Impacts of heat priming on development and physiology of sea anemone larvae

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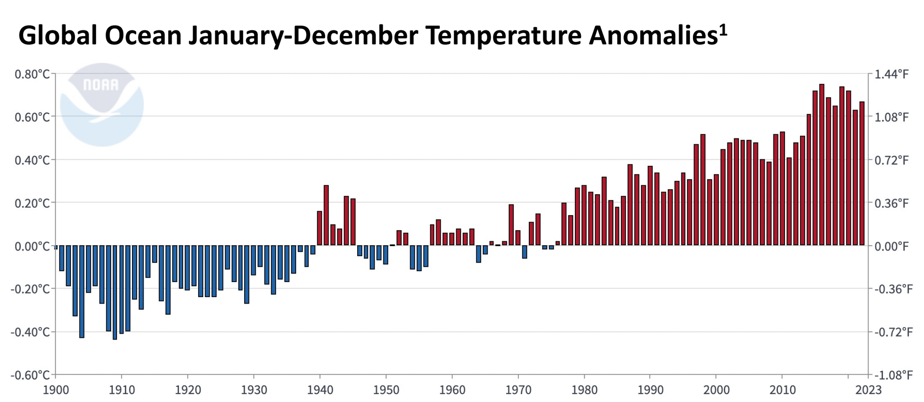
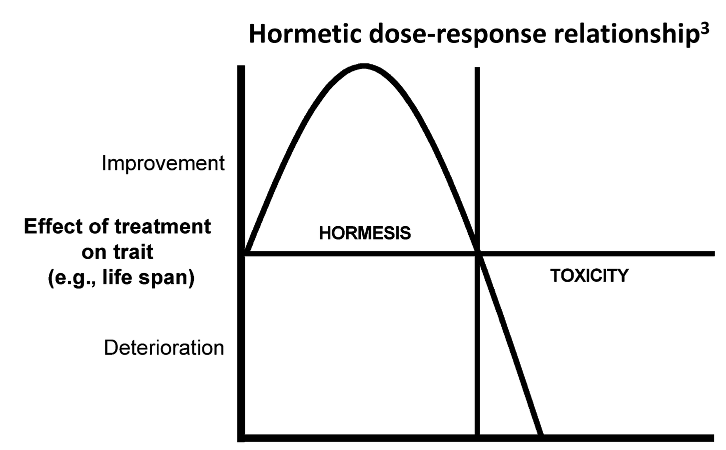
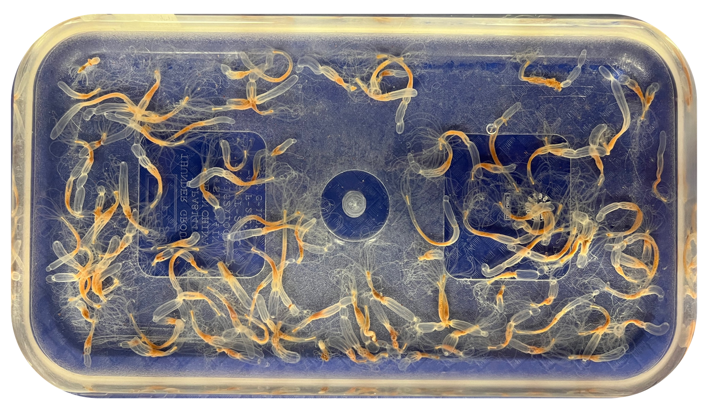
Introduction



Anthropogenic climate change threatens marine ecosystems and their inhabitants. Hexacorals, including reef-building corals and sea anemones, are particularly vulnerable to rising ocean temperatures.[2]

Hormesis refers to a biological phenomenon where organisms benefit from low doses of environmental stress.[4] This could have important implications for hexacorals as a mechanism of acclimatization to warmer environments.[5]



