Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Hydrodynamics of vertical jumping in Archer fish ALEXANDRA H. TECHET, LEAH MENDELSON, MIT Department of Mechanical Engineering — Vertical jumping for aerial prey from an aquatic environment requires both propulsive power and precise aim to succeed. Rapid acceleration to a ballistic velocity sufficient for reaching the prey height occurs before the fish leaves the water completely and experiences a thousandfold drop in force-producing ability. In addition to speed, accuracy and stability are crucial for successful feeding by jumping. This talk examines the physics of jumping using the archer fish as a model. Better known for their spitting abilities, archer fish will jump multiple body lengths out of the water for prey capture, from a stationary position just below the free surface. Modulation of oscillatory body kinematics and use of multiple fins for force production are identified as methods through which the fish can meet requirements for both acceleration and stabilization in limited space. Quantitative 3D PIV wake measurements reveal how variations in tail kinematics relate to thrust production throughout the course of a jumping maneuver and over a range of jump heights. By performing measurements in 3D, the timing, interactions, and relative contributions to thrust and lateral forces from each fin can be evaluated, elucidating the complex hydrodynamics that enable archer fish water exit.

Alexandra H. Techet
MIT Department of Mechanical Engineering

Date submitted: 28 Jul 2017 Electronic form version 1.4