

New study of endangered pacific pocket mice provides valuable genetic insights

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In breeding programs aimed at conserving animals from small or isolated populations, scientists must balance the competing needs of adding genetic diversity and avoiding the introduction of harmful genes. This makes for a delicate task of boosting diversity in the endangered Pacific pocket mouse, the focus of a long-running conservation breeding program undertaken by San Diego Zoo Global. There are just three

remaining populations of this species in the wild, all of which are small and isolated from each other on the Southern California coast—preventing beneficial interbreeding and making inbreeding more likely.

Drawing on [genetic data](#) from six generations of Pacific pocket mice in this program, a new study has tracked reproductive success relative to a mouse's ancestral [population](#). The findings, published this month in the journal *Conservation Genetics*, indicate that genetic [diversity](#) should be introduced from the larger, genetically healthier populations of Pacific pocket mice into a smaller, less [healthy population](#)—and not the reverse.

"These results reinforce the idea that, when there is a large difference in fitness of populations, gene flow should be unidirectional from the more fit to less fit population, in order to avoid the introduction of deleterious alleles into healthier populations," said Aryn Wilder, Ph.D., a senior researcher in *Conservation Genetics* at San Diego Zoo Global, who is the study's lead author.

The damaging effects of genetic load—the total of harmful mutations in the genome—are too rarely considered in management planning, said Wilder, but should be a central concern.

Using the number of offspring as a measure of fitness, the study examined the reproductive success of more than 300 Pacific pocket mice. Descendants of the smallest and least genetically diverse population had the lowest reproductive success, the researchers found. Interbreeding with the larger, more diverse populations increased the fitness of their offspring relative to this small population, but came at a cost to the larger population.

Weighing about the same as three pennies, Pacific pocket mice are the smallest mouse species in North America. They get their name from

pouches in their cheeks, used to carry food and nesting materials. Endemic only to coastal scrublands, dunes and rivers within about 2 miles of the ocean, the Pacific pocket mouse's range once stretched from Los Angeles to the Tijuana River Valley. Because of human encroachment and [habitat degradation](#), their numbers dropped sharply after 1932. In their [native habitat](#), they disperse the seeds of native plants, and their underground burrows encourage plant growth.

Although the species was believed to be extinct for two decades, Pacific pocket mice were rediscovered in the early 1990s. By then, their range had been reduced to just three populations: one on the Dana Point headlands in Orange County, California and two on Marine Corps Base Camp Pendleton. Two of the populations rarely exceed 50 individuals.

In 2011, the Pocket Mouse Conservation Breeding Facility was created at the San Diego Zoo Safari Park to increase their numbers. In 2017, San Diego Zoo Global and partner organizations established a new population of Pacific pocket [mice](#) in Orange County's Laguna Coast Wilderness Park, where they began to breed without human assistance.

In addition to bolstering the species and maintaining high genetic diversity, the breeding program provides the added benefit of increasing the understanding of how to better manage genetic diversity of populations in the wild.

"This study provides direct data to help us understand how populations will respond to assisted migration," said Wilder. "Boosting [genetic diversity](#) by introducing genes from outside populations may help prevent inbreeding and increase fitness, to better enable wild populations to be self-sustaining."

More information: Aryn P. Wilder et al, Fitness costs associated with ancestry to isolated populations of an endangered species, *Conservation*

Genetics (2020). [DOI: 10.1007/s10592-020-01272-8](https://doi.org/10.1007/s10592-020-01272-8)

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