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Characterization of Hop-and-Sink Locomotion of Water Fleas A.N. SKIPPER, Georgia Tech, D.W. MURPHY, Univ of South Florida, D.R. WEBSTER, Georgia Tech — The freshwater crustacean *Daphnia magna* is a widely studied zooplankton in relation to food webs, predator-prey interactions, and other biological/ecological considerations; however, their locomotion is poorly quantified and understood. These water fleas utilize a hop-and-sink mechanism that consists of making quick, impulsive jumps by beating their antennae to propel themselves forward (roughly 1 body length). The animals then sink for a period, during which they stretch out their antennae to increase drag and thereby reduce their sinking velocity. Time-resolved three-dimensional flow fields surrounding the animals were quantified with a unique infrared tomographic particle image velocimetry (tomo-PIV) system. Three-dimensional kinematics data were also extracted from the image sequences. In the current work, we compared body kinematics and flow disturbance among organisms of size in the range of 1.3 to 2.8 mm. The stroke cycle averaged 150 +/- 20 ms, with each stroke cycle split nearly evenly between power and recovery strokes. The kinematics data collapsed onto a self-similar curve when properly nondimensionalized, and a general trend was shown to exist between the nondimensionalized peak body speed and body length. The fluid flow induced by each antennae consisted of a viscous vortex ring that demonstrated a slow decay in the wake. The viscous dissipation showed no clear dependence on body size, whereas the volume of fluid exceeding 5 mm/s (the speed near the sinking speed of the animal) decayed more slowly with increasing body size.

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