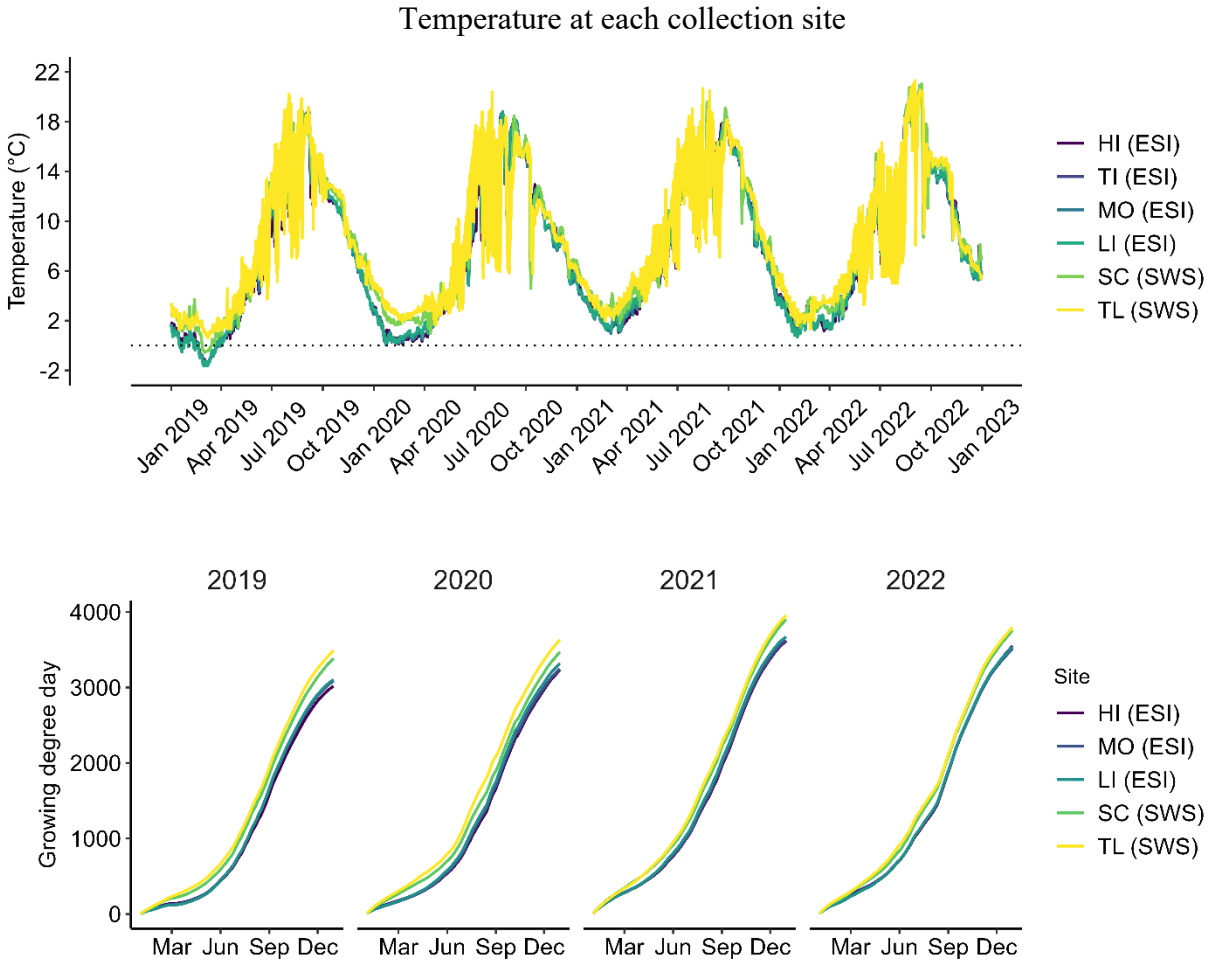

Figure S1. Temperature and growing degree days (GDD), averaged between 6 and 9 m depth at Long Island (LI), The Moll (MO), Tuffin Island (TI), and Halibut Island (HI) in the Eastern Shore Islands (ESI), and Sandy Cove (SC) and The Lodge (TL) from the Southwestern Shore SWS), Nova Scotia, from January 1 2019 to December 31 2022. Dotted line indicates 0 °C in the upper panel. GDD was not calculate for Tuffin Island (TI) as the temperature data do not span the entire period.

