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CFD Study of Pectoral Fins of Larval Zebrafish: Effect of Reynolds Number and Fin Bending in Fluid Structures and Transport TOUKIR ISLAM, OSCAR M. CURET, Department of Ocean and Mechanical Engineering, Florida Atlantic University — Zebrafish exhibits significant changes in fin morphology as well as fin actuation during its physical development. In larval stage (Re $\sim$ 10), they beat pectoral fins asymmetrically during slow swimming and prey tracking and a hypothesis suggests pectoral fin motion enhances fluid mixing to assist respiration. We performed a series of computational simulations to study effect of Reynolds number (Re) and pectoral fin kinematics in the fluid dynamics and mixing around a larval zebrafish. The CFD algorithm is based on a constraint formulation where the kinematics of the zebrafish are specified. We simulated experimental zebrafish kinematics at different Re (17 to 300) and considered variations on the fin kinematics to evaluate role of fin deformation in the fluid structures generated by the pectoral fins. Using Lagrangian Coherent Structures and Lagrangian fluid tracers, we identified distinctly dynamic fluid regions and found that mixing around the pectoral fin significantly increases with Re and fin bending enhance fluid mixing at low Re. However, as zebrafish matures and its Re increases, the need to beat the pectoral fins to enhance mixing is reduced.

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