

Genetic Rescue Saves Species from Extinction

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When a species' habitat shrinks, its populations decline. Individuals that persist in remaining islands of habitat have no choice but to breed with their relatives. Inbreeding depression describes the reduced survival and fertility of the offspring of related individuals, causing populations to shrink and even go extinct.

An effective solution to inbreeding depression is 'genetic rescue', which introduces genetic diversity. In addition to repairing inbreeding, genetic rescue helps populations to adapt to stressors such as climate change. Genetic rescue encourages inbred individuals from one population to mate with individuals from another. When a population is the last of its kind, this may mean using members of a different subspecies.

Sasha Pavlova and Paul Sunnucks at Monash University conduct research that seeks to increase genetic diversity of small populations, helping them rebound. They have established methods to save endangered species from extinction due to genetic problems, collaborating with conservation managers to test solutions. The two researchers have teamed up with Australian wildlife agencies and international groups to help many endangered species.

One of their targets is the Helmeted Honeyeater. Once common in Victoria, this bird is now found only

in Yellingbo Nature Conservation Reserve after losing over 99% of its habitat to human encroachment.

The team evaluated the genetic health of the birds. The severity of inbreeding depression was shocking: reproductive output of the most inbred birds was only 10% that of the least inbred ones – enough to cause extinction within decades. Because this was the only remaining population of Helmeted Honeyeater, the team's collaborators at Zoos Victoria crossed Helmeted Honeyeaters with another subspecies of Yellow-tufted Honeyeater. These crossed birds are faring well at Yellingbo, and a second population was recently established.

The Macquarie Perch is a freshwater fish endemic to Australia, which has faced tremendous stressors including overfishing and habitat degradation. These fish have retreated into small, isolated populations. When studying the perch, Pavlova argued that rather than needing to demonstrate inbreeding depression for every population, we can instead assess genetic problems by simpler genetic analyses, and predict the benefits of genetic rescue using computer simulations. Her work informed the National Recovery Plan for this species.

As part of the plan, Macquarie Perch from multiple sources were reintroduced into the Ovens River.

Monitoring revealed that using multiple sources led to better survival and reproduction than a single-source approach would have.

Genetic rescue is not limited to animals. The Button Wrinklewort, once a common daisy in Australia, has also lost over 99% of its habitat to human impacts.

The collaborative team of scientists and wildlife managers evaluated genetic diversity in populations of Button Wrinklewort, to figure out which populations should be crossed. Surprisingly, some of the smallest, most isolated populations showed the highest diversity, demonstrating that larger populations don't always have better genetic health.

Genetic rescue is growing in uptake and acceptance. Over the last three decades, scientists including Pavlova and Sunnucks have bridged the gap between genetic research and conservation. As a result of their work, Australia is becoming a leader in using genetic rescue for conservation planning.

Global adoption of genetic rescue can't come quickly enough. According to Sunnucks, 'unless we use genetic rescue as part of our conservation efforts, we will often simply manage small, isolated populations to extinction'.