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Niche specialization of reef-building corals in the mesophotic zone: metabolic trade-offs between divergent *Symbiodinium* types

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Abstract:

The photobiology of two reef corals and the distribution of associated symbiont types were investigated over a depth gradient of 0 – 60 m at Scott Reef, Western Australia. *Pachyseris speciosa* hosted mainly the same *Symbiodinium* C type similar to C3 irrespective of sampling depth. By contrast, *Seriatopora hystrix* hosted predominantly *Symbiodinium* type D1a or D1a-like at shallow depths while those in deeper water were dominated by a *Symbiodinium* C type closely related to C1. The photosynthesis/respiration (P/R) ratio increased consistently with depth at the two sampling times (November 2008 and April 2009) for *P. speciosa* and in November 2008 only for *S. hystrix*, suggesting a reduction in metabolic energy expended for every unit of energy obtained from photosynthesis. However, in April 2009, shallow colonies of *S. hystrix* exhibited decreased P/R ratios down to depths of approximately 23 m, below which the ratio increased towards the maximum depth sampled. This pattern was mirrored by changes in tissue biomass determined as total protein content. The depth of change in the direction of the P/R ratio correlated with a shift from *Symbiodinium* D to C-dominated colonies. We conclude that while photobiological flexibility is vital for persistence in contrasting light regimes, a shift in *Symbiodinium* type may also confer a functional advantage albeit at a metabolic cost with increased depth.

Key-words: photosynthesis; respiration; photo-acclimatization; ecophysiology; zooxanthellae; Indian Ocean