

Supplementary Materials:

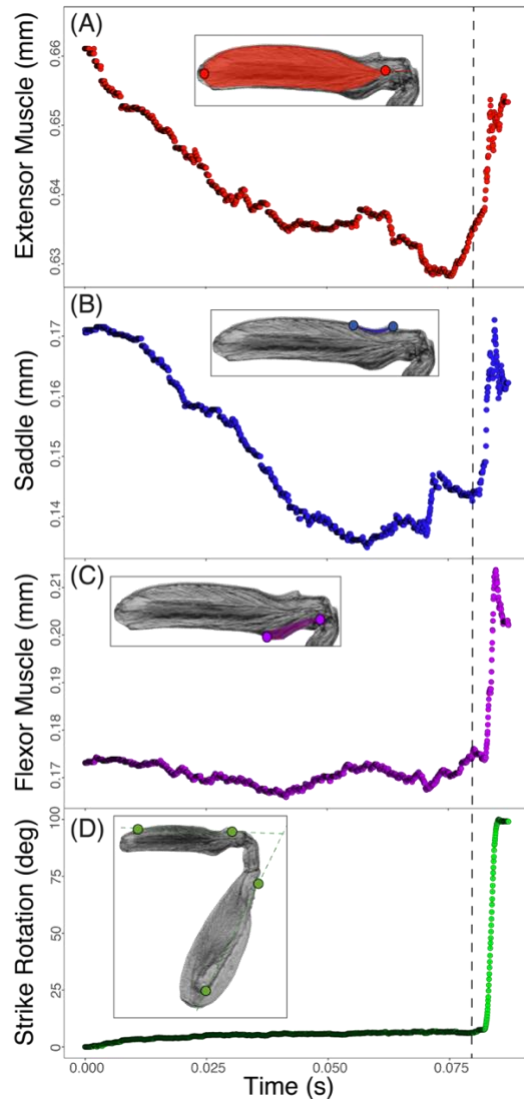


Figure S1. The synchronous and sequential timing of extensor muscle contraction, saddle shortening, flexor lengthening, and striking body rotation support the presence of LaMSA in larval mantis shrimp.

Shortening of the extensor muscles (A) occurs simultaneously with shortening of the saddle (B), which suggests that elastic energy is stored via exoskeletal deformation in larvae similarly to adult mantis shrimp. The lengthening of the flexor muscles (C) occurs prior to the onset of the strike (vertical dashed line). The rapid rotation of the striking body (D) occurs simultaneously with the recoil of the saddle and lengthening of the muscles. points overlaid on the appendage images represent the tracked points over the course of a single strike. Each graph represents the rotational or length changes based on the tracked points. The graphs show a spring actuated larval strike and indicate movement between frames from high speed imaging (20,000 frames s^{-1}).

