Welfare Indicators for Zoo and Wild Animals: theory and examples from practice

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Harm to welfare

Kirkwood (1994)

- M of a case (in animal days) can be calculated:

$$M = n \times t \ / \ L$$

- where

  - n = number of animals involved
  - t = mean duration of harm to each individual (days)
  - L = maximum life span (days)

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From the animals' point of view

$$W = g_1 G_1 + g_2 G_2 ..... g_n G_n - b_1 B_1 - b_2 B_2 .... b_n B_n$$

Where

W = welfare of an animal

G_n = type of good experience

g_n = the number of G_n good experiences

B_n = type of bad experience

b_n = the number of B_n bad experiences

n = number 1 to ∞

This equation can be summarized as:

$$W = \sum_{n=1}^{\infty} g_n G_n - \sum_{n=1}^{\infty} b_n B_n$$

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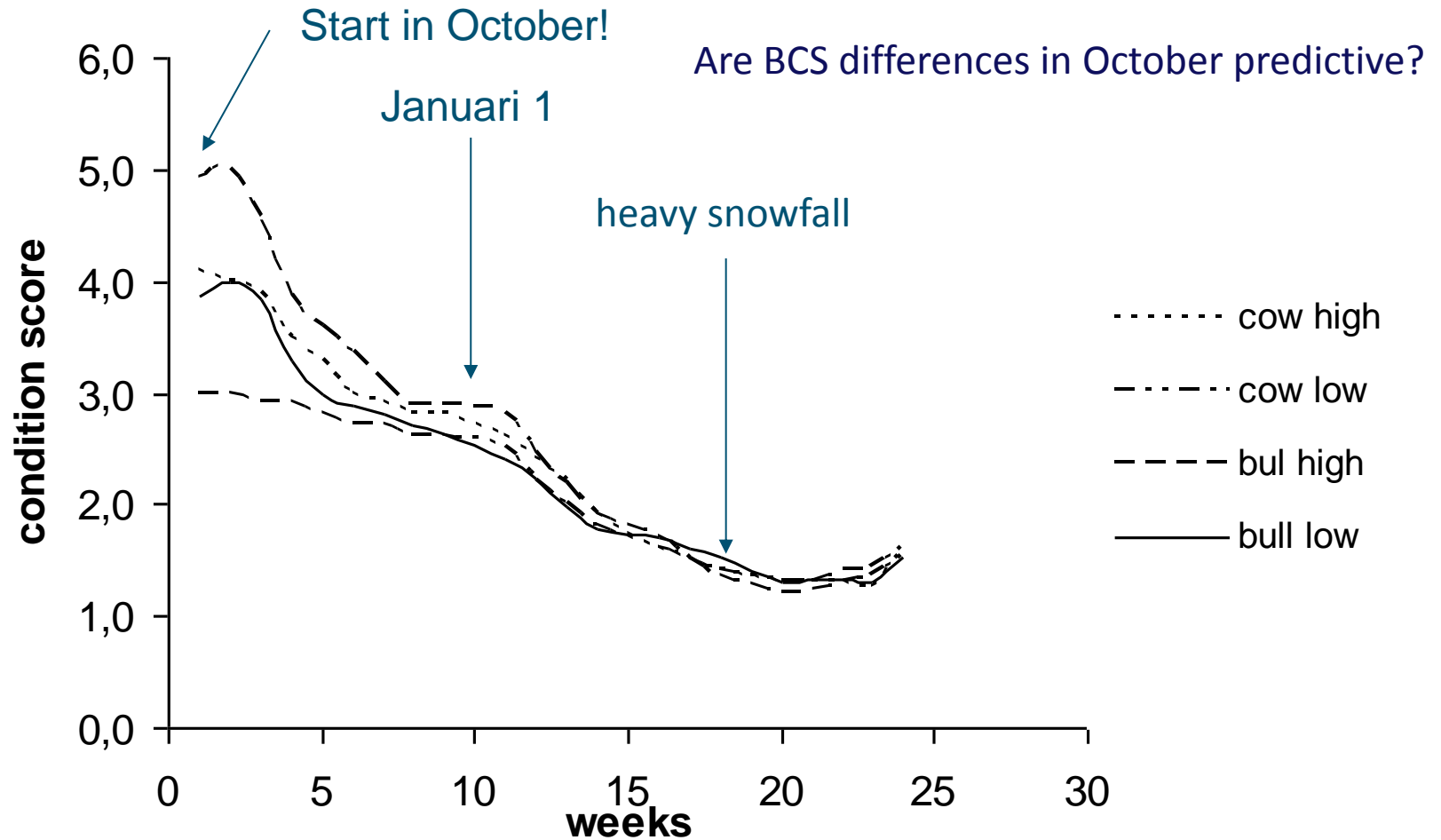**Wageningen Centre for Animal Welfare and Adaptation**

