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Hydrodynamics of jumping for prey capture in Archer fish A.H. TECHET, A.M. SHIH, MIT — The prey capture behavior by jumping Archer fish (Toxotes microlepisis) was investigated using high speed imaging and particle imaging velocimetry (PIV). Archer fish are renowned for their ability to spit jets of water at insects and also to jump out of the water to capture their prey. Our investigations reveal that the fish typically fail to reach their prey by jumping when the bait is placed at a height above 3.5 body lengths. After jumping and failing, the fish do not typically jump again, only spit. For our experiments bait was placed between 0.5 and 3.5 body lengths (BL) above the free surface, within reach of jumping, and thus the fish rarely spit unless they missed first by jumping. It is observed that the fish typically position their bodies under the bait with a slight angle, hover momentarily, snap in their pectoral fins, and then flap their tail in an "S-start"-type maneuver with a fixed number of cycles, which increases as a function of bait height. High speed imaging, including time-resolved PIV, was used to capture the kinematics of the jumping behavior and compare the fluid impulse generated during the fast start, jump maneuver with the total change in momentum of the fish body. Maximum acceleration was observed in the early stages of the jump maneuver and was often on the order of 5 to 15 times gravity. Correlations between the maximum energy, power in, number of tail beats, jump height and overall jumping kinematics will be discussed.

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