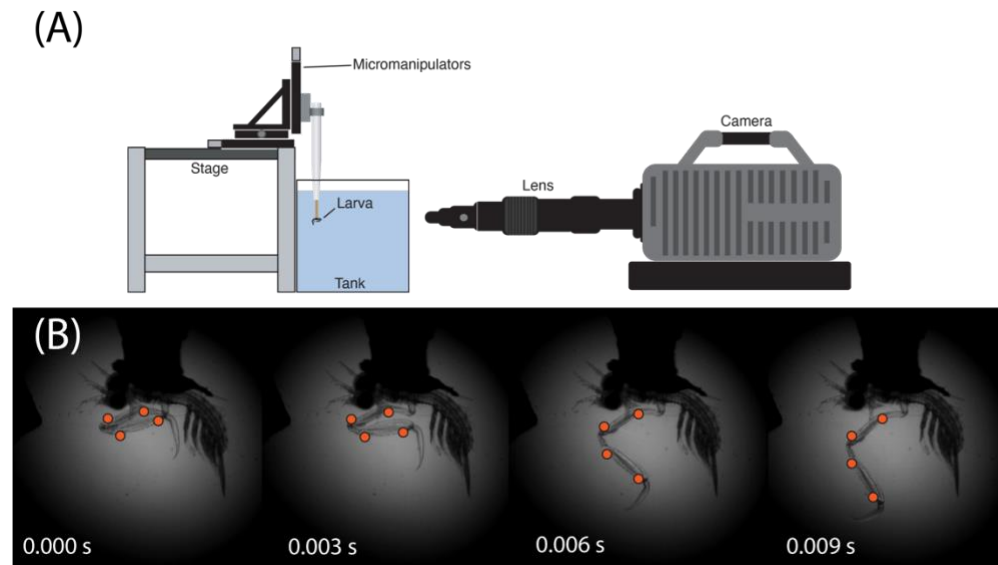


Figure S2: We developed a custom filming rig to collect and measure raptorial appendage strikes from larval *Gonodactylaceus falcatus*. (A) Each larva was affixed to a tooth pick and suspended in saltwater using a custom designed stage. (B) Four points along the raptorial appendage were tracked over the course of each strike in order to measure the angular displacement of the propodus relative to the merus over time. Orange circles represent tracked points.

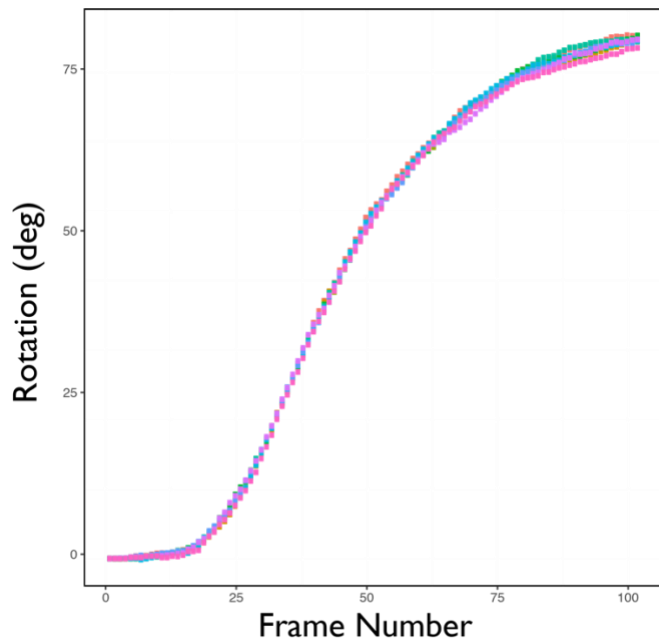
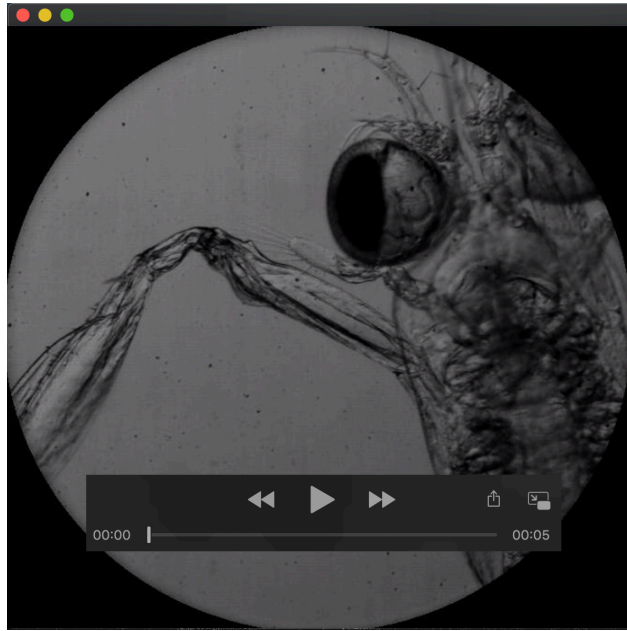


Figure S3: Characteristic strike of larval *G. falcatus* digitized ten times to measure tracking error. Each color represents the same strike but a different digitizing sequence.

Table S1. Peak swimming or prey capture speeds of larval organisms. The present study of larval mantis shrimp strike speed is highlighted in light gray.

[Click here to Download Table S1](#)



Movie 1: The LaMSA mechanism in the *Gonodactylaceus falcatus* larval raptorial appendage is revealed when placed under a microscope slide and filmed at 2,000 frames per second.



Movie 2: A characteristic raptorial appendage strike by *Gonodactylaceus falcatus* larva when fixed to toothpick and filmed at 20,000 frames per second.