

Using historical environmental changes to provide a framework for recovery in Moreton Bay

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A critical problem for ecosystem restoration is how to measure success part way through a decades-long process? Incremental success criteria can be defined using high resolution palaeoecology, allowing managers to sub-divide long term objectives into goals achievable within political cycles. We examined change in key benthic habitats in Moreton Bay by detailed examination of coral and foraminiferal community composition, diversity, spatial/temporal distribution patterns and their associated sedimentological characteristics. Set in a precise chronology, these new data provide a framework for ecosystem restoration.

We found that coral growth is episodic in the past 7000 years with 400-800 year periods without detectable coral growth between episodes with corals. These episodes seem controlled by ENSO intensity and sea-level oscillations. The present coral community, which is only 400 years old, is markedly different than all prior episodes. Benthic foraminiferal assemblages show modest bay-wide shifts in the species diversity and distribution patterns within the past ~30 years. For example, species diversity has increased in parts of the Bay (western-nearshore) and declined in others (eastern-oceanic). Dramatic changes in zonation indicate how water quality and habitats have changed as a possible result of unprecedented increase in urbanization and development in the catchment areas. The sensitivity of foraminifera allows them to play a valuable role in decadal, centennial and millennial scale investigations of the changes in estuarine and marginal reef environments. Our results also show how fluvial sedimentation responded to past climate change.

These findings are important to managers charged with protecting and restoring whole ecosystems. Since many habitats change slowly, long time series are needed to ensure restoration efforts are not abandoned prematurely. We find that foraminifera assemblages may be used as incremental success criteria in ecosystem restoration projects. Our study provides baseline data with which we can assess the magnitude of past change, and measure the success of management actions.

Author's Biographies

Matt Lybolt is a PhD candidate at the UQ Marine Palaeoecology Laboratory (Centre for Marine Studies). He researches the history of change in sub-tropical marginal coral reefs, and why reefs persist in sub-optimal environments.

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John Pandolfi is a Professor at the Centre for Marine Studies and the School of Earth Sciences, University of Queensland and a chief investigator of the Australian Research Council's Centre of Excellence in Coral Reef Studies. He has focused on coral reef ecosystems to shed light on a number of fundamental ecological questions where long-term data are essential.

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