# Zoos, Wissenschaft und Naturschutz

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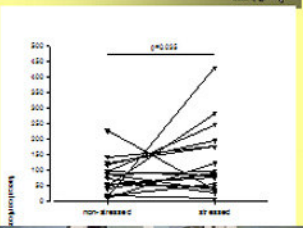
## Today's talk

- Current contributions of zoos to conservation science
- The potential of zoos for conservation science
- Research and the future conservation agenda of zoos: ex situ
- Research and the future conservation agenda of zoos: in situ

## Contribution of zoos to conservation science now : calibrating non-invasive methods

- Calibration of non-invasive physiological methods to assess reproductive status (including oestrus detection) and stress levels in faeces and urine
- *Example: calibrating assays for glucocorticoid metabolites in spotted hyenas to assess stress during periods of social instability in a free-ranging population*



## Before I start ...

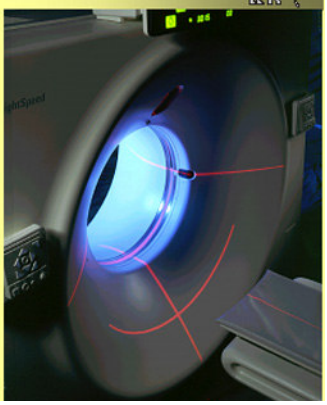
- comments in the spirit of the draft document of the World Zoo and Aquarium Conservation Strategy
- a personal view of key developments
- no ambition to completeness; use examples to give a flavour
- mammal-biased because of my personal expertise

## The potential of zoos for conservation science: zoos are an experiment in population biology

- Zoos constitute a giant **experiment** on the viability and maintenance of genetic diversity of small, highly structured populations, with many repeats (i.e. many species involved)
- If designed from scratch, such a giant experiment would be highly suitable to answer a multitude of fundamental questions in population biology and evolution, and thus in conservation.
- Without zoos, it could not be done.
- Why this potential?

## Contribution of zoos to conservation science now: basic biology

- *Example: non-invasive sophisticated imaging techniques to study the basic biology of fossa*



## The potential of zoos for conservation science: Zoos are also an experiment in evolution

- Evolution: change of gene frequencies between generations
- Evolution happens all the time
- Evolutionary changes in physiological traits and behaviour and loss of behavioural traditions can take place in very few generations
- *Example: massive changes in allocation to reproductive tissue (25 % increase in testicle weight after 2 generations in captive wild stock of Mongolian gerbils)*

## Research and the conservation agenda of zoos: ex situ

- Planning for conservation breeding will include the eventual release of captive individuals
- Variation in „quality" or „environmental competence" of individuals might become important

## Selection and environmental competence ?

- Is there selection on environmental competence in zoos? Is selection pressure on environmental competence „relaxed" in a zoo environment?
- *Example: drought resistance lost in Arabian oryx when water was freely offered in captive environment [and regained after a few generations when the offer stopped]*

## Welfare and stress resistance ?

- Trade-off between animal welfare considerations and attempts to maximise the conservation value of an individual?
  - Genetic basis of coping with environmental stress
  - Only expressed in times of environmental challenge
- *Example: Loss of „resistance" genes in Drosophila fruit flies to challenging temperatures if kept in a benign environment (the „heated floor paradigm")*

## Pathogen resistance and mate choice ?

- Sexual selection and mate choice:
  - female mate choice linked to genes for pathogen resistance
  - elaborate visual, acoustic and chemical male displays permit females to chose between males that vary in their ability to resist pathogens
- *Example: Sticklebacks, peacock, Homo sapiens[?] … (many)*
- Do we conclude from this that the practice of random mating of zoo animals is still suitable?

## Research and the conservation agenda of zoos: in situ

- In situ conservation efforts run by zoos are experiments: thus they can (and should) be designed like scientific experiments
- Serious in situ conservation efforts require long-term commitment: they should be carefully planned and include long-term scientific monitoring (e.g. of released individuals)
- In situ conservation efforts need to apply principles of conservation science (population dynamics, population genetics, behavioural ecology, physiology, reproductive science)

## Outlook – quo vadis?

- Zoos can provide excellent opportunities for first class high quality scientific research.
- The potential of zoos is not fully realised.
- Relatively modest additional efforts promise to provide significant returns in terms of scientific progress and would strengthen the scientific credibility of zoos.
- Committed and serious conservation efforts that involve zoo animals pose a host of new questions for which answers are still lacking to a great degree.
- These questions highlight the importance of variation in individual quality (environmental competence, conservation value).

## Outlook – quo vadis?

- Examples are
  - the ability to cope with environmental challenges;
  - pathogen resistance, an important factor in mate choice for many species.
- Some answers will only be obtained if there is a long-term commitment and substantial effort; networks may provide a solution.
- Rapid scientific advances in recent years have provided techniques for assessing individual health and reproductive status, paternity and other genetic aspects, epidemiological aspects and stress load in a minimally-invasive manner.
- These techniques require such expertise that closer co-operation of zoos with specialised research institutions will become increasingly useful.

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