

Relating Incident Wave and Current Characteristics to the Morphology of the Kelp *Laminaria digitata*

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Work Stream 10: Dissemination of Results

Introduction

Inshore Marine Energy Converters (MECs) have the potential to alter the incident wave and current characteristics impacting the coastline. For regulatory purposes, it is necessary to understand the impact of any installation of inshore MECs on the ecology of the shore. *Laminaria digitata* (Fig. 1) is the dominant kelp of the upper sublittoral zone on rocky shores around the UK [1] and has been shown to exhibit morphological plasticity in relation to its environment [2]. The advent of wave and current profiling devices such as ADCPs and Velocimeters allows the relationships between plant growth dynamics and specific hydrodynamic parameters to be resolved.

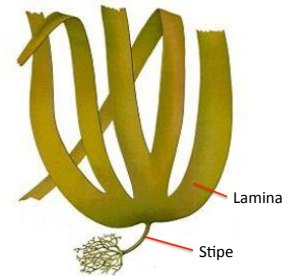


Fig.1 *Laminaria digitata*

Methods

Five sampling sites have been selected, initially on a subjective basis, to exhibit a variety of wave and current characteristics. 40 adult specimens of *L. digitata* are being collected from each site on a seasonal basis and a suite of morphological measurements made on each plant.

Results

The number of blades on the lamina of each individual is being taken as an indicator of the incident wave energy at each site (Fig. 2). In the absence of measured wave and current data this is used as the basis for further analysis.

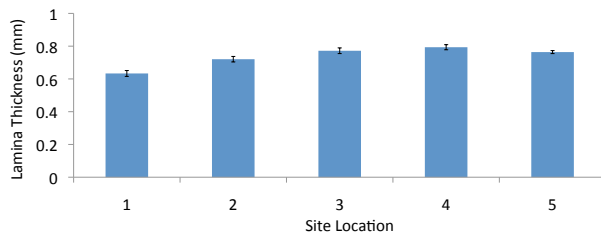


Fig. 3: The average thickness of the laminae at each site in accordance with the order described in Fig. 2 (\pm SE).

The ratio of lamina length to stipe length (Fig. 3) is generally found to decrease along the exposure scale. This may be attributed to erosion of the lamina tips due to wave activity impacting the fronds against the rocky substrate. The exception to the trends illustrated in Figs. 3 & 4 is site 5, this appears to be due to the higher plant density found at this location

Further Work

An acoustic Doppler current profiler will be deployed on the seaward edge of *L. digitata* beds at the five sites to obtain both wave and current dynamics associated with the seaward margin the kelp bed. Two velocimeters will also be deployed on a height adjustable frame within a localised cleared section of kelp to enable current velocity measurements to be made at different heights above the substrate; one sensor will remain static as a reference. This will determine the 'flow field' through and above the different layers (stipe, canopy and above) of the kelp bed

References

Mann, K. H. 2000. Ecology of coastal waters: With implications for management. pp192, Blackwell Press; 2. Sundene, O. (1964). The ecology of *Laminaria digitata* in Norway in view of transplant experiments. *Nytt Magasin for Botanikk* 11: 83-107.

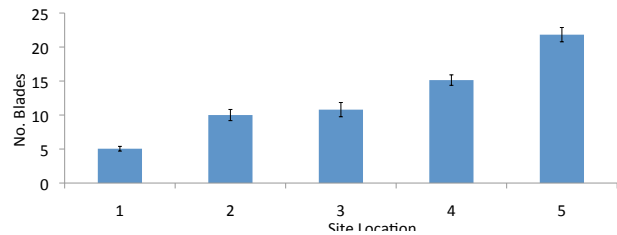


Fig. 2: The average number of blades per lamina for each site (\pm SE).

Lamina thickness (Fig. 3) is generally found to increase along the exposure scale described in Fig. 2. Thicker laminae may be more able to withstand the high accelerational forces they are subjected to in breaking waves at exposed sites.

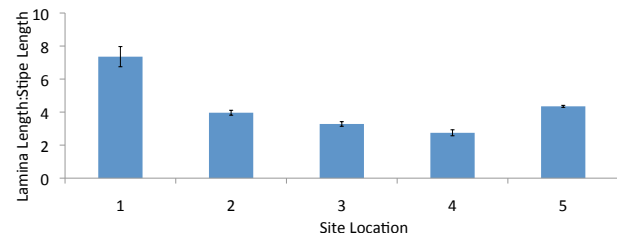


Fig. 4: The ratio of lamina length to stipe length at each site (\pm SE).



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