

Community- and population-level response of marine plankton to stress exposure: learning from the past

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The effects of stress exposure in marine plankton are difficult to assess directly, because it is hard to replicate realistic conditions in laboratory experiments and because the physiological changes and adaptations in response to stress exposure occur over times scales that cannot be covered by direct observations. A viable alternative is provided by studies of marine microfossils. Census counts of microfossil assemblages allow reconstructions of community-level changes, whilst biometric studies provide information on the reaction of populations to different levels of stress. An important prerequisite for such studies is the identification of suitable natural experiments in the geological past, where a well-constrained plankton population was exposed to stress in a situation where it could not respond simply by shifting ranges. An ideal example for such situation is provided by the periodic salinity crises affecting the Red Sea during glacial sea level lowstands. The salinization of the basin during sea level fall has created a unique strong stressor acting with increasing strength up to the level where it drives local extinctions of plankton species. Using planktonic foraminifera as a model, we reconstructed both the community response of the entire group as well as the population-level response of two selected species to the same salinity crisis. These co-registered records allow us to investigate how stress thresholds are linked between community-assembly processes and population processes, assess the reaction norm of selection-relevant parameters and how these are coordinated among members of the same plankton community.