‘The more the merrier’ or ‘Happy when alone’?

Hypothesis on stress susceptibility in captive individuals of solitary species

Marcus Clauss, Dennis Müller, Hanspeter Steinmetz, Jean-Michel Hatt
The concept of ‘stress’

- Stress is known to cause disease susceptibility in humans and laboratory animals

- Little compelling evidence in zoo animals

- How to measure stress
  - faecal corticosteroids
  - disease incidence
  - mortality
  - longevity
  - abnormal behaviour
  - reproductive success
Management factors related to ‘stress’
Management factors related to ‘stress’

- Enclosure size, enclosure design
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
Management factors related to ‘stress’

• Enclosure size, enclosure design
• Climatic conditions
• Exposure to visitors, visitor behaviour
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
- Diet, diet presentation
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
- Diet, diet presentation
- Behavioural enrichment
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
- Diet, diet presentation
- Behavioural enrichment
- Neighbour species?
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
- Diet, diet presentation
- Behavioural enrichment
- Neighbour species?
- Special events (transport, introduction)
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
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- Neighbour species?
- Special events (transport, introduction)
- Group size
Management factors related to ‘stress’

- Enclosure size, enclosure design
- Climatic conditions
- Exposure to visitors, visitor behaviour
- Keeper behaviour, husbandry routine
- Diet, diet presentation
- Behavioural enrichment
- Neighbour species?
- Special events (transport, introduction)
- Group size
- Medication
Animal factors related to ‘stress’
Animal factors related to ‘stress’

• Origin (wild born/captive born)
Animal factors related to ‘stress’

• Origin (wild born/captive born)
• Rearing history (parent-reared/hand-reared)
Animal factors related to ‘stress’

• Origin (wild born/captive born)
• Rearing history (parent-reared/hand-reared)
• Health status (incl. obesity)
Animal factors related to ‘stress’

- Origin (wild born/captive born)
- Rearing history (parent-reared/hand-reared)
- Health status (incl. obesity)
- Social rank
Species-specific approach

- Comparison of husbandry regimes ...
- Comparison of health status ...
- Comparison of rank ...
Species-specific approach

- Comparison of husbandry regimes ...
- Comparison of health status ...
- Comparison of rank ...

... within individuals of a species
Comparative approach (between species)?
Comparative approach (between species)

Why and how should we use environmental enrichment to tackle stereotypic behaviour?

G. Mason *, R. Clubb, N. Latham, S. Vickery

![Graph showing the percentage of species engaged in stereotypic behaviour]

- Carnivore species ($n = 61$)
- Ungulate species ($n = 26$)
- Rodent species ($n = 15$)
- Primate species ($n = 19$)

Sole/most common form of abnormal repetitive behaviour
Comparative approach (between species)

Captivity effects on wide-ranging carnivores

Ros Clubb, Georgia Mason

NATURE | VOL 425 | 2 OCTOBER 2003
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Graphs showing relationships between captive-infant mortality and minimum home-range size, as well as stereotypy frequency and minimum home-range size.
Comparative approach (between species)

Relevance of management and feeding regimens on life expectancy in captive deer

Dennis W. H. Müller, DVM; Laurie Bingaman Lackey, MA; W. Jürgen Streich, Dr rer nat; Jean-Michel Hatt, Prof Dr med vet; Marcus Clauss, PD, Dr med vet
AJVR, Vol 71, No. 3, March 2010
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![Graph showing life expectancy in female deer with different feeding regimens.](image-url)
Differences in sociality
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• Social species usually kept in groups
Differences in sociality

- Social species usually kept in groups
- Solitary species usually kept in ... ?
Differences in sociality

- Social species usually kept in groups
- Solitary species usually kept in ... ?

Examples

Social species:
- Okapi
- Orangutan

Solitary species:
- Leopard
- Cheetah
Differences in sociality

• Social species usually kept in groups
• Solitary species usually kept in ...

... pairs
Differences in sociality

• Social species usually kept in groups
• Solitary species usually kept in ... pairs
... or as individuals ...
Keeping animals ‘individually’
Keeping animals ‘individually’
Differences in sociality

• Social species usually kept in groups
• Solitary species usually kept in ... pairs

... or as individuals *in close vicinity to a conspecific*
Differences in sociality

- Social species usually kept in groups
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... or as individuals *in close vicinity to a conspecific*

- Higher exposure to conspecifics in captive vs. free-ranging individuals of solitary species.
Examples
Example 1: Brocket deer (*Mazama gouazoubira*)

Influence of husbandry systems on physiological stress reactions of captive brown brocket (*Mazama gouazoubira*) and marsh deer (*Blastocerus dichotomus*)—noninvasive analysis of fecal cortisol metabolites

Maurício Durante Christofoletti • Ricardo José Garcia Pereira • José Maurício Barbanti Duarte

*Eur J Wildl Res*
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kept individually, indoors

pair outd. / indiv. indoors
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kept individually, indoors
kept as pair, outdoors
pair outd. / indiv. indoors
Example 2: Black rhino (*Diceros bicornis*)

Relationships Between Patterns of Fecal Corticoid Excretion and Behavior, Reproduction, and Environmental Factors in Captive Black (*Diceros bicornis*) and White (*Ceratotherium simum*) Rhinoceroses

Kathy Carlstead\(^1\)\(^*\) and Janine L. Brown\(^2\)

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Black rhino pairs that were kept separated exhibited lower corticoid variability and less fighting activity when they were introduced during female estrous periods compared to pairs that were kept together every day.
Example 3: Orang utans (*Pongo* spp.)

<table>
<thead>
<tr>
<th>Sumatran (<em>P. abelii</em>)</th>
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<td>Males solitary</td>
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<td>Females in family groups</td>
<td>Females solitary</td>
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Example 4: Cheetah (*Acinonyx jubatus*)

Impact of social management on reproductive, adrenal and behavioural activity in the cheetah (*Acinonyx jubatus*)

Nadja C. Wielebnowski¹, Karen Ziegler², David E. Wildt¹, John Lukas² and Janine L. Brown¹

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Although generally solitary in the wild, zoos frequently house cheetahs in pairs or groups.
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*Animal Conservation (2002) 5, 291–301*
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H. Steinmetz (pers. obs.)

Lick dermatitis in a private-owned captive cheetah that healed when the wire mesh fence that separated the individual from the other cheetah of this owner was replaced by a plywood wall.
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What does ‘solitary husbandry’ really imply?
What other species could benefit from ‘solitary confinement’?

• Ungulates (okapi)?
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- Ungulates (okapi)?

- Bears (giant panda)?
What other species could benefit from ‘solitary confinement’?

- Ungulates (okapi)?
- Bears (giant panda)?
- Tigers and other felids?
Practical approaches?
Practical approaches?
Practical approaches?
Practical approaches?
Practical approaches?
Food for thought

• Do you have individuals of solitary species in your collection that might ‘suffer’ from too close vicinity of conspecifics?
Food for thought

- Do you have individuals of solitary species in your collection that might ‘suffer’ from too close vicinity of conspecifics?