Animal welfare in the wild is

- weight loss!

- It is the most obvious and easiest measurable factor, and is often used to indicate animal welfare

- So

- Body condition = welfare?
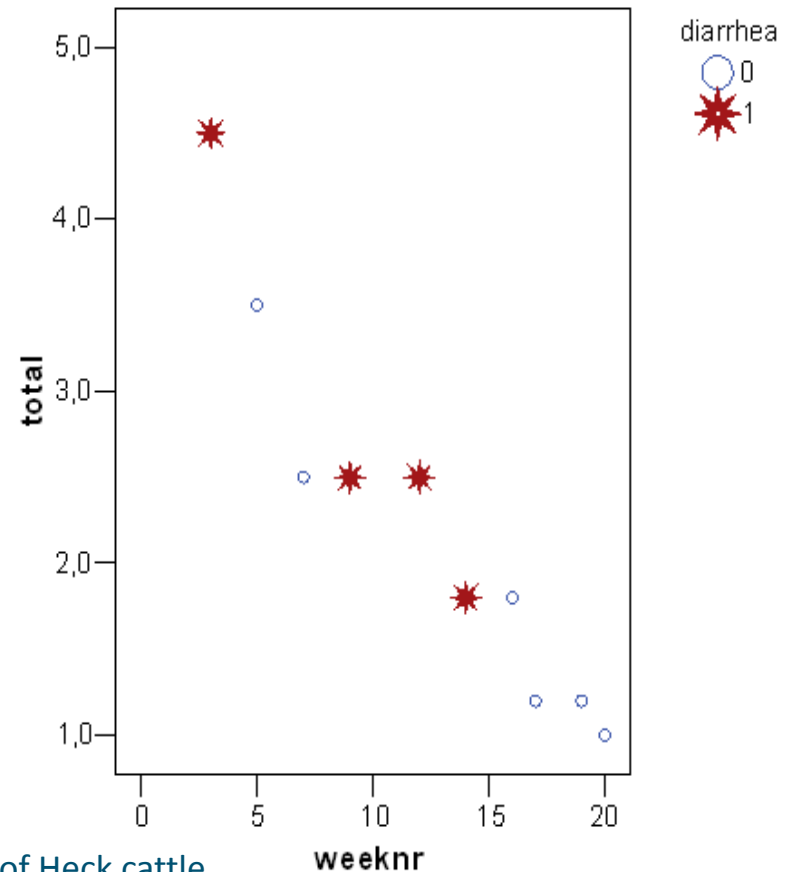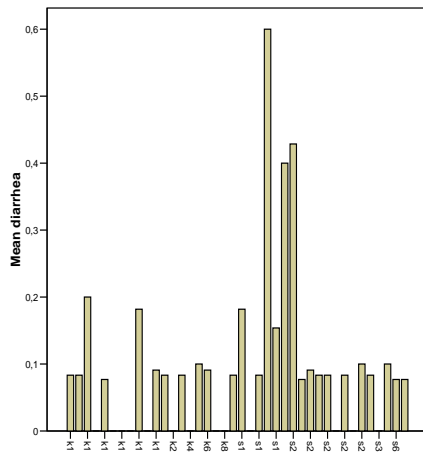
- Welfare = body condition?

Condition score during winter

Start in October!

