Supplementary Data for

"Diffusion or advection? Mass transfer and complex boundary layer landscapes of the brown alga *Fucus vesiculosus*"

Mads Lichtenberg[a,1,2]; mads.lichtenberg@bio.ku.dk, +45 3533 0185

Rasmus Dyrmose Nørregaard[b,1]; rdyn@bios.au.dk

Michael Kühl[a,c]; mkuhl@bio.ku.dk

[a] Marine Biological Section, Department of Biology, University of Copenhagen, Strandpromenaden 5, DK-3000 Helsingør, Denmark.

[b] Arctic Research Center, Department of Bioscience, Faculty of Science and Technology, Aarhus University, Frederiksborgvej 399, 4000 Roskilde, Denmark.

[c] Climate Change Cluster, University of Technology Sydney, PO Box 123, Ultimo Sydney NSW 2007, Australia.

Running title: Complex boundary layer landscapes around *Fucus vesiculosus*

[1] These authors contributed equally to this work

[2] Corresponding author

Supplementary Data

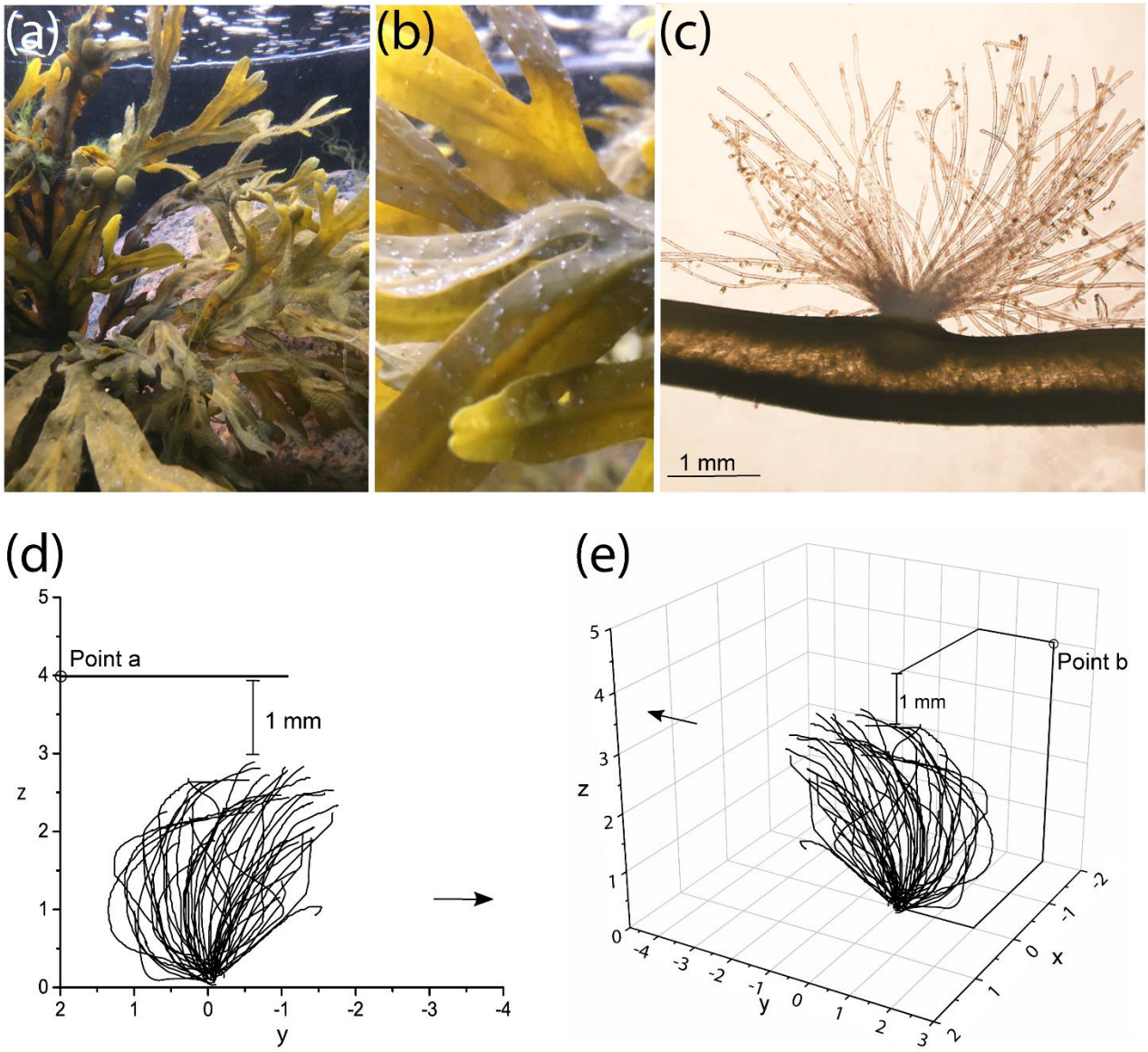

Figure S1. Photographs of *Fucus vesiculosus* showing hyaline hairs and schematic plots of the measurement details of 2D transects and 3D grids. a) Stand of the brown alga *Fucus vesiculosus*, and b) close-up photograph showing whitish tufts of hyaline hairs protruding from the thallus. c) Cross-section through a thallus showing a single tuft of hyaline hairs anchored in a cryptostomata cavity. d) Schematic drawing of the spatial orientation of flow direction, thallus surface and tufts of hyaline hairs during microsensor measurements of transects, where point A indicates the starting point of transect measurements. e) Grids of O_2 concentration profiles used for mapping the diffusive boundary layer over the *F. vesiculosus* thallus, where point B indicates the starting position in grid measurements.

