

Supporting Information for “Wave-Induced Motion and Drag Reduction of Kelp”

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Contents of this file

1. Figure S1

Additional Supporting Information (Files uploaded separately)

1. Caption for large Table S1
2. Captions for Movies S1 to S4

Introduction

To support our discussion, we have included supplementary animations of the equilibrium cycles of kelp frond motion corresponding with Fig. 4 in the main text. In all movies, the black line represents the modeled kelp frond, blue dashed lines represent the wave excursion, and gray arrows represent the direction and relative magnitude of the instantaneous fluid velocity. Both axes are normalized by frond length (l). Frame rates are standardized across all animations so that each cycle appears 10 s long and is looped 5 times. Additionally, Figure S1 is included to help illustrate the relationship between the frond velocity and relative velocity between the flow and the frond. Table S1 lists all the variables and notation referenced in the main text.

Table S1. List of all variables referenced in the main text. Boldface denotes vector quantities.

Movie S1. Movie illustrating frond motion corresponding with Fig. 4a (buoyancy dominated), with $H_s = 0.25$ [m], $T_p = 20$ [s], $l = 2$ [m].

Movie S1. : Movie illustrating frond motion corresponding with Fig. 4b (drag dominated), with $H_s = 2$ [m], $T_p = 20$ [s], $l = 10$ [m].

Movie S1. : Movie illustrating frond motion corresponding with Fig. 4b (drag dominated), with $H_s = 0.25$ [m], $T_p = 5$ [s], $l = 10$ [m].

Movie S1. : Movie illustrating frond motion corresponding with Fig. 4b (drag dominated), with $H_s = 0.25$ [m], $T_p = 20$ [s], $l = 5$ [m].

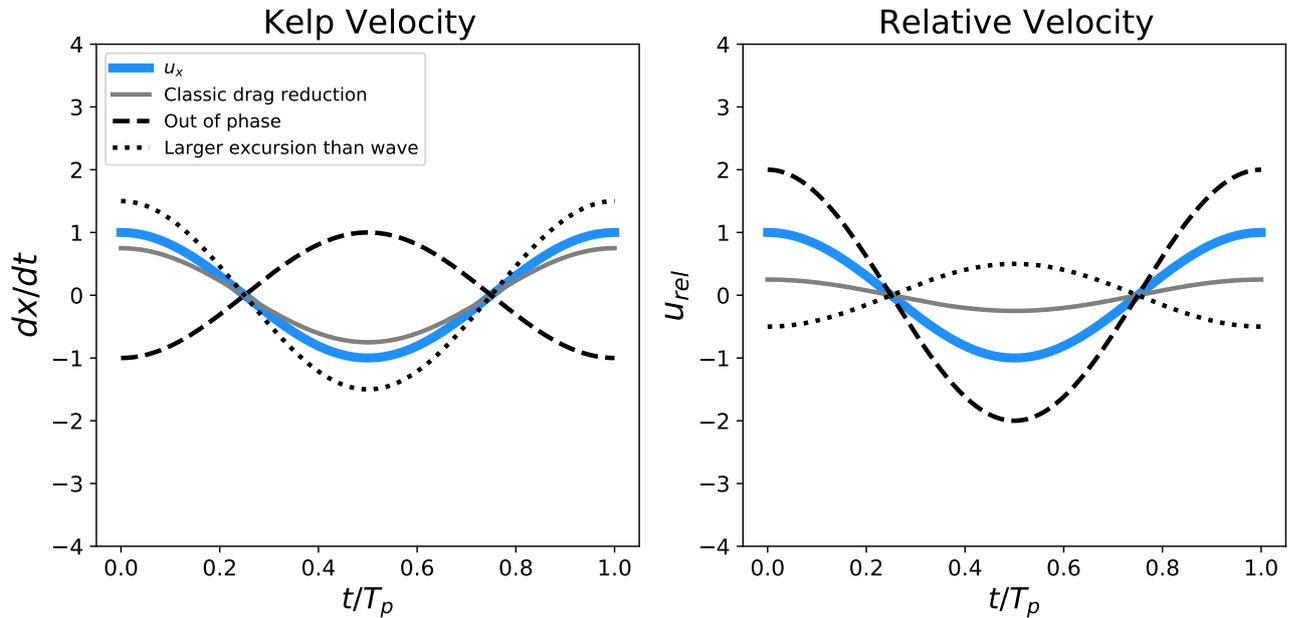


Figure S1. Schematic illustrating how different profiles of kelp frond velocity and their corresponding relative velocity plots. Thick blue lines represent the wave velocity; solid gray lines represent classical example of a flexible frond with reduced drag (e.g., the frond moves closely with the wave and thus has little relative velocity); dashed black lines represent a frond moving out of phase with the wave (e.g., Fig 7a); dotted black lines represent a frond with a larger excursion than the wave does (e.g., Fig 7b).