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Experimental evidence for adaptive divergence in response to a warmed habitat reveals roles for morphology, allometry, and parasite resistance

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Abstract

Ectotherms are expected to be particularly vulnerable to climate change driven increases in temperature. Understanding how populations adapt to novel thermal environments will be key for informing mitigation plans. We took advantage of threespine stickleback (Gasterosteus aculeatus) populations inhabiting adjacent geothermal (warm) and ambient (cold) habitats to test whether their evolutionary divergence was adaptive using field reciprocal transplant experiment. We found evidence for adaptive morphological divergence, as growth (length change) in the non-native habitat was found to relate to head, posterior and total body shape. Higher growth in fish transplanted to a non-native habitat was found to be associated with shape profiles closer to that of the native fish. The consequences of transplantation were asymmetric with cold sourced fish transplanted to the warm habitat suffering from lower survival rates and greater parasite prevalence than warm sourced fish transplanted to the cold habitat. We also found evidence for divergent shape allometries that related to growth. Our findings suggest that wild populations can adapt quickly to thermal conditions. However, immediate transitions to warmer conditions may be particularly difficult.

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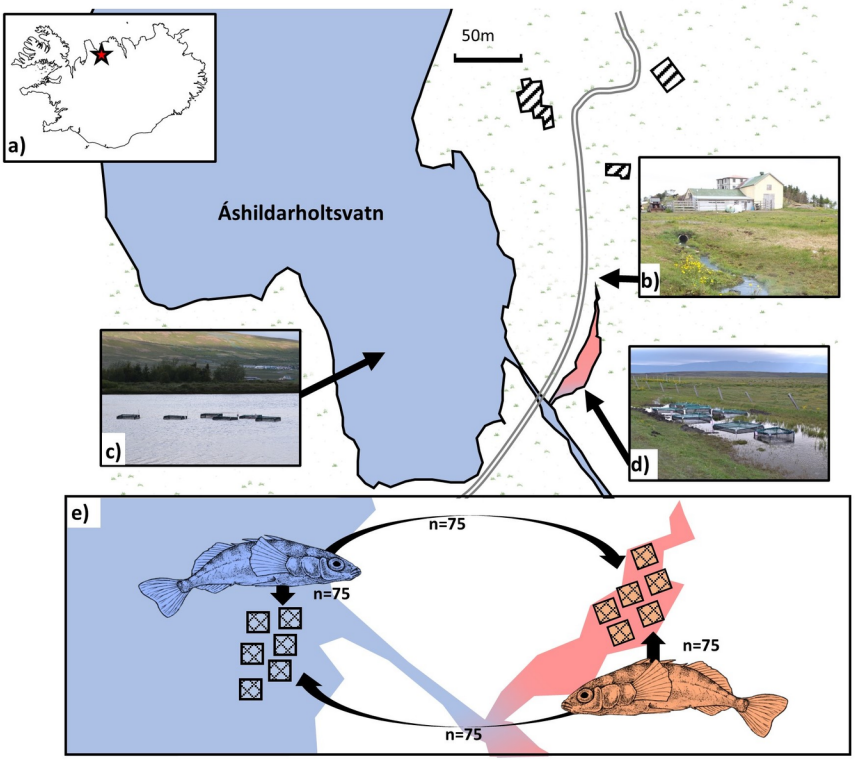

