Abstract

Ocean acidification (OA) is occurring across a backdrop of concurrent environmental changes that may in turn influence species' responses to OA. Temperature affects many fundamental biological processes and governs key reactions in the seawater carbonate system. It therefore has the potential to offset or exacerbate the effects of OA. While initial studies have examined the combined impacts of warming and OA for a narrow range of climate change scenarios, our mechanistic understanding of the interactive effects of temperature and OA remains limited. Here, we use the black turban snail, Tegula funebralis, as a model species to test how OA affects the respiration rate of a herbivorous invertebrate across a wide range of temperatures encompassing their thermal optimum. Snails were exposed in the laboratory to a factorial combination of low and high pCO2 (400 and 1200 µatm CO2) and temperatures (12, 14, 16, 18, 20, 22, 24, 26°C) for two weeks. Results indicate that the effects of OA on respiration rate are highly dependent on temperature. Although high CO2 significantly increased respiration rate at 20°C, this effect gradually lessened with successive warming to 20°C, illustrating how moderate warming can mediate the effects of OA through temperature's effects on both physiology and seawater geochemistry. Together, these results highlight the importance of considering the physiological and geochemical interactions between temperature and carbonate chemistry when interpreting species' vulnerability to OA.