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5) Traits and metabolic constraints affect marine animal forest structure

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Abstract

The term marine animal forests (MAFs) describes a diverse range of 3-dimensional habitats dominated by benthic suspension feeders. The ecosystem functions of MAFs are broadly understood, but an overall framework remains to be developed. We present an equation that generalizes the relationships among species' height, depth of occurrence and mean water temperature in terms of the metabolic theory of ecology (MTE). The applicability of the equation to field observations collated from the literature (n = 284) was tested using a multiple regression of colony density (log of numbers m^{-2}) against transformed depth, height and temperature as predictors. Morphology was also examined both as a factor and when interacting with the effect of colony height. The model explained 39.7% of the variability in colony density with significant effects of morphology and height. Colony density decreased with taller individuals (slope -0.760, SE 0.1677). Typical mass-height scaling in MAF species suggests that the observed slope is less than the slope that would be predicted by the MTE. A detailed evaluation requires further estimates of metabolic rates in MAF species. Some morphologies, particularly planar and bushy sea rods, reach higher colony densities than expected for their size. These morphologies have been associated with environments where food supply may be higher due to currents or turbidity. Morphology-environment associations may therefore allow traits to be incorporated into an overall description of MAF ecosystems. With further improvements in observations of both colony density and metabolic scaling with size, a comprehensive description of energy flow in MAFs could be possible.