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Rainbow trout gait synchronisation with pitching aerofoil vortex shedding VALENTINE MUHAWENIMANA, Cardiff University, SAM TUCKER HARVEY, University of Warwick, STEPHANIE MUELLER, Cardiff University, PETR DENISSENKO, University of Warwick, CATHERINE WILSON, Cardiff University, UNIVERSITY OF WARWICK COLLABORATION, CARDIFF UNIVERSITY COLLABORATION — The swimming kinematics of rainbow trout (*Oncorhynchus mykiss*) were linked to the wake dynamics of a pitching aerofoil using motion tracking and Particle Image Velocimetry (PIV). A traveling wave equation was used to describe the fish's centreline deflection, while the fish's centre of volume was located in two dimensions. PIV measurements and dye visualisation of the aerofoil wake structures illustrated varied vortex shedding modes and vortex patterns, which were governed by the amplitude and frequency of aerofoil pitching, as well as the chord length based Reynolds number. Fish tuned their body dynamics to the aerofoil vortex street as indicated by changes in the fish Strouhal number, velocity and acceleration direction, yaw angle, and tailbeat frequency when comparing swimming in the wake of a stationary aerofoil to a flapping aerofoil. Due to the presence of turbulent structures shed from the pitching aerofoil, an additional oscillation of the fish body that was synchronised with the aerofoil vortex shedding occurred in the yaw behaviour, with clear peaks in the power spectrum of yaw angles. These experimental observations provide new evidence on the quick adaptation of fish to effectively swim in regions of coherent vortex structures by adjusting their swimming kinematics.

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