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Genetic rescue to the rescue

By ARCHBOLD BIOLOGICAL STATION
Jan 6, 2021

Dr. Sarah Fitzpatrick presents an overview of the proposed research on genetic rescue and a photo of the outdoor fish tanks during the Archbold Research Symposium.

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In the fall of 2020, Archbold Biological Station biologist Dr. Betsie Rothermel, along with Drs. Sarah Fitzpatrick and Gideon Bradburd of Michigan State University's W. K. Kellogg Biological Station, were awarded a grant through the National Science Foundation to fund a study based at Archbold, exploring the concept of 'genetic rescue,' the idea that new genes can help otherwise small and inbred populations withstand environmental stress.

Dr. Sarah Fitzpatrick, Assistant Professor at Kellogg Biological Station's Department of Integrative Biology, is the principal investigator on the new project. In her presentation to Archbold's Research Symposium on Dec. 10, Dr. Fitzpatrick described how genetic rescue can be used to boost population sizes of endangered species by introducing genetic variation to a dwindling population. She discussed the widely known genetic rescue success story of the introduction of eight Texas Pumas to Florida in 1995 which helped overcome the inbreeding and decline of the Florida Panther population, and the resultant increase in numbers and genetic diversity.

Fitzpatrick also mentioned she is working on genetic rescue in the federally threatened Florida Scrub-Jay: this was just featured in a full-length article "Rescue Mission" in the Winter 2020 Issue of National Audubon magazine. While the Florida Panther project and a handful of other examples have been successful, Fitzpatrick concluded that genetic rescue is not a widely used strategy for population management, largely because there are still too many unknowns and possible risks when introducing new individuals to an established population.

Dr. Hilary Swain, Archbold Director noted, "We are delighted that Sarah and her co-investigator Betsie Rothermel received this highly-competitive, peer-reviewed, NSF science award. Sarah is to be commended for her success at this early stage in her career. Just as increasing genetic knowledge brought huge benefits for human health, so will increasing genetic knowledge of plants and animals improve conservation outcomes.

"This research will enhance our understanding of genetic rescue as a tool for conservation: this has relevance for many of the plants and animals worldwide that are already on the edge of extinction, and also that other species do not end up in the same perilous position."

This newly funded project at Archbold addresses the need for more testing of genetic rescue to gain acceptance as a tool for conserving biodiversity. Fitzpatrick aims to gain a better understanding of the benefits of increasing genetic diversity by performing long-term experiments on Eastern Mosquitofish. She notes that, "Using a common species like mosquitofish provides a chance to experiment and fine-tune the strategy in a way you can't do with endangered species."

At Archbold, several outdoor tanks have already been constructed to mimic isolated populations of fish and allow researchers to control the evolutionary history of those populations and the environments they experience. The group plans to track changes in genes and in the number of fish in each tank, ultimately hoping to improve the design, implementation, and monitoring of genetic rescue in imperiled species.

According to Fitzpatrick, "We will be monitoring the tanks for hopefully up to two more years, making this a unique long-term multi-generational dataset with lots of replication, which is the kind of study we need to improve our understanding of genetic rescue and use it for conservation purposes. This is important because

genetic rescue is typically used as a last resort strategy when a population is on the brink of extinction," continues Fitzpatrick. "But if we can show that introducing new genetic variation can speed up adaptation to environmental change — it could have major implications for conservation and management of biodiversity."