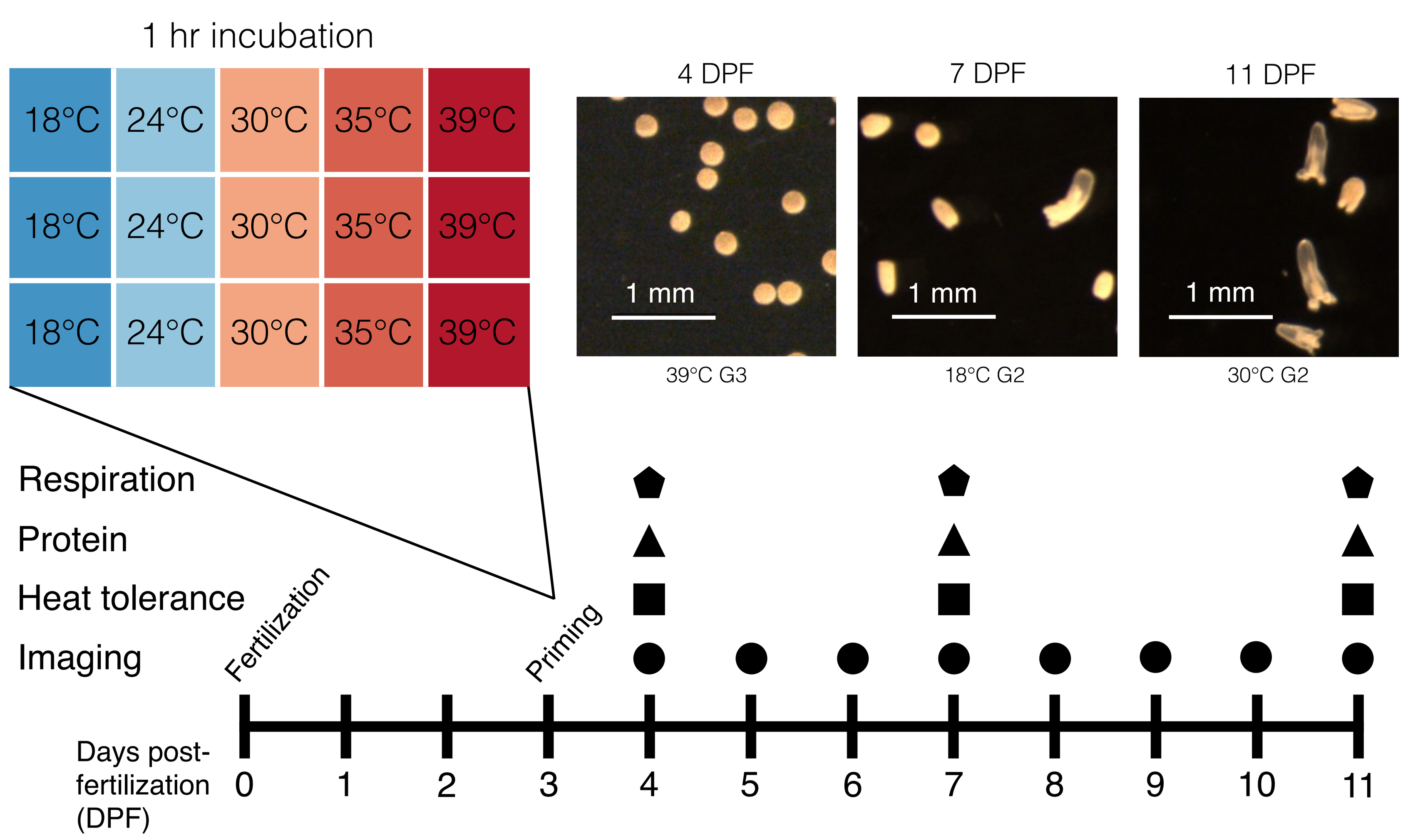


Our question: how does early exposure to heat stress affect development and physiology of the sea anemone *Nematostella vectensis*?

We hypothesized that larvae would exhibit hormetic growth and physiological responses to early heat stress.

