Investigating the demogenetic responses of exploited Atlantic salmon (Salmo salar) populations to climate change

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Abstract

A key aim of current ecological research is to predict whether and how populations will be able to respond to environmental change. However, our predictive ability is still limited by the complexity of environments, organisms life cycle and especially by the challenges of teasing apart evolutionary change from more 'plastic' responses to environmental perturbation. Simulation studies provide a powerful tool for disentangling eco-evolutionary processes and investigating interactive, synergistic effects among multiple factors in order to fully understand the resilience of populations in the face of various scenarios of climate change. Using, an Individual-based model, we investigate the demogenetic consequences of environmental change scenarios on an exploited population of Atlantic salmon *Salmo salar*. Our results show that increasing flow amplitude and water temperature in freshwater, and poor oceanic growth conditions resulting from environmental change drove mainly demographic consequences and phenotypic responses, such as a shift towards a multiple-sea-winter life history accompanied by a decline in population size. Effects of environmental change was also contrasted with fisheries strategies impacts to investigate whether fisheries induced evolution and how selective fisheries can promote adaptation to climate change. We show that increased selective fishing against multiple-sea-winter fish mainly induced an evolutionary effect in the form of a lower maturation threshold in females, increasing the proportion of one sea-winter fish. The maturation threshold of males was not modified by selective fishing due to their earlier reproduction and return after a single winter at sea, thereby avoiding most of the selective effects of fishing.

Keywords: climate change, fisheries, induced evolution, individual, based model, life, history strategies, Salmo salar

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