

Spatial and temporal patterns of reef-fish assemblages in the Solitary Islands Marine Park and their utility for protected area management



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Candidates Declaration

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification. I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.


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Signature

Acknowledgements

I dedicate this study to my late father, Frank Malcolm.

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ABSTRACT

Understanding of biotic patterns is essential to effectively plan for biodiversity conservation in a marine park. Reef fish are an important component of biodiversity in coastal systems, but were poorly known within the Solitary Islands Marine Park (SIMP). Their patterns, determined at the marine park scale, have utility in testing a Habitat Classification System (HCS) used in conservation planning. No other biota has been studied comprehensively at this scale in the SIMP.

Reef fish assemblages were broadly sampled across the SIMP using diver timed counts and baited video. Assemblage patterns correlated with environmental factors were used to refine categories in the HCS. The refined-HCS and patterns of species-richness, abundance, and biogeography were assessed for representation in sanctuary zones (SZ). Temporal stability was examined and bioregional comparisons were made with other studies. Surrogate families representing assemblage patterns were objectively selected. An algorithm approach (Marxan) was used to systematically evaluate solutions in zone planning.

Over 330 reef fish species were recorded; 90% rarely. Many were not previously recorded from the SIMP. More than 50% were tropical, although the most-abundant were predominantly temperate or subtropical. Distinct cross-shelf patterns in assemblages were incorporated as refined-HCS categories (inshore <1.5 km, mid-shelf, and offshore >6 km from the coast) for shallow reef. Inshore had the strongest temperate-influence and the highest levels of endemism. Offshore had the strongest Indo-Pacific tropical-influence and the highest species-richness, particularly associated with islands. Intermediate-depth assemblages separated from shallow at 25 m and showed a cross-shelf pattern. Deep assemblages, only found offshore,

separated from intermediate assemblages at 50 m. There is no representation of deep reef in SZ. Assemblage patterns were found to be stable at the marine park scale over years. An assemblage recorded in the SIMP was different from marine parks in bioregions further south, supporting this regionalisation. The families Labridae and Pomacentridae combined were an effective surrogate to represent assemblage patterns of reef fish. From Marxan analyses, some areas are 'hotspots' for representation. Areas of deeper habitat should be included in SZ with a large cross-shelf transect in at least one of the two positions at which the SIMP is broadest.

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