

Disentangling ecological and anthropogenic drivers of coral reef fish populations in the western Indian Ocean

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Understanding the primary drivers that determine fish species assemblages on coral reefs is vital for effective conservation planning. However, separating factors that are natural, such as habitat requirements for juveniles fishes, from anthropogenic, such as fishing and climate induced coral bleaching, is challenging. The western Indian Ocean (WIO) represents a region of highly variable coral reefs ranging from shallow fringing reefs on the east African mainland to steep volcanic reefs in Comoros to turbid low relief reefs in north-east Madagascar, within an oceanic context of the South Equatorial Current and the East African Coastal Current. The abundance and size structure of over 140 species of coral reef fishes were measured together with a range of benthic and reef structure variables at over 100 sites in four countries of the WIO to examine likely drivers of fish species assemblages. The results illustrate drivers are complex and interact. Reef profile and relief, geographic location or oceanic conditions, and reef benthic composition all play a primary role in determining reef fish populations. Principle species driving these patterns come from the acanthurids, scarids, lutjanids, balistids and lethrinids and the proportion of juveniles is a significant factor. The value of large scale regional analyses of data as presented here lies in the ability to determine broad scale patterns in reef fish assemblages that can be attributed to natural ecological processes, after which anthropogenic drivers can be examined more closely. This revealed, among others, high impact areas related to fishing in Comoros, low impacts from coral bleaching in northern Mozambique and effective protection measures at Mafia Island, Tanzania. Disentangling these drivers now enables more accurate spatial planning to maximise the conservation of reef fish populations across the WIO.