Hydrobiologia **356**: 11–19, 1997.

Long-term changes of epibenthic macrofauna communities in a closed lagoon (Taiaro Atoll, French Polynesia): 1972–1994

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Received 12 March 1997; in revised form 11 June 1997; accepted 12 July 1997

Key words: coral reefs, atolls, macrobenthic, temporal variation, French Polynesia

Abstract

Epibenthic macrofauna communities (species composition and densities of the dominant species) were investigated at Taiaro Atoll, Tuamotu Archipelago, 22 years after a previous survey. This small atoll is completely closed, has no permanent functional hoa, and is not affected by direct anthropogenic disturbances since it is a Biosphere Reserve. Ten species were identified in 1994 (5 molluscs, 4 corals, and 1 echinoderm). With the 14 species identified in 1972 (12 molluscs, 1 coral, and 1 echinoderm), a total of 17 species (12 molluscs, 4 corals, and 1 echinoderm) has been recorded for the lagoon. There has been a shift in dominance away from the bivalve *Crassostrea cucullata* (in 1972) to *Pinctada maculata* (in 1994). A high mortality of the epibenthic macrofauna affected the central part of the lagoon shortly before 1972 and reached the inner reef flat afterwards. The distance of Taiaro from sources of colonizers, its small size, and the isolation of its lagoonal waters posing a physical barrier to colonization by organisms and leading to harsh environmental conditions (e.g. very high salinities: 42.5–43 psu), are likely to be the major causes of the exceptionally low diversity observed.

Introduction

In February, 1994, a multidisciplinary marine ecological survey was conducted at Taiaro Atoll. Except for a brief visit in 1992 that dealt exclusively with fish communities, the present survey is the second of its kind, 22 years after the first scientific study in 1972 (Chevalier & Salvat, 1976). The geomorphological and hydrological characteristics of Taiaro are of particular interest. It is one of the smallest Tuamotuan atolls (5 km in diameter) and is completely closed. Exchange of water with the open ocean, with all the ecological consequences that it suggests for the life cycles of living organisms and species diversity, appears to occur via one hoa (i.e. channel as described by Salvat, 1967; Chevalier, 1972; Stoddart & Fosberg, 1994) and only during exceptional high periodic swells or tropical storms. Thus, the lagoonal waters appear very confined, as indicated by the high salinities measured since 1972 (between 42.5 and 43 psu). Taiaro was established as a Biosphere Reserve in 1972, with no permanent human inhabitants; in actual fact, no direct anthropogenic disturbances have affected it. Its location in the Central Pacific, far away from the maximum diversity area, suggests some important characteristics from a biogeographical viewpoint. A previous survey of the epibenthic macrofauna in 1972 (Poli & Salvat, 1976; Richard, 1976) and a study of fish (Galzin et al., 1994) have pointed out the low diversity of the lagoon's epibenthic macrofauna and the dominance of the communities by just a few species.

In 1994 we had the opportunity to re-survey the species composition and abundance of the dominant epibenthic macrofauna species and we decided to follow the method used in 1972 by Poli & Salvat (1976). The goals of this survey were: (1) to examine the long-term variation of such a unique lagoon system without direct anthropogenic disturbance; (2) to identify which