Genetic Rescue of an Insular Population of Bighorn Sheep

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Abstract: Many bighorn sheep (*Ovis canadensis*) populations are isolated by development and habitat loss. Isolation at small size is thought to reduce individual and population fitness via inbreeding depression. However, little is known about the timescale over which adverse genetic effects may develop in natural populations or the number and types of traits likely to be affected. Benefits of restoring gene flow to isolates therefore also are largely unknown. In contrast, potential costs of migration (e.g., disease spread) are readily apparent. Management for ecological connectivity is controversial and sometimes avoided. Using pedigree and life history data collected over 25 yr, we evaluated genetic decline and rescue in a population of bighorn sheep founded by 12 individuals in 1922 and isolated at an average size of 42 animals for 10 to 12 generations. Immigration was restored experimentally beginning in 1985. We detected marked improvements in reproduction, survival, and 5 fitness-related traits among descendents of the recent migrants. Trait values increased from 23 to 257% in maximally outbred individuals relative to coexisting, minimally-outbred individuals. This is the first demonstration of increased male and female fitness attributable to outbreeding in a fully competitive natural setting. Our findings suggest that genetic principles deserve broader recognition as practical management tools with near-term consequences for large-mammal conservation.

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