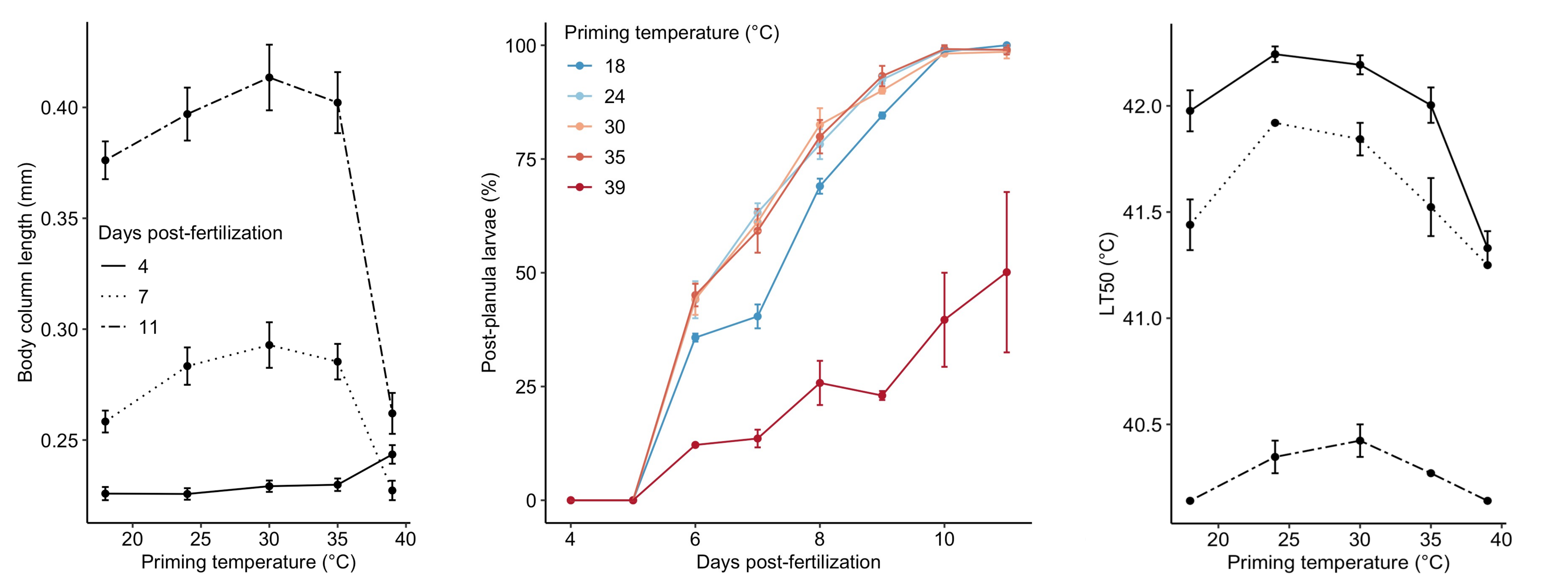
Methods

Nematostella vectensis larvae were exposed to five temperatures and assessed for size, development, metabolic rate, protein content, and heat tolerance. Short-term (11 days; see below) and long-term (6 weeks; weekly image analysis) data were collected.

