Large birth size does not reduce negative latent effects of harsh environments across life stages in two coral species

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Abstract

When juveniles must tolerate harsh environments early in life, the disproportionate success of certain phenotypes across multiple early life stages will dramatically influence adult community composition and dynamics. In many species, large offspring have a higher tolerance for stressful environments than do smaller conspecifics (parental effects). However, we have a poor understanding of whether the benefits of increased parental investment carry over after juveniles escape harsh environments or progress to later life stages (latent effects). To investigate whether parental effects and latent effects interactively influence offspring success, we determined the degree to which latent effects of harsh abiotic conditions are mediated by offspring size in two stony coral species. Larvae of both species were sorted by size class and exposed to relatively high temperature or low salinity conditions. Survivorship was quantified for six days in these stressful environments, after which surviving larvae were placed in ambient conditions and evaluated for their ability to settle and metamorphose. We subsequently assessed long-term post-settlement survival of one species in its natural environment. Following existing theory, we expected that within and between species, larger offspring would have a higher tolerance for harsh environmental conditions than smaller offspring. We found that large size did enhance offspring performance in each species. However, large offspring size within a species did not reduce the proportional, negative latent effects of harsh larval environments. Furthermore, the coral species that produces larger offspring was more, not less, prone to negative latent effects. We conclude that within species, large offspring size does not increase resistance to latent effects. Comparing between species, we conclude that larger offspring size does not inherently confer greater robustness, and we instead propose that other life history characteristics such as larval duration better predict the tolerance of offspring to harsh and variable abiotic conditions. Additionally, when considering how stressful environments influence offspring performance, studies that only evaluate direct effects may miss crucial down-stream (latent) effects on juveniles that have significant consequences for long-term population dynamics.

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