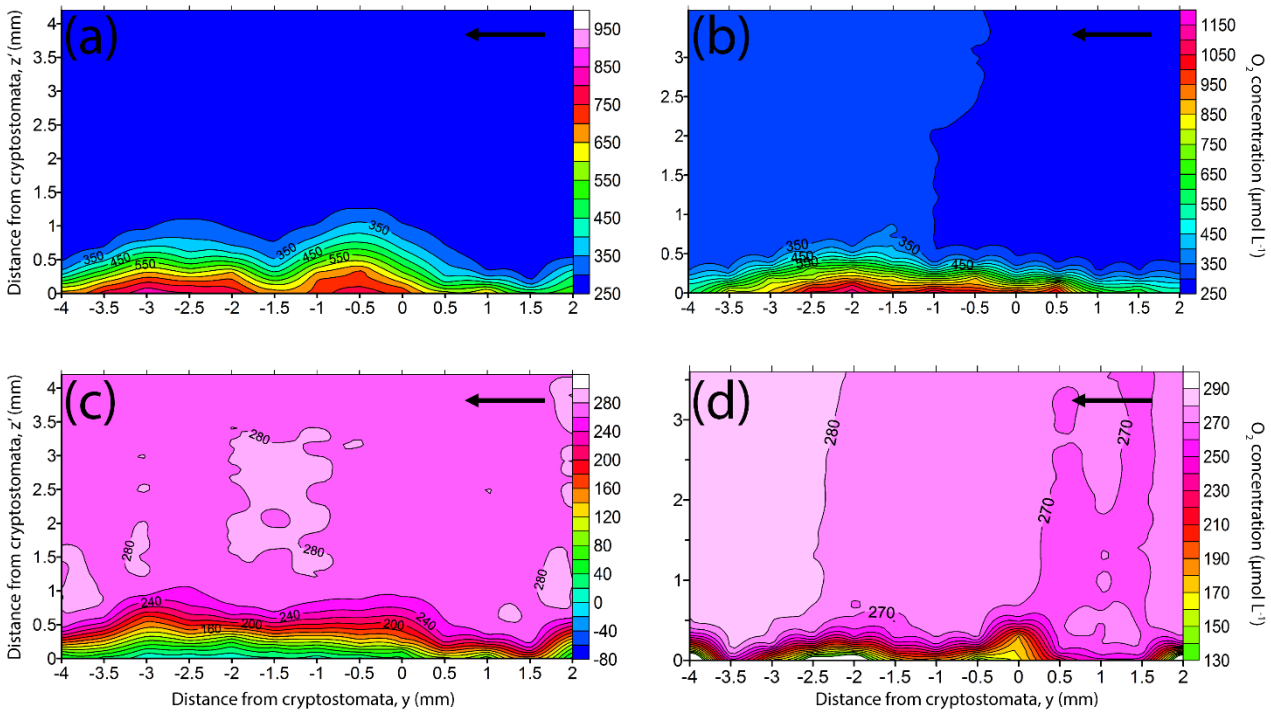

Figure S2. Transects of O_2 concentration (in µmol L^{-1}) measured across a single tuft of hyaline hairs in *Fucus vesiculosus* measured at flow velocities of 1.65 (a, c) and 4.88 cm s^{-1} (b, d), in light (350 µmol photons m^{-2} s^{-1}) (a, b) and darkness (c, d). The arrows indicate flow direction. The zero position (0,0) indicates the position of the cryptostomata, and transects were adjusted to the thallus surface. Colour bars denote O_2 concentration (in µmol O_2 L^{-1}).