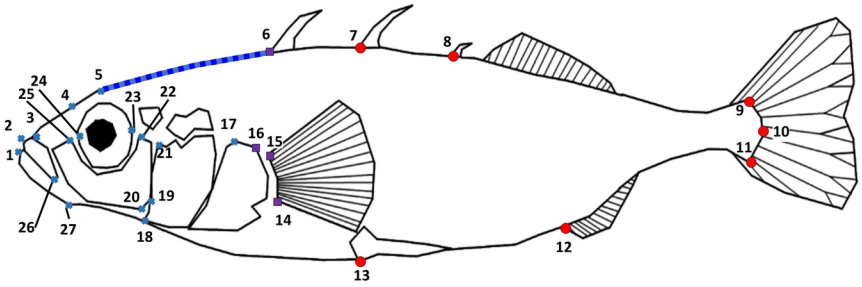

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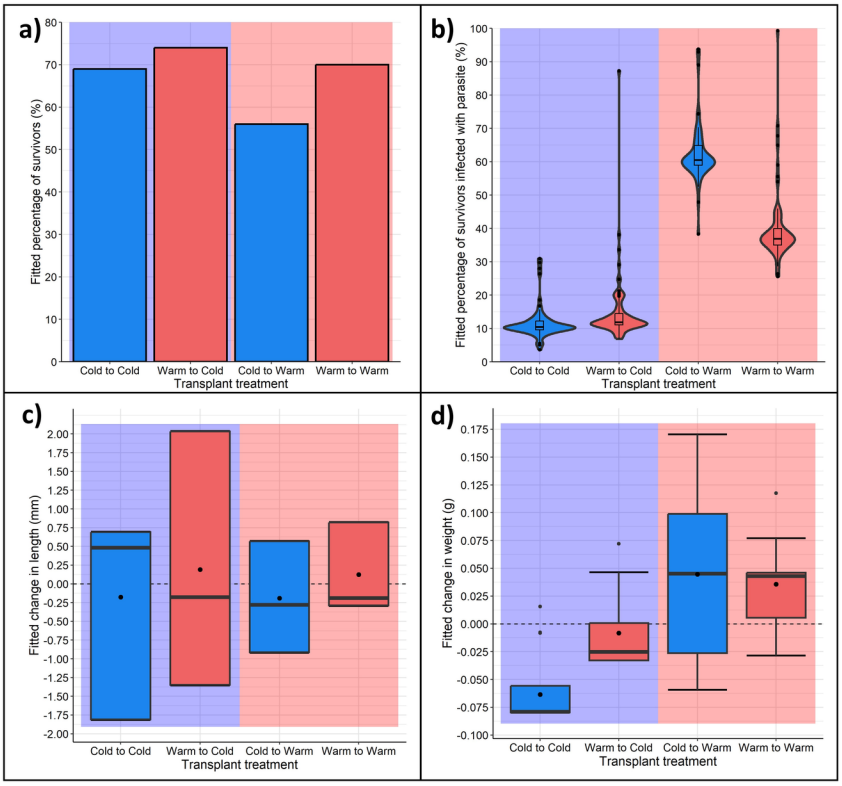

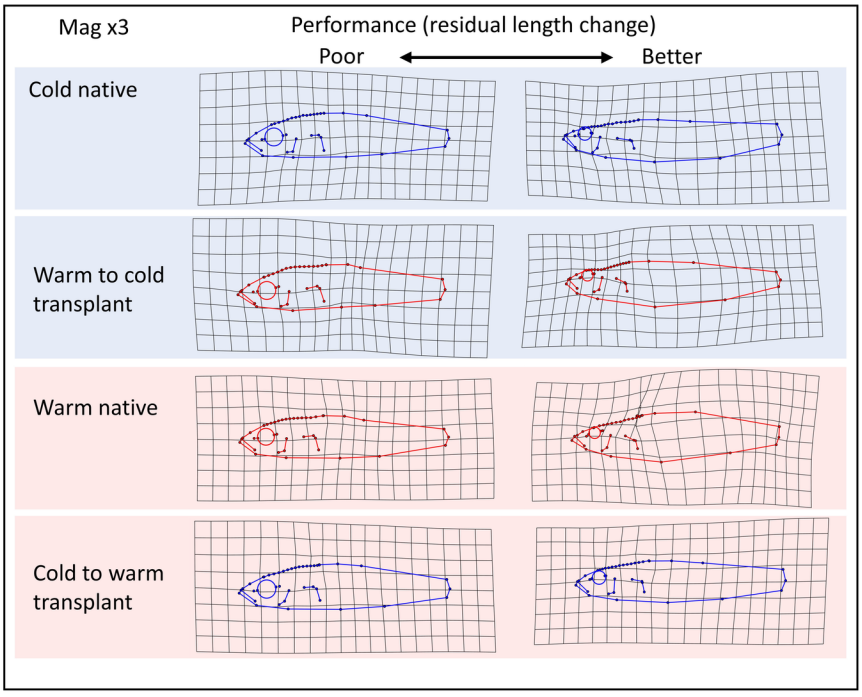

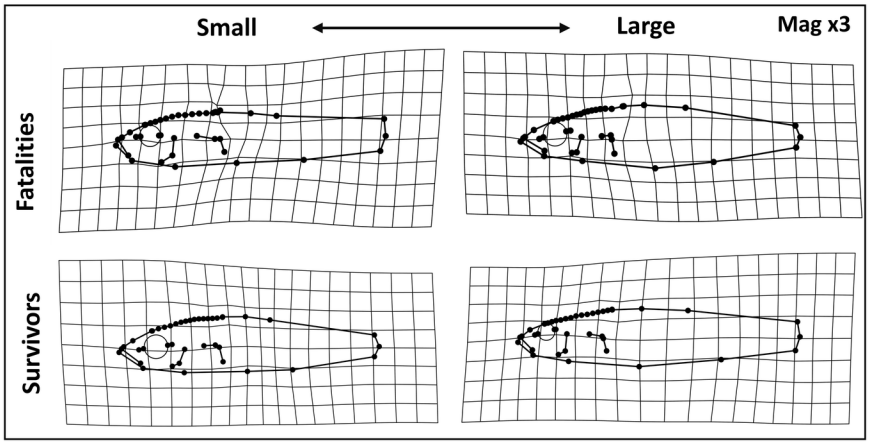

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