

Growth and population dynamics of the coral *Plesiastrea versipora* along a temperature gradient

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Abstract

In higher latitudes colder water often restricts coral performance, with effects such as stunted growth and limited recruitment. However this restriction was removed following recent warming of Western Australian coastal waters from both gradual temperature increase and the marine heat wave of 2011, possibly favouring coral development in high latitudes. Specifically, there was an observed increase in recruitment of the widespread coral species *Plesiastrea versipora* along the northwestern coast. Although its population has increased by four-fold since 2005 the mechanisms of this effect with temperature remained unknown. Therefore performance of *P. versipora* was measured in terms of variation in latitudinal and temporal growth and population structure in relation to seawater temperature. In Hamelin Bay, Marmion, and Port Gregory colonies were sampled and x-rayed to observe growth banding for age estimation and growth rates. Photographic surveys were undertaken and colony diameter measured to relate size with age and determine population structures for Hamelin Bay, Cervantes, Jurien Bay, and Greenhead. The results indicated an overall increase in mean relative linear growth rate with latitude (Hamelin Bay 0.82 ± 0.05 , Marmion 1.02 ± 0.07 , and Port Gregory 1.43 ± 0.08) and a positive relationship between normalised growth rates and temperature for colonies from Marmion ($r^2 = 0.72$) and Hamelin Bay ($r^2 = 0.89$). However the heat wave event negatively impacted growth rates in Marmion, with 2011 having the lowest growth rate of the measured growth period. Strong relationships ($r^2 > 0.7$) were found between age and minimum diameter, with significant differences between Hamelin Bay and the other two locations (both $p < 0.001$). The age distributions revealed pulsed recruitment as a distinct peak in Hamelin Bay, and a constant supply of recruits in Cervantes, Jurien Bay, and Greenhead however distributions did not correlate with the heat wave year. These results imply that gradual warming has an overall positive effect on coral performance with exception to extreme heat events as seen in 2011, and that recruitment is more stable for locations in higher latitudes.

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