Januari 1

Are BCS differences in October predictive?

heavy snowfall

- .... cow high
- -.-.- cow low
- - - - bul high
- —— bull low

condition score

weeks

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Mortality 2004-5

35% mortality of Heck cattle
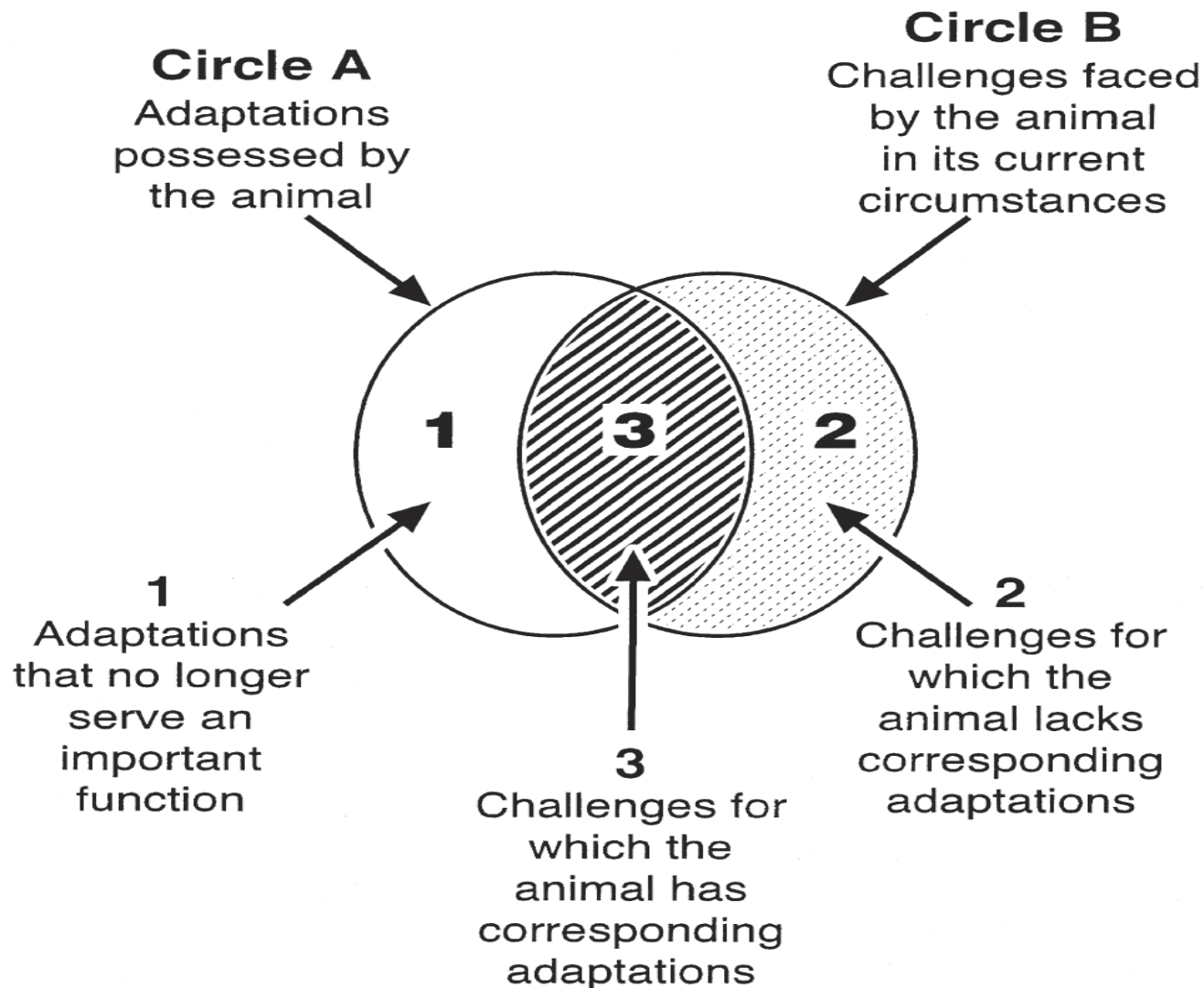10% mortality of focal animals:
4 Heck cattle: 3 high bulls died

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From nature to captivity / zoo

Circle A
Adaptations possessed by the animal

Circle B
Challenges faced by the animal in its current circumstances

1

3

2

1
Adaptations that no longer serve an important function

3
Challenges for which the animal has corresponding adaptations

2
Challenges for which the animal lacks corresponding adaptations

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5 Freedoms related to minimum standards

