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Optimization Strategies for Captive Breeding

Brigitte Tenhumberg
University of Nebraska - Lincoln, btenhumberg2@unl.edu

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There are many uncertainties that must be evaluated when captive breeding is considered. We have begun examining methods for supporting captive breeding decision-making by combining stochastic models with optimization methods. Captive breeding decisions should be state dependent – i.e., the best decision when there are 20 animals left might be different from one when there are 100 animals left. The method we use to search for state dependent decisions that minimize the risk of extinction for a species is called Stochastic Dynamic Programming. We construct stochastic models of two populations, a captive population and a wild population, and use stochastic dynamic programming to identify the optimal size of translocations between captivity and the wild. For an initial test we parameterized the model with data on Arabian oryx (*Oryx leucoryx*). A key result is the importance of captive breeding in minimising the extinction risk of a species in the wild if we can be sure that the captive population will fare better than the wild population. If the wild population is small the entire wild population is best transferred to a captive breeding facility even if the population in the wild is growing. The optimal strategy for release should not compromise the captive population, so at any point in time only one or two animals are released. As a result of the high growth rate of the captive population the released animals are replaced quickly and can be released the following year. Therefore, the optimal release strategy stretches the release effort over several years, ultimately releasing a large number of animals. In future work we are going to test the generality of our results by varying parameters such as translocation costs, birth and death rates of the endangered species in the wild and in captivity, and uncertainty about the breeding success in captivity.

From Brigitte Tenhumberg (btenhumberg@zen.uq.edu.au), Hugh P. Possingham and Drew Tyre