Finding the right partner can be difficult if you're choosy – and let you go extinct if you're stranded on an island

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The forming of new biological species requires a genetic divergence between different evolutionary lineages. In practice, this means that populations of the same species experience different selective pressure and as a result develop in different directions. However, this is only possible if the exchange of genes through breeding between individuals of these populations is limited.

Often in nature, such limitation results from long distances separating populations or a barrier such as a mountain range or an ocean which make travelling of individuals back and forth impossible. Yet there are examples where populations have diverged despite complete isolation from one another. Restrictive mate choice such as mating only with individuals of the opposite sex that look similar to oneself, or preferring especially capable and healthy partners can be imagined as one of the mechanisms working in such a scenario: As the desired properties are more likely to occur in individuals adapted to the local conditions, immigrants from other populations can be excluded from mating.

It can be imagined, though, that if these mechanisms of choosiness can become so strong as to limit population growth: if a suitable partner cannot be found, one might just leave no offspring at all. This problem is bigger in smaller populations, as there are fewer possible mates around (one example of a group of disadvantageous effects related to small population sizes, named “Allee effects”). It may hinder such small populations - for example on an island off the coast of a continent - from forming new species, because they may go extinct before any divergence takes place.

In my thesis, I built a computer model of such interacting populations, simulating every individual and their mating behaviour, i.e how many potential mates they met and how they decided to choose with whom to mate. I found that many different factors decide whether a newly-founded island population can diverge from a larger continental population which spawned it. Among the ones I tested, strength of choosiness, population size, natural selection and difference between the environments of the populations proved important. There seems to be a window in which divergence can occur to a degree where the new population is fully adapted to its environment. Outside of this window, founder populations either still mate with their continental cousins (and thus do not diverge) or go extinct due to very strong choosiness and the resulting failure to mate.

These theoretical findings still need to be validated in comparison with nature, but might provide helpful insights into such matters as understanding the past of families of species, conservation or pest control.

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