Freedom	Provision
From thirst, hunger, and malnutrition	Access to fresh water. A nutritionally balanced diet
From discomfort	A suitable environment, including shelter and a comfortable resting area
From pain, injury, and disease	Prevention or rapid diagnosis and treatment
To express natural behaviours	Sufficient space, proper facilities, and company of the animal's own kind
From fear and distress	Ensuring conditions that avoid mental suffering

Melfi and Hosey, 2009

- Use of minimum standards can prohibit advances in knowledge or the promotion of higher standards (Koene and Duncan, 2001)

- because minimum standards can sometimes be viewed as a benchmark towards which to aim, rather than as a standard beyond which to go.

- Risk to lag behind when welfare standards are increasing

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Naturalistic welfare

- Definition
  - The welfare of an animal depends on its being allowed to perform its natural behaviour and live a life as natural as possible

- Advantage
  - This approach intuitively appeals and fits with public opinion

- Disadvantage
  - This approach idealizes natural environment and neglects the fact that animals are able to adapt to an artificial environment

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Functional welfare

- Definition
  - Animal welfare is related to the normal functioning of physiological and behavioural processes

- Advantage
  - Changes in biological functioning are easier to demonstrate scientifically

- Disadvantage
  - The link between biological functioning and the welfare is not always apparent.
  - It is difficult to draw conclusions about welfare if different measures of biological functioning disagree

Feelings welfare

- Definition
  - The feelings of the animal (suffering, pain and pleasure) determine the welfare of the animal

- Advantage
  - Understanding the subjective experience of animals is a great challenge and hard job for scientists in the field of animal behaviour

- Disadvantage
  - The feelings and emotions of animals can not be observed directly

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Zoo animal welfare

Background = Public opinion
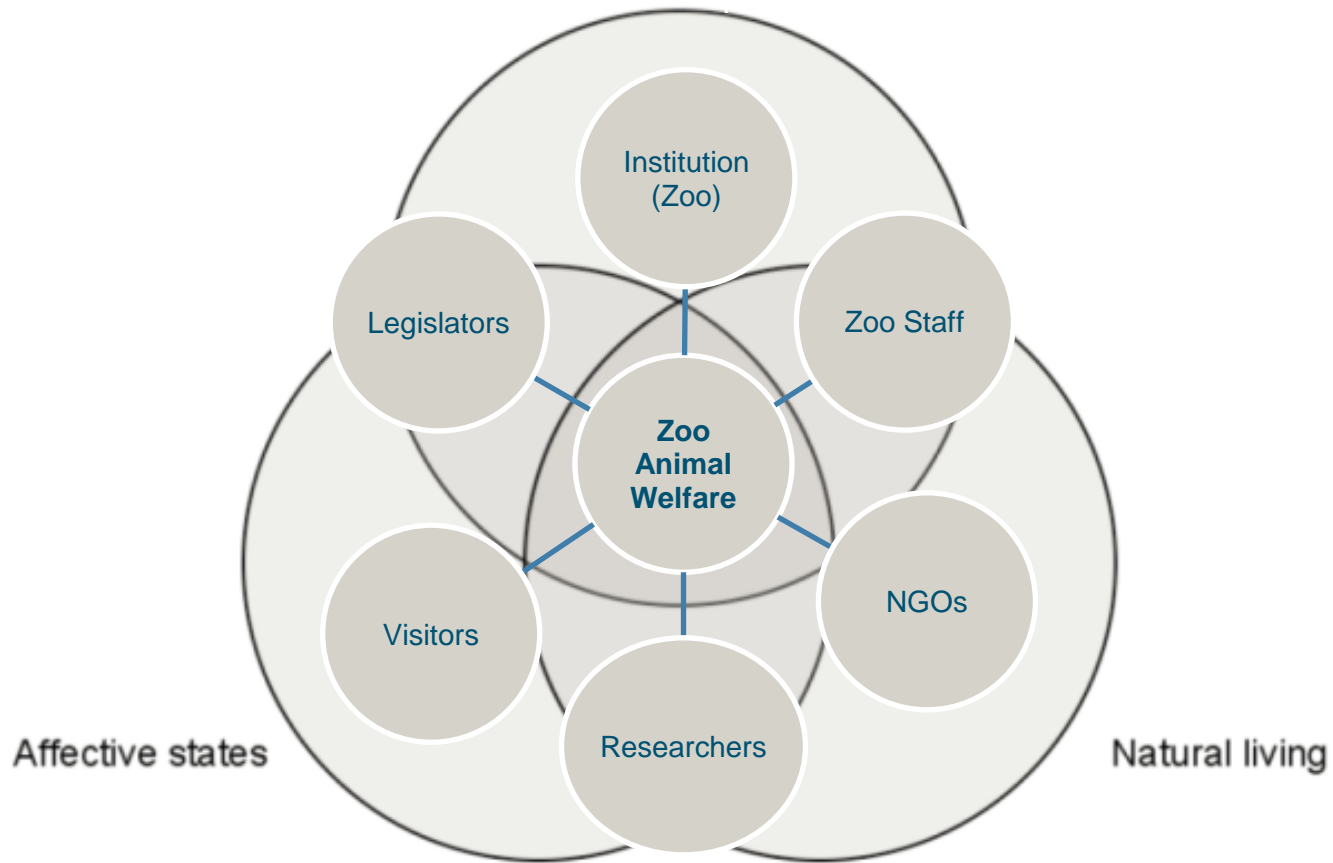
Figure 1
Three conceptions of animal welfare, adapted from Michael Appleby [21] and Vonne Lund [21].

