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Morphological changes in kelp result in reduced drag and increased stability JEFFREY ROMINGER, HEIDI NEPF, Massachusetts Institute of Technology — Many species of kelp change their blade morphology in response to the local flow environment. Several studies document increases in blade thickness, and thus increases in blade rigidity, in more energetic flow environments. This morphological strengthening has been traditionally understood to provide increased strength in tension which allows blades to remain intact under high tensile forces. In this work, however, we describe two mechanisms by which increases in blade thickness can also reduce fluid drag forces: first, by reducing the drag created by blade perturbations provoked by passing turbulence; second, by increasing the blade stability in the fluid-elastic stability space. To describe the stable interactions between the blade and turbulent flow, we appeal to previous experimental results that draw on Lighthill's elongated body theory to explain the drag force benefits of increased rigidity. As blades pass the fluid-elastic stability threshold and become unstable, there is a well-documented increase in the drag coefficient of over one order of magnitude. Therefore, morphological changes in blade thickness not only increase strength in tension, but can help reduce dynamic drag forces associated with blade bending.

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