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Review Article

CAPTIVE BREEDING IN ENDANGERED WILDLIFE: A REVIEW

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ABSTRACT

The captive breeding is one aspect of species conservation efforts, which involve breed animals of an endangered species in captivity with the goal of releasing them back into the wild at some time in the future. The captive breeding of endangered wildlife animals is often necessary for their conservation. It prevents the extinction of a species, subspecies or population. Small captive populations are likely to become extinct. Detailed breeding plans based on the principles of population genetics and demography can greatly increase their chances of long-term survival. Captive breeding started with small number of founder population potentially increases the chances of inbreeding that lead to poor fitness of these populations, decrease in genetic diversity and reproductive and survival rates leading to increased extinction risk.

Key words: Captive breeding, Founders, Inbreeding

INTRODUCTION

Captive breeding is the process of breeding of wild animals in places such as zoos or wildlife parks, especially to help preserve endangered species that are threatened by extinction in the wild. The process also includes the release of individual species to the wild, when there is sufficient natural habitat to support new individuals or when the threat to the species in the wild is minimized. Conservation biologists aim to prevent species extinction in the wild, usually by removing probable threats such as invasive species, habitat loss or poaching. In certain cases, however, *in situ conservation* efforts may be insufficient, not all species can be efficiently preserved in their natural habitats and more extreme involvement such as captive breeding may be advocated to enhance the probability of species perseverance¹, though it is very expensive². A major goal of captive breeding programmes is the preservation of maximum genetic variability within a species.³ The techniques from genetics and genomics can be useful for preventing, the process of extinction.⁴ Modern methods for sequencing and genotyping make it possible to directly assess the genetic diversity of a species and identify its population structure, sequencing a small sample of geographically distinct individuals can identify a number of the available genetic variants and genotyping methods can then efficiently determine the genetic make-up of a large number of individuals in population. Captive breeding programs bring about biodiversity and may save species from extinction. Conservation genetics has received increasing attention in recent years.⁵ In conservation genetics, information of the relatedness between individuals is particularly important in captive breeding programs that to reduce mating between closely related individuals in order to minimize inbreeding and the loss of genetic variation.⁶ Inbreeding and the loss of diversity has been recognized as a major problem in *ex situ conservation* since the 1970s⁷, which has led to the

implementation of captive breeding schemes.³ In general, to use as many founders as possible to start a captive breeding programme, which should be large, non-inbred and unrelated.⁸ However, threatened animals brought into captivity often have small population sizes and therefore the founders may be related to each other.⁹

Captive breeding programmes should aim at the creation and conservation of healthy, self-sustaining captive populations that resemble their wild counterparts as closely as possible both in behavior and genetics.¹⁰ Many captive breeding programmes use studbooks to record pedigree information.³ A combination of the pedigree and microsatellite information may in fact be the optimal method for measuring genetic relationships especially when pedigree information is incomplete.¹¹ Molecular methods play an important role in estimating the genetic diversity among individuals by comparing the genotypes at a number of polymorphic loci.¹²

Advantages of captive breeding

Captive breeding is a key component in many threatened species management programmes.¹³ Zoos or wildlife parks holding the world's endangered species in captivity and saving their genetic material from total elimination. Captive breeding programs also have goals for the reintroduction of these animals back into a natural or wild environment. These reintroductions can help in conservation efforts by keeping population numbers up and decreasing inbreeding and genetic drift. Worldwide 168 bird species are captive bred for the purposes of re-introduction and population supplementation.¹³

Drawbacks of captive breeding

Captive populations are often started with a low number of founders, either because it is difficult to collect more individuals or because there are simply no more available.¹⁴ This low number of founders increases the risk that deleterious alleles

become homozygous and lead to inbreeding depression. With the possibility of inbreeding, in small populations genetic drift occur, where genes have the potential to disappear completely and reducing genetic variation and population display inbreeding's detrimental effects, which were observed in the least genetically variable felid species such as cheetah. Thus, it was very difficult to pair animals in a way that would increase genetic diversity because, all cheetahs were essentially genetically identical.¹⁵ The decline in genetic variation decreases its disease immunity, long term survival, lower individual fitness¹⁶, poor adaptability¹⁷ and phenotypic abnormalities. Wildlife populations with lower genetic diversity are at greater risk of extinction.¹⁸ Genetically inferior endangered populations often fail to exhibit signs of recovery until crossed with individuals from other populations.¹⁹ Maintenance of genetic viability is widely considered a key factor for long-term viability of populations²⁰, particularly when populations have undergone severe bottlenecks.¹⁴ Population bottlenecks increase inbreeding and can lead to decreased heterozygosity, increased genetic load and increased expression of deleterious alleles.²¹ The frequency of disease outbreak in captive population due to enhanced exposure to exotic pathogens. The prevalence of international wild life trade and normally close connect of diverse species in zoos into contact with diseases and parasites for which they have little resistance.²²

Recommendations

Knowledge and studies on genetics can reduce the extinction risk by helping to develop appropriate population management programs that can minimize the inbreeding risks. Breeding programs are often started with wild founders initiating the captive population are unrelated. Mobilizing public awareness of conservation issues, give adequate funding to local institutions to breed and maintain native species, provide environmentally adapted species for reintroduction programme.

CONCLUSION

Assessment and preservation of biodiversity of wild populations is crucially important to minimize the loss of initial genetic variation as a consequence of inbreeding. Inbreeding can affect the long-term viability of small populations by decreasing fitness, therefore it is necessary to avoid inbreeding in captive breeding management programmes. Appropriate breeding programmes need to be established for these endangered species or the existing programmes need to be assessed and strengthened.

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