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Managing Reef Fish under Stochastic Dispersal Conditions

Effective placement of marine protected areas (MPAs) in the Great Barrier Reef (GBR) may be vital for maintaining fishable populations. The success of MPAs depends in part on reef connectivity and larvae dispersal patterns. Because ocean currents in the GBR are complex and dynamic, managers are challenged to place MPAs that maintain fish abundance over the long run. One strategy to improve management efforts is to cluster bordering reefs into several distinct MPAs. Placing MPAs as clusters of reefs may allow for local larval dispersal patterns to successfully seed reefs under a variety of ocean conditions Here I use a single-species metapopulation model of the GBR to test how the size and number of MPAs affects mean fish abundance and fishery catch levels. I find that under a constant total protected area there is an increase in mean fish abundance and decrease in variance as the number of distinct MPAs increases. I also compare this pattern across different amounts of total reef area protected (10%, 20%, 30%, 40% of the GBR) and find that cluster size may have a more profound impact on fishery catch than fish abundance as MPAs make up a higher proportion of the reef.