

Modelling the impacts of marine protected areas for mobile exploited fish populations and their fisheries: what we recently learnt and where we should be going ■



Marine protected areas (MPAs) are increasingly being considered and used for the management of fisheries targeting mobile fish populations. Here, the recent modelling literature on MPA effects for mobile fish populations and their fisheries is reviewed. Modelling studies conducted since 2011 have filled a considerable number of knowledge gaps on the impacts of MPAs for species exhibiting home-range behaviour, nomadic movements or behavioural polymorphism, and on the effects of "targeted MPAs", which aim to protect relatively small areas where migratory fishes spend an inordinate fraction of time or are highly vulnerable to fishing (e.g., nursery or spawning zones). Also, in recent years, two studies investigated the consequences of MPAs targeting highly migratory (tuna-like) fish populations for the first time in the history of MPA modelling. Recent modelling studies found that MPAs aimed at protecting mobile species may have positive conservation effects under a relatively wide range of situations, but may generate long-term fisheries benefits only under a very limited set of conditions. In particular, MPAs were not found to be beneficial for the fisheries

targeting highly migratory populations. Strategies producing both conservation and fisheries benefits were identified, which depend on fish movement patterns and numerous aspects of fish life history and fisheries dynamics. However, in view of the diversity of fish movement patterns in MPA systems and current dynamics in resource management, it is clear that additional modelling work is needed to fully understand how protected areas affect mobile fish populations and their fisheries and to be able to implement pertinent MPAs. In particular, future modelling studies should systematically assess the effects of MPAs in relation to other management tools to find strategies that are most effective in meeting management objectives, and explore the impacts of "dynamic" MPAs that follow highly migratory fish populations in space and time.

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