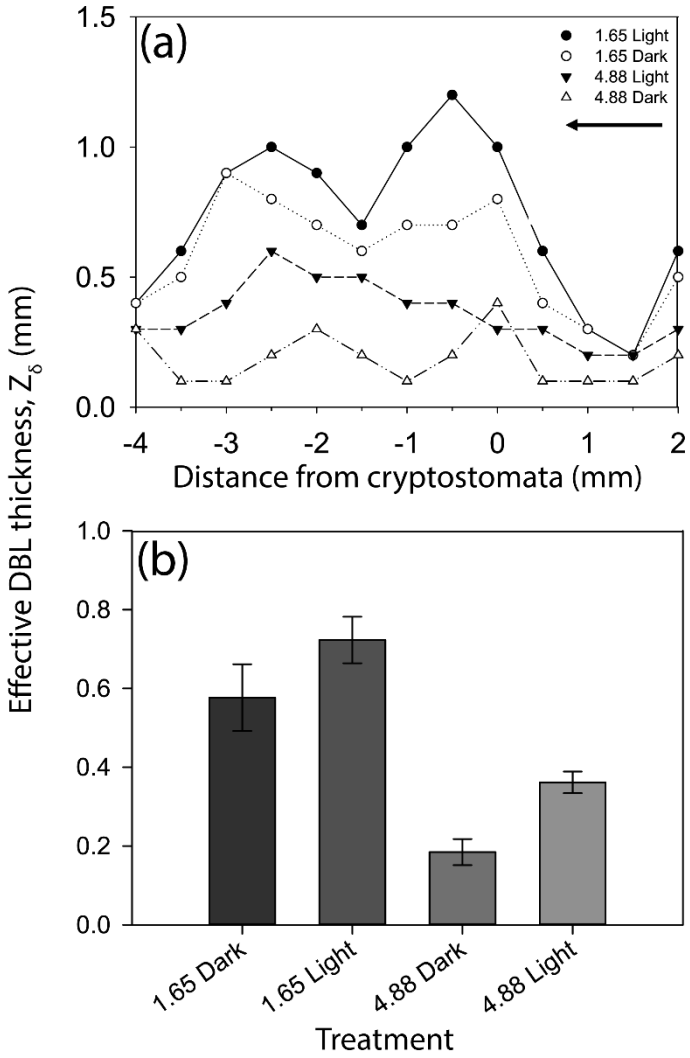

Figure S3. Effective diffusive boundary layer thickness, Z_δ (in mm) over a *Fucus vesiculosus* thallus measured as a function of the distance from the center of the cryptostomata with a tuft of hyaline hairs in light (350 µmol photons m^{-2} s^{-1}) and in darkness under flow velocities of 1.65 cm s^{-1} and 4.88 cm s^{-1} (a). The average Z_δ (± SEM) over four transects measured both in light and in the dark at flow velocities of 1.65 cm s^{-1} and 4.88 cm s^{-1} (b).