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Interaction between interests

Summary of "parameters"

- Adequate
    - Appropriate
    - Regular (range)
- Available
- No excessive
- Easily maintained
- Suitable
- Have access
- No chronic health problems
- Readily collected
- Enrichment provided
- True/false
- Yes/no

- Valid
- Reliable
- Feasible

- SMART =
    - Specific
    - Measurable
    - Acceptable
    - Realistic
    - Time bound

Potential zoo animal welfare indicators

- Health
- Biological processes
  - endocrine function (cortisol)
- Life history variables and events
  - reproduce and live a relatively long time...
  - Keeper records/opinions

- Behaviour
  - Stereotypies (validation)
  - Vocalizations
- Cognition
- Asking the animals?
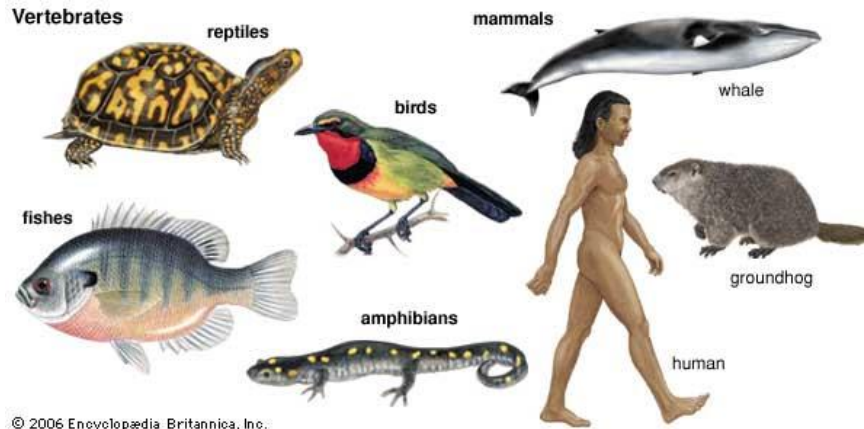 - Preference tests
  - Consumer demand
  - Single case analysis

