HOW VULNERABLE IS THE BLACK RHINO?
A genetic and demographic analysis

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To determine the vulnerability status of South African black rhinoceros populations it was necessary to study black rhino population biology. Since population genetics and population demography are the two main themes of population biology, the aim of this project was to investigate both of these in order to make valuable management recommendations. The effective population size is the critical factor for the conservation of the black rhinoceros since most of the remaining populations are small.

Thirty protein and enzyme-coding loci of four black rhinoceros populations were analyzed to determine the levels of genetic variation. Protein electrophoresis revealed that all four populations still carry high levels of genetic variation. This is reassuring for the long-term survival of the species.

A polymorphism of glucose-6-phosphate dehydrogenase (G-6-PD) was observed. Evidence suggests that a deficiency of this enzyme is associated with intravascular haemolysis similar to the situation in humans. Stress associated with capture and the administration of some drugs to rhinoceroses may induce haemolytic anaemia in animals that carry an allele that is G-6-PD deficient.

Analysis of demographic factors indicate that wild black rhinoceros populations remain stable (i.e. sex ratio and age structure do not change dramatically) even if they experience ecological threats such as competition, predation, droughts and fire. Poaching has a negative effect on the sex ratio and age structure, however, and will result in a serious decline in effective population size.

A demographic extinction model (DEMM) was written to determine the persistence time of black rhinoceros populations. The model uses a Leslie matrix with age-specific fecundity and mortality data. The results of DEMM compare well with other extinction models, e.g. Vortex and Goodman's models. All three models (based on the small population aproach) suggest that demographic and environmental stochasticity will cause the three black rhinoceros populations (captive, Mkuzi and Tsavo) to go extinct within 300 years. This highlights the urgent need for intensive management of the remaining black rhinoceros populations. The population persistence analysis model (PPA) was also used to predict the persistence time of larger black rhinoceros populations. PPA is based on the declining population approach and only requires census data which makes this model more accessible to managers of rhinoceros populations. Ideally, PPA can be used to prevent the small population situation by identifying a decline in a population at an early stage. If a population is already classified as "small", extinction models such as DEMM, Vortex and Goodman, which address the problems faced by small populations, are invaluable. Managers of black rhinoceros populations can use extinction models as valuable tools to assist them in making scientific decisions for the conservation of the species.

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