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Spatially constrained propulsion in jumping archer fish LEAH MENDELSON, ALEXANDRA TECHET, MIT — Archer fish jump multiple body lengths out of the water for prey capture with impressive accuracy. Their remarkable aim is facilitated by jumping from a stationary position directly below the free surface. As a result of this starting position, rapid acceleration to a velocity sufficient for reaching the target occurs with only a body length to travel before the fish leaves the water. Three-dimensional measurements of jumping kinematics and volumetric velocimetry using Synthetic Aperture PIV highlight multiple strategies for such spatially constrained acceleration. Archer fish rapidly extend fins at jump onset to increase added mass forces and modulate their swimming kinematics to minimize wasted energy when the body is partially out of the water. Volumetric measurements also enable assessment of efficiency during a jump, which is crucial to understanding jumping's role as an energetically viable hunting strategy for the fish.

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