EXECUTIVE SUMMARY

Marine protected areas increasingly are being seen as precautionary mechanisms by which to provide for the conservation of major marine habitats. An underlying principle of the approach is that the protection of representative areas from impacts of human activities will establish patches of healthy habitats in perpetuity and provide refugia from which the wider ecological systems will be replenished. McNeill (1994) pointed out, however, that marine parks and protected areas around Australia generally have been established with little attention to monitoring their biological (resource) status, or formal assessment of the effectiveness of their management. Both the design and ongoing assessment of marine protected areas require knowledge of the main patterns of distribution of biota in the managed areas and structured monitoring studies tailored to rigorously tests the effectiveness of various levels of protection from human use.

In this report we describe some relatively large-scale patterns in the distributions and abundances of several coral reef organisms on the northern Great Barrier Reef. We considered the degree to which habitat, position across the continental shelf, and region explained variations in abundances. These factors have been invoked as major determinants of pattern in abundances in past studies and we sought to examine the consistency and generality of such models. Our main focus was on the implications of systematic patterns in abundance for the spatial design of sampling and monitoring programmes. Ignorance or inappropriate treatment of strong systematic patterns when designing monitoring and assessment programmes has the potential to cause mistaken conclusions about the merits of future management strategies or the performance of existing strategies.

Our data indicated that strong patterns in abundances were correlated with habitat, shelf position, and regions. Many of these single factor patterns, however, were not consistent among taxa or across other major physical gradients. For example, differences among habitats varied greatly from mid-shelf to outer-shelf reefs, and the effects of shelf position varied among regions for many organisms. The lack of generality of such patterns is contrary to important assumptions underlying much previous work.

Our results have important implications for the design and interpretation of future studies and for the design and assessment of managed protected areas. It is clear that for almost all organisms we analysed (42 taxa), the common strategy of sampling only 'representative' sub-sections of reefs will result in inaccurate depictions of patterns in abundances among reefs. It is critical in future studies that sampling be well distributed over major within-reef strata. It is also clear that the successful choice of truly representative areas for the conservation of major biomes on the Great Barrier Reef will require highly structured descriptive information that encompasses a range of bio-physical factors. Strong patterns in abundances can be related to major bio-physical factors, but it is becoming clearer that the relationships are far less static and general than previously thought. Failure to consider the variation in such patterns, that presumably reflect important large-scale processes, may lead to the misrepresentation of important aspects of the Great Barrier Reef in conservation management strategies.