Abstract Submitted for the DFD16 Meeting of The American Physical Society

To flap or not to flap: a discussion between a fish and a jellyfish<sup>1</sup> NATHAN MARTIN, CHRIS ROH, Caltech, SUHAIL IDREES, University of Cambridge, MORTEZA GHARIB, Caltech — Fish and jellyfish are known to swim by flapping and by periodically contracting respectively, but which is the more effective propulsion mechanism? In an attempt to answer this question, an experimental comparison is made between simplified versions of these motions to determine which generates the greatest thrust for the least power. The flapping motion is approximated by pitching plates while periodic contractions are approximated by clapping plates. A machine is constructed to operate in either a flapping or a clapping mode between Reynolds numbers 1,880 and 11,260 based on the average plate tip velocity and span. The effect of the total sweep angle, total sweep time, plate flexibility, and duty cycle are investigated. The average thrust generated and power required per cycle are compared between the two modes when their total sweep angle and total sweep time are identical. In general, operating in the clapping mode required significantly more power to generate a similar thrust compared to the flapping mode. However, modifying the duty cycle for clapping caused the effectiveness to approach that of flapping with an unmodified duty cycle. These results suggest that flapping is the more effective propulsion mechanism within the range of Reynolds numbers tested.

<sup>1</sup>This work was supported by the Charyk Bio-inspired Laboratory at the California Institute of Technology, the National Science Foundation Graduate Research Fellowship under Grant No. DGE-1144469, and the Summer Undergraduate Research Fellowships program.

> Nathan Martin Caltech

Date submitted: 29 Jul 2016

Electronic form version 1.4