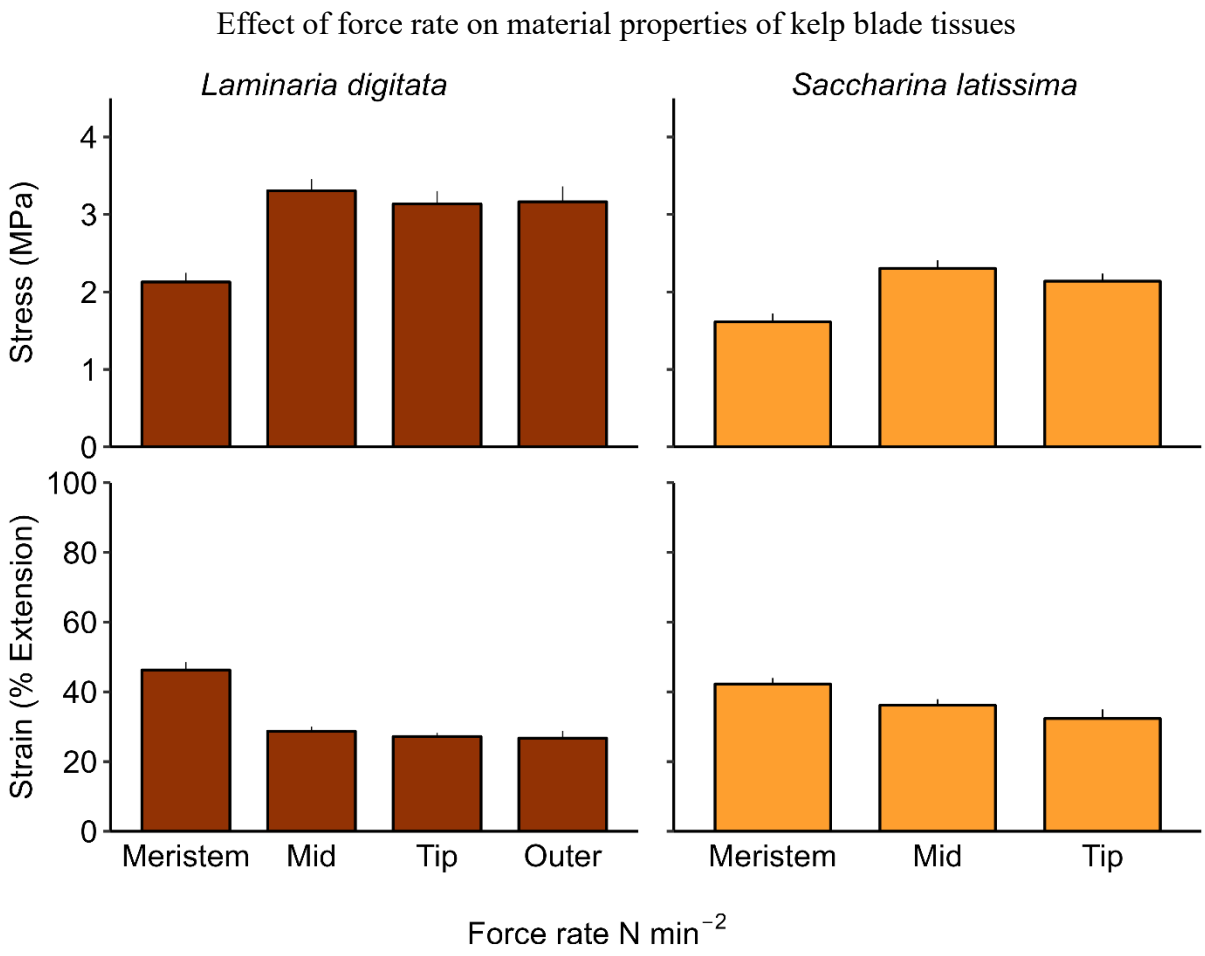

Figure S2. Stress and strain (mean + SE) measured at two different force rates. Tissue samples taken from the middle of the blade (*Laminaria digitata:* 25 cm from stipe, n = 9; *Saccharina latissima:* 40 cm from stipe, n = 9). Kelps were collected from The Moll in the Eastern Shore Islands, Nova Scotia in October 2022. There was no effect of force rate on the stress of either *L. digitata* (t_8 = 2.02, P = 0.08) or *S. latissima* (t_8 = –0.32, P = 0.76). There was a significant effect of applied force on strain (*L. digitata*: 5.6 % reduction, t_8 = 4.75, P < 0.01; *S. latissima*: 9.1% reduction, t_8 = 3.27, P = 0.01)

