## Shrimp as a Model Organism for Bio-Inspired Underwater Vehicles

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Abstract

Metachronal locomotion, characterized by the sequential beating of appendages moving in a tail-to-head motion with a phase lag, is present across a wide range of length scales and Reynolds numbers (Re). We have yet to explore many important mechanisms of shrimp swimming, especially at the single appendage scale. We designed and built a fully articulated, multi-link robotic platform, integrating the kinematics of shrimp pleopods. Its modular design allows for integrating morphological features to test parameters of interest and is suitable for studying multi-legged systems. Using experimental techniques, we use our robotic platform to investigate the hydrodynamics of a single beating appendage's near- and far-field flow. Insights from our robotic platform can provide design guidelines for bio-inspired underwater uncrewed robots, contribute to understanding the evolutionary history of metachronal swimmers, and establish a link between their adaptations and the ecosystem.
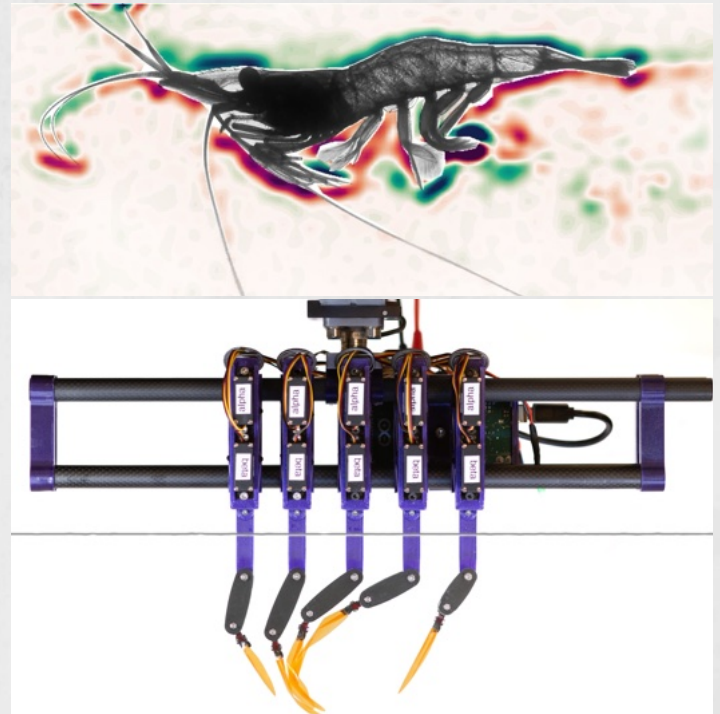
Background

Sara Oliveira Santos is a research scientist focused on ecological and environmental fluid mechanics. She has conducted velocimetry experiments with live shrimp and robotic counterparts to investigate the fluid mechanics of shrimp swimming. At the University of Texas Institute for Geophysics, Sara is working on sediment transport on Earth and in reduced-gravity environments like those found on Europa and Enceladus. She is also examining the ecology of mussel and oyster reefs through remote sensing data and laboratory experiments on smaller-scale processes. Her broad interest in fluid mechanics has led her to work on various topics, including human swimming, breastfeeding, and the scaling relationships of swimming organisms.