Does substrate temperature control the zonation of intertidal seagrasses? Implications for restoring intertidal seagrass meadows.

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A number of existing theories attempt to explain the vertical zonation of seagrass within the intertidal zone. Some zonation trends seem relatively straightforward to explain, such as the biotic interactions of predation and competition, and abiotic interactions such as wave exposure, desiccation, temperature exposure, thermal tolerance, and light availability. Yet, a unifying theory for intertidal zonation of seagrass species is elusive. Three paradigms are suggested by various authors as possible mechanisms that result in zonation of seagrasses. However, the limiting factors within these paradigms do not constrain all species, or act at all sites. Consequently, the question of 'what is controlling the zonation of intertidal seagrasses?' has yet to be adequately addressed. It would appear that the intertidal seagrass system is more dynamic than originally postulated, and that a fourth factor, substrate temperature limits the vertical zonation of intertidal seagrass species.

This study investigated five subtropical, intertidal seagrass species (Zostera muelleri, Halophila ovalis, Halophila decipiens, Halophila spinulosa and Halodule uninervis) in Gladstone, Queensland, Australia. Gladstone's climate is sub-tropical, with the location of meadows within the Great Barrier Reef World Heritage Area and within the industrial port of Gladstone. The aim of our research was to determine the substrate temperature profiles that species occupied, across multiple substrate types and depths. As expected, as substrate depth increased there was a reduction in substrate temperature. Species depth occupancy (the average depth a species rhizome grew at) differed significantly between all species, with three broad clusters existing: surface/interface (H. spinulosa and H. decipiens); mid-depth (1-1.5cm; Z. muelleri and H. ovalis); and deep (3cm; H. uninervis). Substrate granularity did not appear to influence H. uninervis rhizome depth, but temperature was a limiting factor. The implications of the results are placed within climate adaptation and seagrass restoration contexts.