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Dynamic Surface Morphing of Sunfish Caudal Fin Enhances Its Propulsive Efficiency in Steady Swimming[1] GENG LIU, CHENGYU LI, HAIBO DONG, University of Virginia, GEORGE LAUDER, Harvard University — In this work, an integrated experimental and computational approach has been used to investigate the correlation between the propulsive performance and surface morphology of bluegill sunfish's caudal fin in steady swimming. 3D sunfish caudal fin kinematics and surface morphing were reconstructed based on the output of a high-speed photogrammetry system. Hydrodynamic performance and wake structures were numerically studied by an in-house immersed-boundary-method flow solver. It is found that the spanwise surface morphing enhances both the thrust and the propulsive efficiency by more than 30%. Further investigation of the near-field and far-field wakes has shown that the enhanced span edge vortices were responsible for the performance improvement. Vortex dynamics analyses of such unsteady flow are expected to provide physical insight into the understanding of a potential performance enhancement mechanism in bluegill sunfish caudal fin propulsion.

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Haibo Dong
University of Virginia

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