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Conserving and enhancing genetic diversity in translocation programs

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Summary

Small population size and isolation impact genetic diversity through random genetic drift and inbreeding, and can lead to reduced population fitness and an increased risk of extinction. Threatened species often exist as small populations that are highly fragmented and thus prone to the effects of random genetic drift and losses of genetic variation. Conservation strategies therefore need to consider how genetic diversity can be maintained or enhanced when undertaking translocations, both when restoring populations and when introducing them outside their current range (conservation introduction). Here we discuss the genetic impacts of small population size on the persistence of populations and species. We then consider how genetic diversity can be maintained in reintroductions. This depends primarily on sourcing the right number of founders and increasing the effective population size soon after the animals are released or developing reinforcement regimes to preserve genetic diversity. Finally, we discuss the use of different genetic translocations as a way of assisting gene flow in small, isolated populations to reduce inbreeding depression and increase evolutionary potential and resilience. We also discuss conservation introductions and translocations in the context of climate change.

Introduction

The demographic consequences of small population size are of primary importance in conservation biology (Caughley 1994). Conservation strategies generally focus on increasing population size to remove demographic and environmental stochastic threats; often this comes in the form of habitat restoration (including management of predators, pathogens and diseases), captive breeding and translocations. When populations remain small, demographic and environmental stochasticity can result in extinction (Melbourne and Hastings 2008). Small population size also impacts the genetic diversity of populations and, while somewhat controversial in the past, genetic impacts are now recognised as often contributing to the increased risk of extinction of small populations (Frankham 2005; Willi *et al*. 2006; Markert *et al*. 2010).