TEMPORARY FRESHWATER ROCKPOOLS AS SENTINEL SYSTEMS FOR CLIMATE CHANGE

Sandro Lanfranco[1], Sheryl Sammut[2], Kelly Briffa[2], Lara Galea[2], Claire Grima[2]

[1]Department of Biology, University of Malta, Malta. sandro.lanfranco@um.edu.mt

[2]Department of Biology, University of Malta, Malta.

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Temporary freshwater rockpools are seasonal bodies of rainwater that accumulate in small solution hollows in karstified limestone landscapes. These pools support a relatively simple community of specialised aquatic flowering plants and macroalgae during the wet season, and may be colonised by opportunistic terrestrial plants during the dry season. The wet-season species may be categorised into hydrophytes, amphiphytes and terriphytes, according to their predominant ecological strategy. The small size of these pools and short life-cycles of the resident species suggest that these habitats would exhibit population and community-level responses to climatic change that would be relatively rapid compared to those observed in larger wetlands.

We hypothesise that the ratio of hydrophytes, amphiphytes and terriphytes in these pools may be used as an early sentinel for detection of climatic change. In general, warmer climatic conditions would be expected to lead to shorter and more fragmented hydroperiods, giving a higher proportion of pools dominated by amphiphytes and terriphytes relative to the presenty-observed proportions. Three future climatic scenarios ('Most optimistic', 'Optimistic' and 'Pessimistic'), based on IPCC data for Southern Europe and the Mediterranean, were constructed and the projections were used to predict the hydroperiod characteristics of a generalised temporary freshwater rockpool under each scenario.

The fragmentation of hydroperiods in all three climatic scenarios was significantly higher than that observed for the reference hydroperiod ($P<0.05$), whilst the duration of the longest hydroperiod, an important constraint for life-cycle completion, was significantly shorter in a warmer and drier climate ($P<0.05$). The results implied that pools are likely to be subject to increased infiltration by 'opportunistic' terriphytes from the surrounding habitat. Pool communities dominated by hydrophytes would be expected to decline in abundance, as warmer and drier climatic conditions favour a compositional shift away from such species and towards amphiphytes.

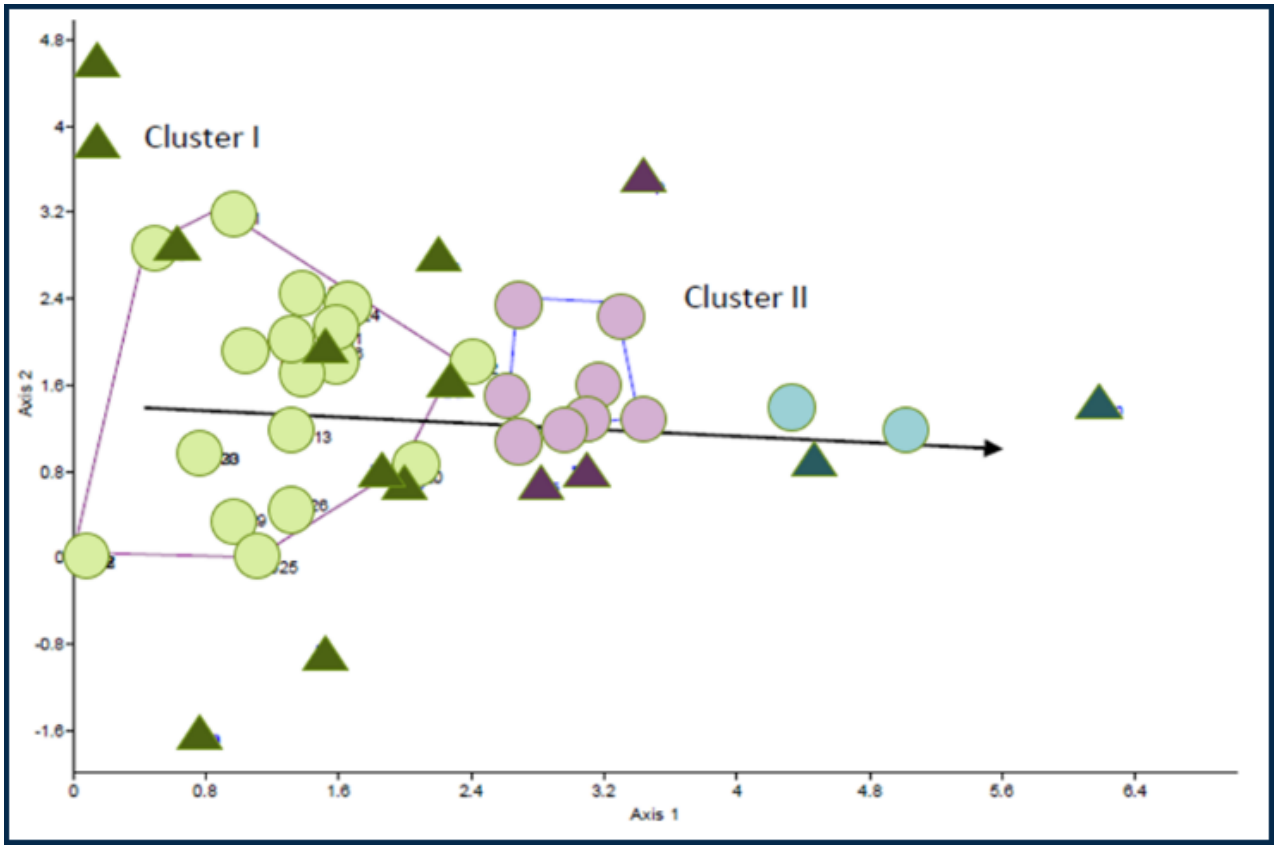

Figure 1 - DCA plot showing community composition in 30 pools in 2008/09. Scores on Axis 1 for each pool were correlated with hydroperiod index. Cluster I: Pools with very brief hydroperiods, rich in 'opportunistic' terriphytes (green circles). Cluster II: Pools with longer hydroperiods and mainly colonised by amphiphytes (purple circles) and hydrophytes (blue circles). Triangular symbols represent the individual species on which the analysis was based. The arrow represents a vector corresponding to increasing hydroperiod duration.

Figure adapted from Sammut, S., Briffa, K., Camilleri, J. & Lanfranco, S. (2014). Pools, plants and people: challenges for wetland conservation in Malta. Wetlands 2014, Huesca, Spain.