New model could help save koalas at a fraction of the price

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Biobanking and assisted reproduction could become a reality for koalas by leveraging the existing technology used to help humans conceive. A detailed model, published in the international journal *Animals*, reveals

this would significantly help captive breeding programs to retain genetic diversity, and drastically cut the costs currently required to deliver these programs.

Co-author and conservation scientist at the University of Newcastle, Dr. Ryan Witt, said a koala biobanking and assisted breeding conservation program could future-proof the species, which faces extinction by 2050 without intervention.

"Currently, we have no optimized tools that can store live koala reproductive material, such as sperm. So, we have no insurance policy against natural disasters like the 2019-2020 bushfires that threaten to wipe out large numbers of animals at the one time. If the koala population dies in these kind of fire events, there is no way to bring them back or preserve their genetics.

"Biobanking, if developed for the koala, would offer a solution to store or 'bank' live koala genetics by freezing sex cells such as sperm. The frozen sperm can then be used to impregnate female koalas in breed-for-release programs, using assisted reproductive technology," Dr. Witt said.

Economic modeling

Dr. Witt said their model shows a 5-to-12-fold reduction in overall program costs of current captive koala breeding programs, if biobanking and assisted reproduction is incorporated.

"Captive breeding programs require larger koala colony sizes to prevent inbreeding. But by integrating assisted reproduction we can reduce the number of koalas needing to be in captivity, lower costs, and improve genetic diversity," Dr. Witt said.

"This would free up valuable conservation funding to support a greater

number of species, or to support other koala conservation efforts such as habitat restoration."

Through his Ph.D. research at the University of Newcastle, lead author Dr. Lachlan Howell has spent years developing and analyzing this robust model for various endangered animals but believes it offers the koala the most promise.

"The beauty of applying assisted reproductive technologies to the koala population is that much of the foundation has already been laid, much of the infrastructure is already in place. We've identified 16 wildlife hospitals and zoos across Australia that could act as nodes to collect koala sperm and help integrate assisted reproduction," Dr. Howell said.

"Recent advances have shown us that artificial insemination using fresh and chilled sperm works in koalas. The hurdle is trying to freeze sperm and make use of it. All that is needed now is more research and funding to tweak existing assisted reproduction technologies so that we can cryopreserve koala sperm, just like we do for humans."

The genetic benefit

While captive breeding programs are a powerful tool to save koalas, they face significant challenges of high costs and genetic diversity.

Dr. Howell said genetic issues in koalas can lead to reproductive dysfunction and infertility.

"These issues can also compromise survival, disease resistance, and the species' ability to adapt to changing environmental conditions from climate change.

"Our modeling shows that supplementing frozen founder sperm into

koala colonies using various assisted reproductive technologies—such as those common in agriculture and human fertility—could significantly reduce inbreeding and allow captive programs to hold smaller colonies whilst still meeting optimal genetic diversity targets," Dr. Howell said.

"By using frozen sperm, we can reintroduce genetic variation into wild koala populations without having to relocate koalas. In New South Wales for example, koala populations are declining rapidly in some locations so they would greatly benefit from the introduction of biobanked material from other unique populations to help manage genetic diversity," Dr. Howell explains.

If cryopreservation is made possible for koalas, it will also open the door to recover and biobank genetic material from koalas who may have died in bushfires or been hit by cars so they can still contribute to reproduction and the population.

Proven success: The black-footed ferret

In North America, an applied research effort to save the black-footed ferret from near-extinction proved successful.

Dr. Howell said dedicated research funding meant assisted reproductive techniques such as freezing sperm and artificial insemination could be developed for the ferret.

"In 1981 the black-footed ferret population was reduced to just 18 animals. And now through years of research, assisted reproduction has become a reality for the animal," Dr. Howell said.

"Sperm frozen for 20 years was used to artificially inseminate some of the captive bred ferrets which were becoming more inbred over time. This was crucial to reintroduce genetic variation in the captive

population, which over time suffered reproductive complications from inbreeding.

"Thousands of ferrets have since been born and released into the wild.

"In this case, researchers cryopreserved black-footed ferret sperm many years before they figured out how to use the sperm in assisted breeding. This may be the pathway we need to take to ensure the future of Australia's much-loved koala," Howell said.

More information: Lachlan G. Howell et al, Modelling Genetic Benefits and Financial Costs of Integrating Biobanking into the Captive Management of Koalas, *Animals* (2022). DOI: 10.3390/ani12080990

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