THE CONVERSATION

Academic rigour, journalistic flair

The program can work well for polygamous species such as gorillas. Mary Ann McDonald/shutterstock.com

Swingers' hookup program can find the right match for endangered species

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A quick look at the popularity of online dating services like OkCupid and eHarmony shows us that people are pretty comfortable with letting an algorithm choose them a mate. Now we at the Flinders Molecular Ecology Lab want to do a similar thing for other animals.

With human-driven extinctions on the rise, many species are likely to be left relying on captive breeding for their survival. We hope that our algorithm will help ensure these breeding programs are successful, by pairing up matches who will have healthy, thriving offspring.

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Unlike human dating services, we cannot ask a snake, fish or possum to answer questions. But we can look at their DNA. This allows us to breed individuals who are not closely related, avoiding the genetic problems that arise from inbreeding, and thus producing healthy populations with a diverse gene pool.

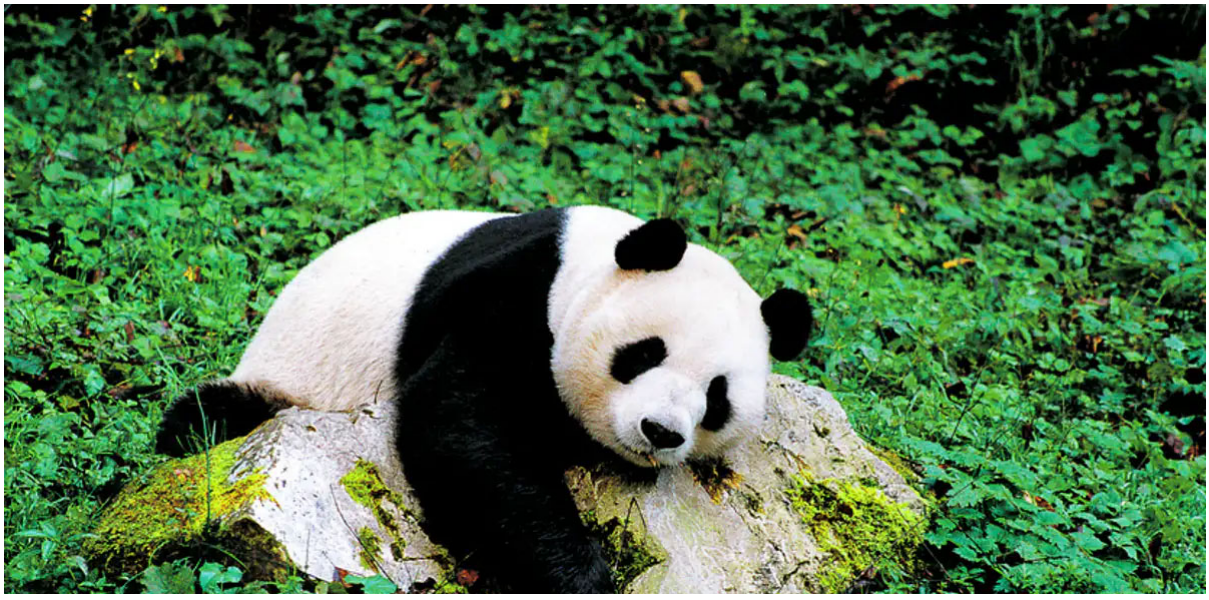
We have created Swinger, a computer program that uses DNA profiling to matchmake endangered animals for captive breeding - especially those that have multiple mates - and which we describe in a paper published in the journal *Molecular Ecology Resources*. We envision it helping to conserve many endangered animals, with the first animals being native freshwater fishes in Australia.

It’s all in the DNA

Genetic diversity is crucial, because it helps populations to adapt and evolve in response to environmental changes that they may encounter in the future. So maintaining a large gene pool is an important consideration for captive breeding programs, particularly in populations that have already dwindled to small numbers. This makes avoiding inbreeding vitally important.

Many species kept in zoos – such as pandas – have clear family relationships or are bred in pairs and so their parentage is certain. Armed with pedigree information, it is relatively easy for zoos to select unrelated breeding pairs, often by working in collaboration with other zoos.

But most animals in the world are polygamous, with each individual naturally having multiple partners, even around the same time. This is where it becomes harder to track family relationships, unless you can examine their DNA.



It's easier with pandas - well, the choosing part at least. Ritesh251123/Wikimedia Commons, CC BY-SA

The matchmaking algorithm is also ideal for starting a captive breeding program from individuals newly brought into captivity. This is because we often have no idea about their relationships to each other, except through DNA, and they may be highly related individuals.

The very circumstances that brought about the need for captive breeding also often results in inbreeding in wild populations. This is because the population has reduced in size to the point that individuals may unavoidably breed with their close relatives. This makes it especially important to ensure breeding in captivity occurs between unrelated individuals.

Captive breeding of swingers

Even when dealing with such serious issues as extinction, we like to keep a sense of humour – hence the name Swinger, which we feel is pretty appropriate given that individuals of most species in the world are naturally polygamous. Indeed, our algorithm is just as suitable for setting up polygamous breeding groups as monogamous ones.

The algorithm is inspired by our efforts to save freshwater fishes in Australia. Native freshwater fish lineages recently became at risk of extinction due to human activities during the Millennium Drought in the Murray-Darling Basin, in southeastern Australia. The fish needed to be saved by their removal from the wild before their habitat completely dried out.

Test species: Running River rainbowfish. Steven Hume, Author provided

We created breeding groups of these rescued polygamous fish. This was done by using DNA information to create, by hand, “swinger” groups of unrelated individuals. The breeding was successful, with offspring reintroduced to the wild. However, the breeding groups were unavoidably sub-optimal because at that time we had no algorithm to work out the best possible mates for individuals.

Swinger is now being used to save native rainbowfish in northern Queensland. Although it is still early days, the rainbowfish breeding has been very successful, producing thousands of fingerlings that our collaborators are releasing to the wild.

We are also using Swinger to inform the design of a breeding program of endangered species of Galápagos giant tortoises previously considered extinct. These tortoises were rediscovered in a remote volcano and moved to the captive breeding facility of the Galápagos National Park. The aim is to reintroduce the captive-born offspring to the island where they evolved.

The brilliance of DNA is that it is in all living things. This means that Swinger could potentially be used to help breed all endangered species with sexual reproduction - especially, of course, the many polygamous species.

To borrow another concept from the world of human dating, there will hopefully soon be “Plenty of Fish” as a result of our efforts.

Fish **Endangered species** **Captive breeding** **genetic diversity** **DNA analysis**