Morphometric heterogeneity of temporary pools in Malta and its effect on species and life-form richness: implications for management and restoration

Sheryl Sammut, Kelly Briffa, Sandro Lanfranco*

Department of Biology, University of Malta, Msida MSD2080, Malta. sheryl.sammut.09@um.edu.mt

Department of Biology, University of Malta, Msida MSD2080, Malta. kelly.briffa.10@um.edu.mt

Department of Biology, University of Malta, Msida MSD2080, Malta. sandro.lanfranco@um.edu.mt

Extended abstract

The effect of morphometric heterogeneity of pool basins on the diversity of microcrustaceans and macrophytes was investigated in 39 cupular pools from six pool landscapes across the Maltese Islands. Each basin was characterised on the basis of its primary axis and secondary axis, maximum morphological depth, depth of the sediment layer and the maximum water level. The depth parameters were used to sub-divide each basin into depth classes based on morphological depth, sediment depth and maximum water level and variation in these parameters was expressed as a Heterogeneity Index for each basin. Basin morphometry did not vary significantly within pool landscapes and across pool landscapes. Deeper segments of a basin were characterised by longer hydroperiods and by a larger sediment volume.

The macrophytic species colonising each depth-class of the study basins were noted on a presence/absence basis during each field visit whilst the proportionate coverage of life-forms (hydrophytes, amphiphytes, terriphytes and 'filamentous algae') in each depth-class was also recorded during every visit. In general, hydrophytes predominated in the intermediate water-depth classes whilst amphiphytes were mainly found in the shallower regions, where they would have a fitness advantage over other life-forms towards the end of the wet season. Terriphytes were mainly found in the shallow water-depth classes, towards the margins of the pool, although some were present in the deeper parts at the start of the wet season. 'Filamentous algae' were found in all depth classes, although more abundantly in the shallow depth classes. Life-form diversity was positively correlated with morphometric heterogeneity of basins ($p<0.01$) and with sediment-depth heterogeneity ($p<0.001$). The results concerning the variation of macrophytic species richness with morphological heterogeneity of basins did not correspond with those obtained from larger Mediterranean Temporary Ponds, however, the result was attributed to the much smaller size of Maltese temporary freshwater rockpools relative to those included in other studies. In general, basins with more varied heterogeneity supported a higher richness and evenness of macrophytic life-forms than basins with more uniform morphometry.

Micro-crustaceans were divided into two functional groups: 'swimmers' (comprising Anostraca, Cladocera and Copepoda) and 'bottom dwellers' (Ostracoda, Notostraca and Conchostraca). Only 'bottom dweller' community composition was significantly affected by morphometry, in particular sediment depth, the general trend being that as sediment depth

decreased, the number of faunal taxa decreased. When considering interaction effects, 'bottom dweller' community composition was affected by the interaction between maximum water level and surface area, and sediment depth and surface area, where these interactions explained 25.5% and 20.5% of the variation in the number of 'bottom dweller' taxa.

As regards microcrustacean assemblages, pool morphometries favouring a more fragmented hydroperiod resulted in more diverse micro-crustacean communities, where, every inundation-desiccation cycle implied the hatching of a fresh set of micro-crustacean species. The number of hydroperiods affected the number of 'swimmer' taxa ($p=0.037$), and abundance of 'bottom dwellers' ($p=0.016$) across pools.

These results fill an important knowledge gap about the ecological dynamics in very small temporary pools. Information about the significance of morphometric variation in these habitats can be used to inform management and restoration strategies and has important implications for understanding the ecological dynamics of pool flora and fauna, of small-scale biological invasions and for ecological restoration processes in such habitats.

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