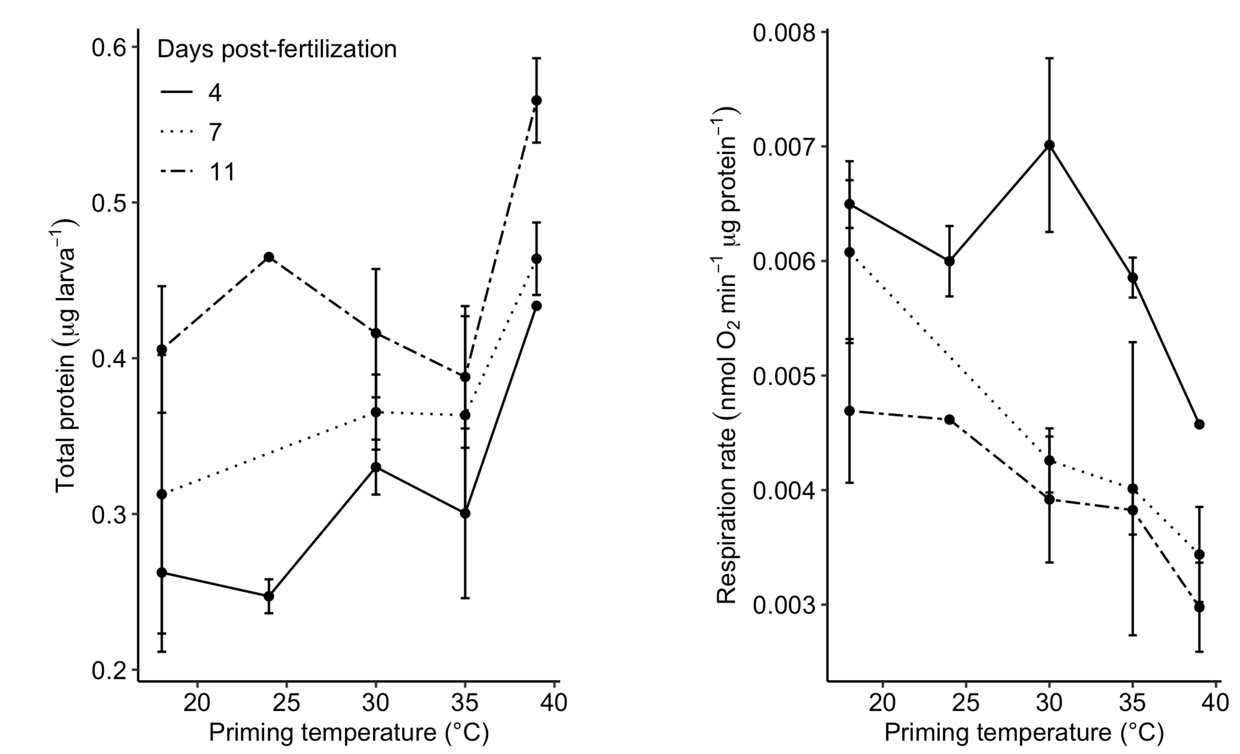


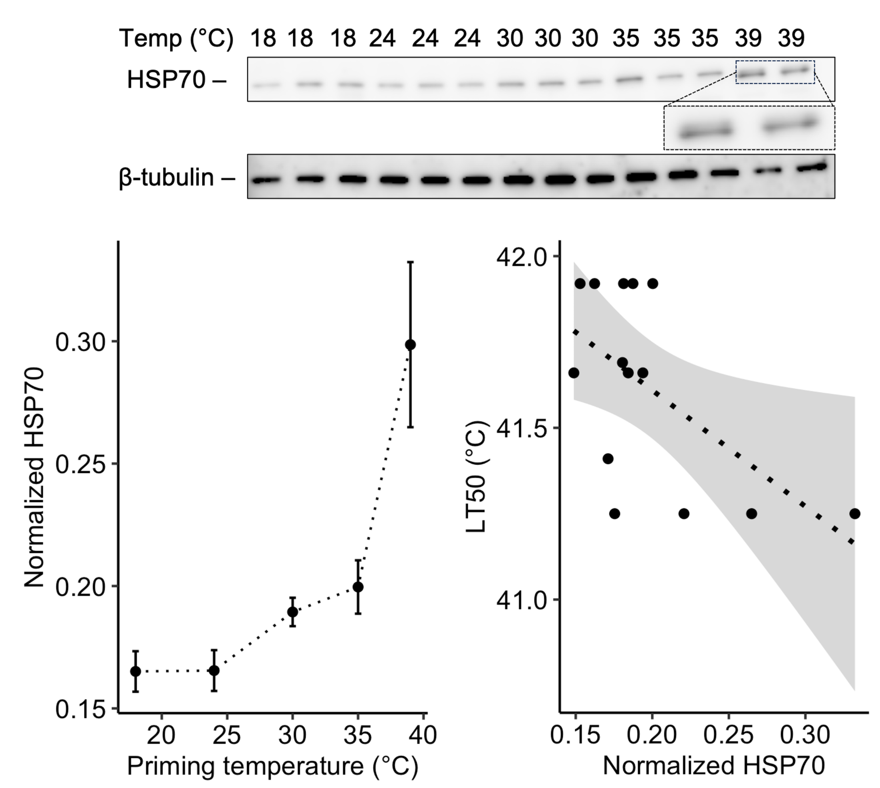
Results

Larvae primed at intermediate temperatures (24, 30, 35°C) exhibited faster short-term growth and development and higher thermal tolerance (LT50), with dose-response curves characteristic of hormesis.



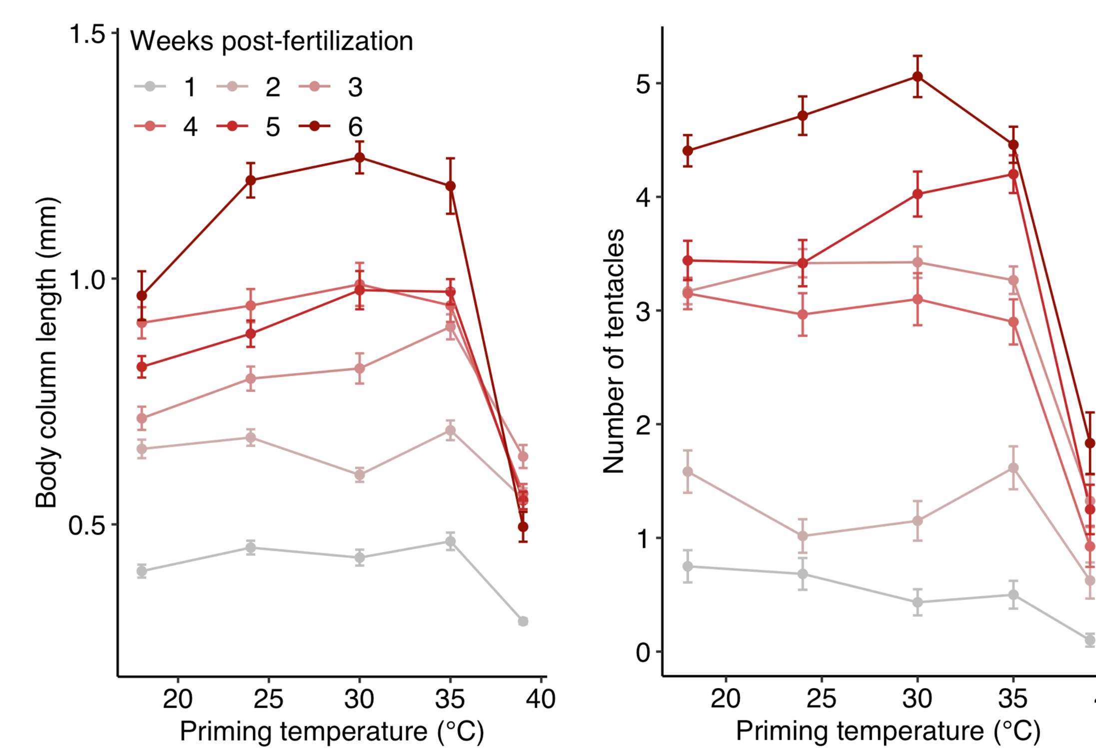
There were no significant changes in protein content or respiration rate across temperature treatments or days.



