

# Physical factors of differentiation in macrobenthic communities between atoll lagoons in the Central Tuamotu Archipelago (French Polynesia)

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**ABSTRACT:** Nine atolls were characterized in order to understand how physical factors control the species composition, diversity, and abundance of macrobenthic (coral, mollusc, echinoderm, and algal) communities inside the lagoons. Only one region, the central part of Tuamotu Archipelago, French Polynesia, was considered, in order to minimise the variation due to regional factors between regions. The lagoons investigated showed a gradient of physical factors, providing various landscape configurations. The physical factors were surface area, abundance of pinnacles, degree of hydrodynamic aperture, and relative importance of passes in this degree of aperture. Macrobenthic communities were characterized by low diversity and strong dominance of a few mollusc or echinoderm species that generally occurred in lagoons without passes. Correlation analyses indicated that species richness increases with the surface area of the lagoon. Species richness of corals, echinoderms, and macroalgae was also higher in lagoons having numerous pinnacles. Canonical correspondence analyses revealed that the distribution and the relative abundance of coral, echinoderm, and macroalgae species were correlated to the relative importance of passes, whereas degree of aperture of the lagoon was also relevant for corals and molluscs. The physical factors that control the processes of water exchange between ocean and lagoon, including passes, submerged reef flats, and spillways, influence the identity and the abundance of most macrobenthic species inside the lagoons.

**KEY WORDS:** Coral reefs · Tuamotu Archipelago · Canonical correspondence analysis · Correlations · Species composition · Diversity · Abundance

## INTRODUCTION

Ecologists have abandoned the notion that a single monolithic process governs community organisation (Dunson & Travis 1991). Most recent studies have recognized the relative contribution of biotic and abiotic factors to, and the importance of both local and regional

processes on, local diversity and spatial heterogeneity (Quinn & Dunham 1983, Cornell & Lawton 1992, Karlson & Hurd 1993, Cornell & Karlson 1996, Caley & Schluter 1997, Karlson & Cornell 1998). In coral reef ecosystems, equilibrium theories invoked competitive interactions as an important factor in the control of species assemblages and diversity, and consequently in the dissimilarities among ecosystems (Smith & Tyler 1972). Patterns of local species richness and assemblages have

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