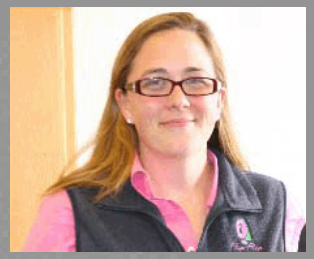
Jumping Archer Fish Hydrodynamics in 3D



Professor Alexandra H Techet
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Archer fish can successfully jump to capture prey located several body lengths out of the water from directly below the surface with zero initial velocity. The biomechanics and hydrodynamics of the fin and body motions for propelling, steering, and stabilizing the fish is highly three-dimensional and of interest to engineers aiming to replicate these aquatic launches. Results from 3D PIV studies on live jumping archer fish over a range of jump heights will be presented. Experiments focus on the interactions between three posterior fins (anal, dorsal, and caudal) and the role of these fins in stability and propulsion. The timing, interactions, and relative contributions to thrust and lateral forces from each fin show direct interactions between the upstream momentum generated by the anal and dorsal fins and the caudal fin in subsequent tail strokes. Strong wake features from the anal fin are additionally observed independently of the caudal fin wake.

Prof. Alexandra (Alex) Techet is an Associate Professor of Mechanical and Ocean Engineering (with tenure), in the department of Mechanical Engineering at MIT. Professor Techet is the director of the Experimental Hydrodynamics Laboratory (EHL) at MIT and runs the MIT Marine Hydrodynamics Laboratory water tunnel facility. Her group's research in experimental hydrodynamics has made important contributions to several key areas, including: light field imaging for fluid mechanics, 3D multi-phase flow imaging, spray hydrodynamics, water entry of spheres and projectiles, flow structure interactions, unsteady bio-inspired propulsion and maneuvering, and sensing at the air/sea interface. Prof. Techet received her B.S.E. in Mechanical and Aerospace Engineering in 1995 from Princeton University and then graduated from the MIT/WHOI Joint Program in Oceanographic Engineering with a M.S. in 1998 and a Ph.D. in 2001.

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