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Effects of flexibility on bio-inspired aquatic propulsion[1] PETER DEWEY, BIRGITT BOSCHITSCH, ALEXANDER SMITS, Princeton University — We present the results of an experimental investigation aimed at understanding the role that flexibility plays in bio-inspired aquatic propulsion. A rectangular pitching panel apparatus, where both the flexibility and aspect ratio can be systematically varied, is utilized as a simplified model for bio-inspired propulsion in water at a Reynolds number of 7200. It is found that, when optimized, flexibility can double the thrust produced and propulsive efficiency achieved in comparison to a rigid panel. There is a notable thrust enhancement when the flexible panels are operating near resonance; however, it is found that resonance is not the primary mechanism governing efficient propulsion. Peaks in propulsive efficiency are found below, at, and above the resonant frequency depending on the flexibility of the panel. Finally, a scaling law is derived that is shown to collapse the thrust production, power consumption, and propulsive efficiency data across all panels examined.

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