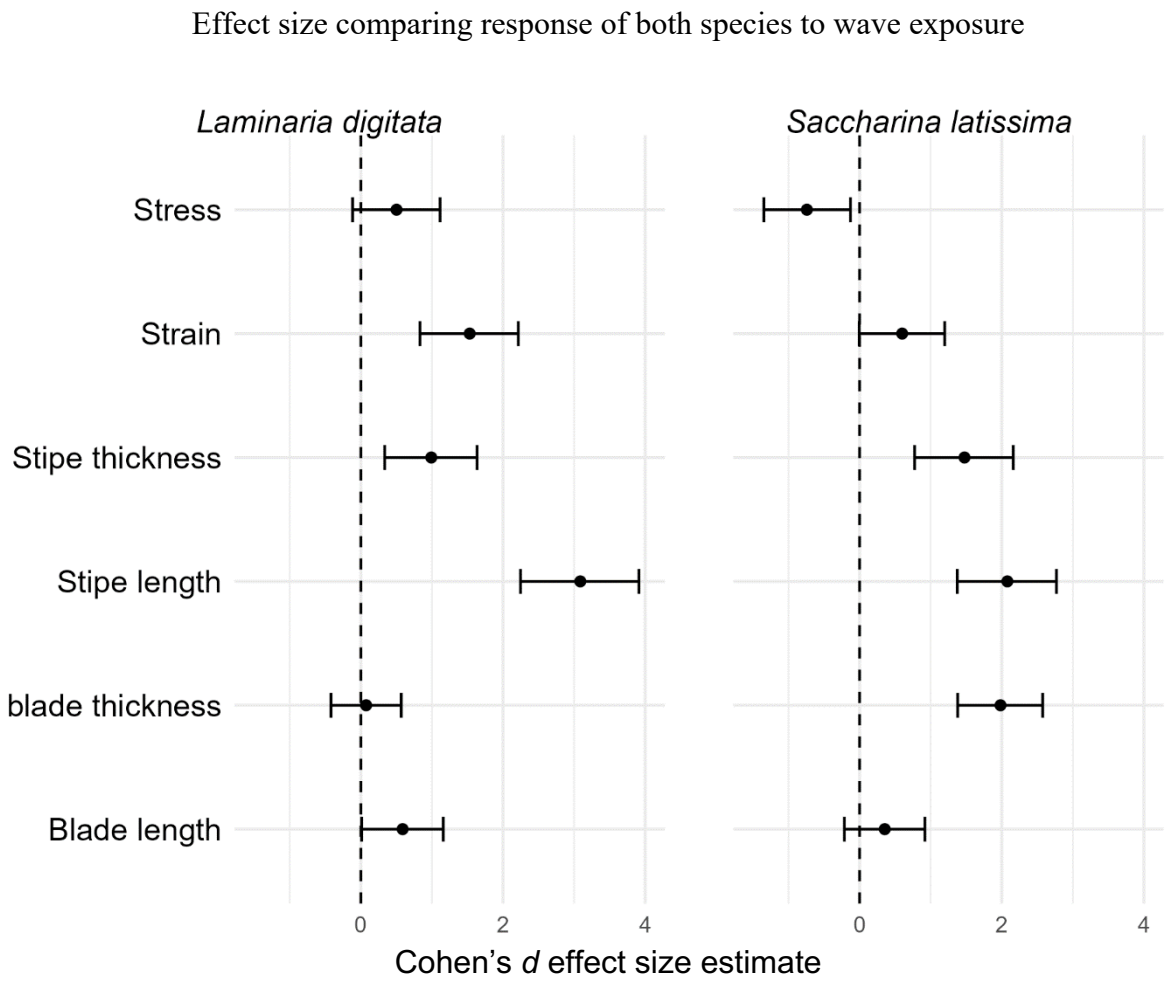

Figure S3. Effect size (Cohen's *d*) for the effect of wave exposure on morphology and material properties. Contrasts are averaging sampling dates (July and August) and made between the two sites of Low and High exposure.