, with a wide range of flow and turbulence patterns. In this study, it was investigated the mean flow and the turbulence characterization in three kinds of pool fishways: (1) with vertical slots; (2) with rectangular weirs and (3) with bottom orifices. Flow numerical simulation and experimental measurements were conducted. The numerical model code solves the 3D Reynolds-averaged Navier-Stokes equations using a finite volume approach. Several turbulence model were tested with the k-epsilon model showing the best results. The VOF model was used to modeling the free surface. Regarding to the experimental data, three-direction velocities were measured in a 3D-mesh in one pool of each structure, with Acoustic Doppler Velocimeters. Velocities time series, filtered (through a digital process) without substitution, allowed to analyze mean velocities and turbulence parameters, as turbulence kinetic energy, turbulence intensity and Reynolds' shear stresses. To verify the performance of the numerical model, the results were compared with the experimental data. The comparative analysis indicates a good agreement between the experiments and the simulations. The simulations were able to represent the general mean flow patterns and the turbulence variation along the structure.