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Diversity and ecology of crustaceans from shallow rocky habitats along the Mediterranean coast of Egypt

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Abstract Spatio-temporal patterns of the distribution of crustaceans from shallow hard bottoms along the Alexandria coast (Egypt, Mediterranean Sea) were studied during a complete year cycle and also in relation to potential drivers of change (both biotic and abiotic), including variation in habitat-forming species. Overall, the crustacean assemblages appeared poor, including only 14 species belonging to Amphipoda (five species), Isopoda (five species), Tanaidacea (two species), Cirripedia and Decapoda (one species each). The distribution patterns of crustacean assemblages appeared significantly variable both in the spatial and in the temporal dimension on a rather unpredictable basis, albeit variation was related to changes in dominant algal and invertebrate habitat formers. High variability and low species richness observed suggest that the analyzed assemblages are selected by local unfavorable environmental conditions. In fact, the crustacean hard bottom fauna is composed by a bulk of tolerant forms, including the dominant *Tanais dulongi*, *Apohyale perieri*, *Dynamene bidentata*, *Sphaeroma serratum*, *Elasmopus pectenicrus*, and *Jassa marmorata*. Their spatio-temporal dynamics, as well as those of the remaining species, and correlations with the variation of habitat formers and environmental variables are reported. This is a baseline assessment of the crustacean diversity along the Mediterranean coast of Egypt, thus having paramount importance for understanding the predicted future changes of biodiversity for the area.

Keywords Crustacea · Levantine Sea · Amphipoda · Isopoda · Tanaidacea

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Introduction

Spatial and temporal variations in the distribution of benthic marine assemblages are driven by the interplay of various abiotic and biotic factors. High heterogeneity in patterns of distribution is particularly evident in shallow habitats experiencing strong fluctuations of key environmental factors, such as temperature, salinity, wave action, etc. (Benedetti-Cecchi et al. 2000; Therriault and Kolasa 2000; Sousa 2001; Witman and Dayton 2001). The heterogeneity of shallow rocky shore habitats determines spatio-temporal changes in the composition and abundance of sessile macrobenthos (macroalgae, sponges, bryozoans, and other sessile invertebrates), which, in turn, represents the habitat for highly diverse macrofaunal marine assemblages mainly composed by molluscs, nematodes, annelids, and crustaceans (Connell 1972; Jacobi and Langevin 1996; Parker et al. 2001; Chemello and Milazzo 2002). In fact, variation of habitat-forming macrobenthic species may further enhance the variability of associated assemblages and should be considered when analyzing patterns of distribution of epibenthic invertebrates (Dorgham et al. 2014). For example, Gambi et al. (2016) showed that subtle effects of ocean acidification on shallow macrofaunal assemblages may be underrated if variation of

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