# A Holocene Record (7.5 ka–Present) of Variable Coral Community Structure from the Southern Great Barrier Reef

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## Abstract

Mounting evidence relates ongoing coral reef decline to recent human impact. However, the natural and anthropogenic causes of variation in reef-building coral community composition and the underlying mechanisms ruling such variation remain unclear owing to the scarcity of empirical data spanning longer than a few decades. Here we examined the variation of coral community structure in three reefs from the southern Great Barrier Reef (GBR) during three time intervals: the mid-Holocene (8–4 ka), the (pre-European) late-Holocene (4–0.2 ka) and the modern (~present day). We tested the role of stochastic versus deterministic processes in shaping community assembly. Community structure differed significantly from the mid-Holocene to later time intervals but not from the late-Holocene to the modern. The diversity in each local community (i.e. α-diversity as measured by genus richness and Shannon-Weiner diversity) decreased and the dissimilarity among communities (β-diversity) increased with time. These results were associated with lower and more variable sea-levels, lower wave energy, and enhanced El Niño Southern Oscillation and Pacific Decadal Oscillation since the onset of the late-Holocene. In contrast, β-diversity among local communities did not vary across time intervals any more or less than expected by chance. While our evidence highlights the impact of regional environmental factors on α-diversity, it indicates that stochastic processes played a key role in maintaining coral community structure in these reefs from 7.5 ka to the present day. Further, stability of community structure since the onset of the late-Holocene suggests that coral communities in the Keppels remain ecologically indistinguishable from their pre-colonial counterparts, with no apparent degradation from human intervention.