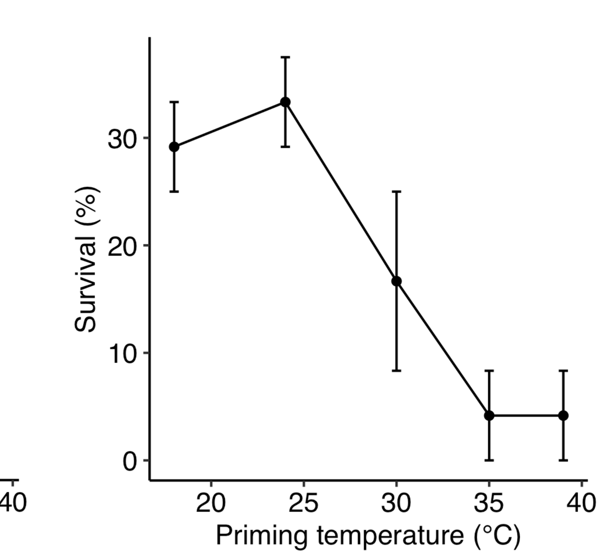


Heat shock protein 70 (HSP70) was measured at 11 DPF as a potential mechanism of heat tolerance.

Larvae primed at 39°C expressed significantly greater HSP70 than other groups, despite exhibiting slower growth and lower heat tolerance. This observation, along with a weak negative correlation between HSP70 and LT50, suggests that HSP70 alone is not responsible for heat tolerance, contrary to our hypothesis.

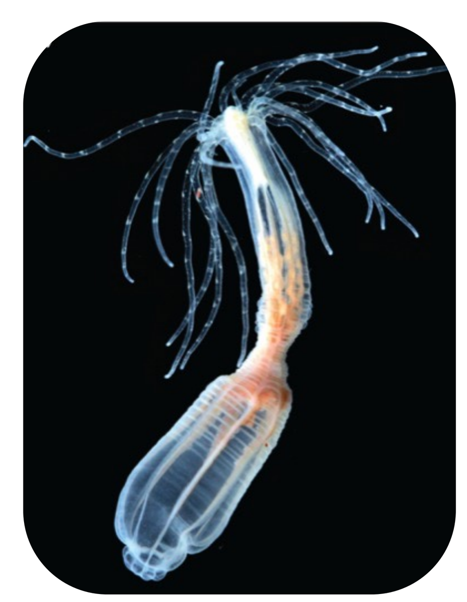


Hormetic effects on growth and development persisted after 6 weeks, whereas effects on heat tolerance were lost over time.



Conclusions

- Heat exposure has hormetic dose-response relationships with growth, development, and heat tolerance of *N. vectensis* larvae—strongly suggesting that **heat priming boosts sea anemone resilience to climate change.**
- Heat tolerance is a complex and dynamic phenotype arising from environmental, genetic, and physiological factors.
- Even short-lived exposure to high temperature (39°C for 1 hour) has adverse effects on growth. Our research highlights the urgency of ocean warming and the necessity to redouble marine conservation efforts.
- Further research should more fully characterize organismal phenotypes following priming, as well as elucidate molecular and cellular mechanisms underlying the heat stress response.



References & Acknowledgements

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