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Thermal tolerance and range expansion of invasive foraminifera under climate changes

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Biogeographic expansion is largely attributed to temperature constrains. Considering expected rise in sea surface temperature (SST), the faith of ecosystems through the next decades will be determined by resilience or sensitivity to changing temperatures. Rising SST at the Eastern Mediterranean promotes invasion by allowing range expansion and establishment of new species that often creates a dramatic change in ecosystem structure. The environmental differences between the Red Sea, the Mediterranean and the Suez Canal, act as a buffer allowing only certain species to invade and settle in the Mediterranean. This provides an opportunity to study the differences between invasive and non-invasive co-occurring species.

We conducted laboratory experiments aiming to compare the temperature sensitivity ranges of the closely related foraminifera species: *Amphistegina lobifera* and *Amphistegina lessonii*. Both species are extremely abundant at the same shallow habitats in the Red Sea, but while *A. lobifera* is a successful Lessepsian invader extremely common at the Eastern Mediterranean, *A. lessonii* is rare or absent. Furthermore, we compare temperature sensitivity of the invading and origin population of *A. lobifera* to examine long term effect of invasion on the temperature sensitivity of the invasive population.

Our results exhibit differences between the invasive and the non-invasive species in respect to their temperature sensitivity. We demonstrate that the physical barrier that impedes the invasion of *A. lessonii* is the low winter temperature of the Eastern Mediterranean. Furthermore, the differences between the species indicate that in respect to climate change resilient marine species can be distinguished by their ability to compensate for temperature changes by adjusting their physiological performance and by having tolerance to a wider temperature range. Moreover, we demonstrate that selective filtering mechanisms during invasion can prefer strains that are more resilient to colder rather than expected warmer temperatures.