The resilience of the coral holobiont to ocean warming depends on the combined response of its members

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Different coral holobionts (i.e., coral-algal-prokaryote symbioses) exhibit varying thermal sensitivities which may determine their adaptive capacity to global warming. It is increasingly recognized that healthy corals are multi-partite symbiotic organisms with prokaryotes potentially providing the plasticity needed to adapt to a changing environment. However, studies simultaneously investigating the effects of warming on all holobiont members are lacking. Thus, we conducted a thermal stress experiment to understand the role each member plays in influencing the response of the holobiont to thermal stress. We show that exposure to higher temperature affects the main physiological traits of all members (herein: animal host, *Symbiodinium* and diazotrophs) of both *Acropora hemprichii* and *Stylophora pistillata* during and after thermal stress. *S. pistillata* experienced severe loss of *Symbiodinium* (i.e., bleaching) with no net photosynthesis at the end of the experiment. Conversely, *A. hemprichii* was resilient to thermal stress. Exposure to the increased temperature (+6 °C) resulted in a drastic increase in daylight N_2 fixation, particularly in *A. hemprichii* (3-fold compared to controls). After the stress event, diazotrophs exhibited a reversed diel pattern of activity, with increased N_2 fixation rates recorded only in the dark, particularly in bleached *S. pistillata* (2-fold compared to controls). Concurrently, both animal hosts displayed impaired organic matter release and picoplankton feeding, but more so for the bleached *S. pistillata*. These findings indicate that the resilience of the holobiont to warming depends on the combined response of its members. In particular, coral-associated diazotrophs show physiological plasticity under high temperature, fixing additional nitrogen that may play a beneficial role during thermal stress events. This functional association can therefore play a fundamental role in the selection for 'winning' and 'losing' coral species under future climate change.