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Marine reserve network design for coral reef fisheries

Key words: Marine Reserves, Fisheries Management, Connectivity

Abstract:

Overfishing threatens the sustainability of coastal marine biodiversity, especially in tropical developing countries. To counter this problem, about 200 governments worldwide have committed to protecting 10%–20% of national coastal marine areas in reserves. However, the fisheries management implications of decisions on the total coverage, location and individual size of marine reserves are generally unspecified, potentially diminishing catches that millions of fishers depend on for food and livelihoods. In this seminar, we will present findings from two research projects in the south-east Coral Triangle region, which aim to advance marine reserve network designs with the explicit focus to benefit diverse and otherwise unregulated coral reef fisheries. Our findings suggest that realistic marine reserve network design targets (10-30% strict protection of fished habitat in 1-20 km wide reserves) should help sustain or rebuild the long-term productivity of almost any such diverse and otherwise unregulated fishery. Intuitively, we find that one of the most critical drivers of fisheries outcomes is the level of fish population recovery in reserves and whether the subsequent export of young fishes from reserves to unprotected areas includes the most important fishing grounds. To achieve this management goal based on systematic reserve placement within a given seascape, we therefore developed a novel marine protected area (MPA) design approach. We find that this new method can help not only to prevent fishery collapse, but also to achieve on average at least two-times higher fisheries productivity than standard MPA designs. Future applications of our MPA design approach should therefore be encouraged, specifically where fisheries management tools other than MPAs are not feasible.