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Environment and animal-based
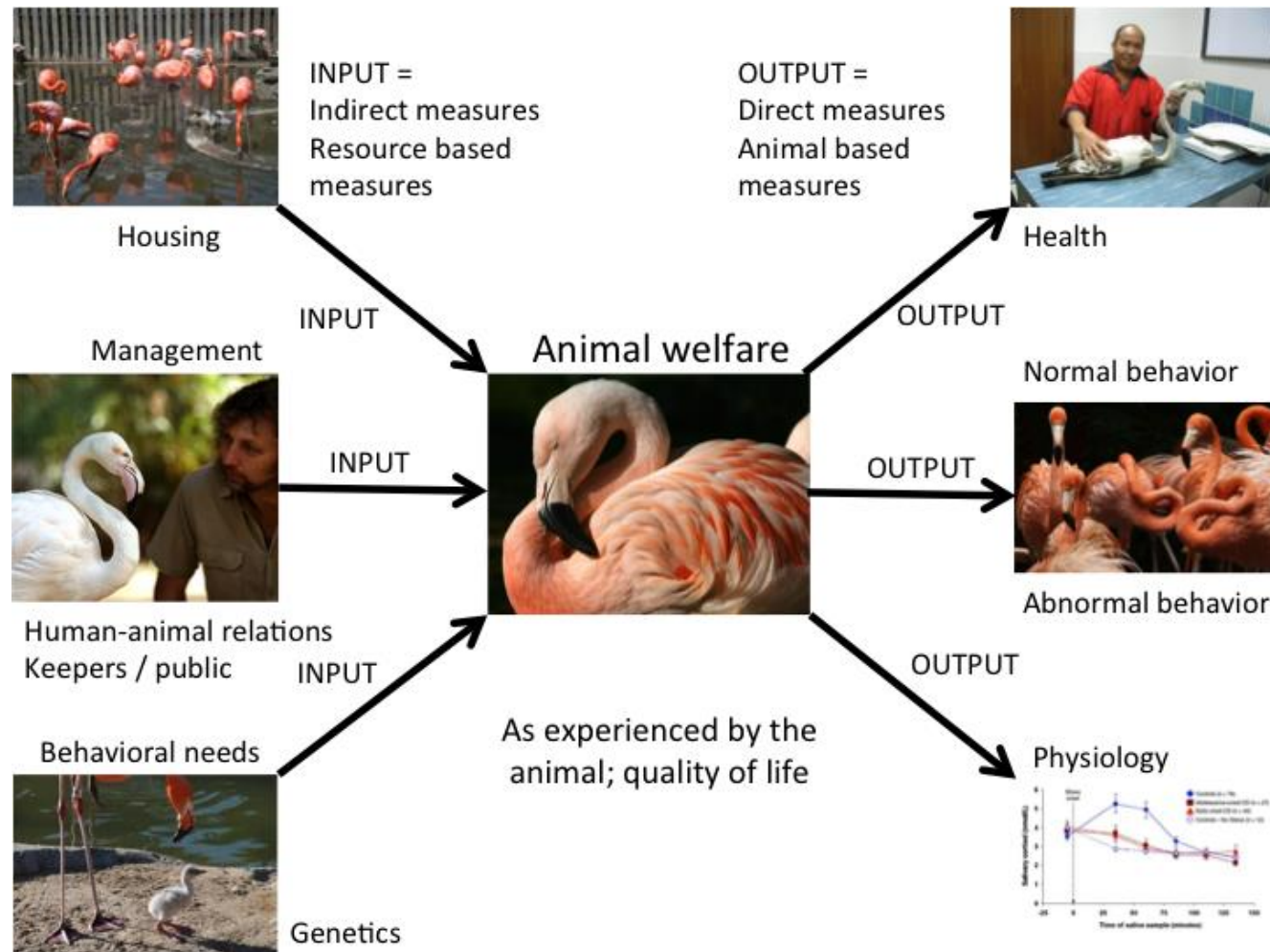
Groups and welfare

Groep/Jaar	2005	2006	2007	2008	2009	2010	2011	Total
Mammals	9	9	11	9	8	18	21	85
Birds	-	-	1	1	-	2	-	4
Reptiles	-	-	-	-	-	-	1	1
Fish	-	-	-	-	-	1	-	1
Invertebrates	-	-	-	-	-	-	1	1
Total	9	9	12	10	8	21	23	92

| Species/Year	2005	2006	2007	2008	2009	2010	2011	Total
Elephant	-	1	1	3	3	4	-	12
Gorilla	2	1	1	1	1	1	1	8
Chimpanzee	-	-	-	1	2	1	3	7
Tiger	1	-	1	1	1	-	1	5
Macaque	2	1	1	-	-	-	-	4
Polar bear	-	3	-	-	-	1	-	4
Dolphin	-	-	-	-	-	1	2	3
Vos	-	-	-	-	1	2	-	3
Orang utan	-	-	1	-	-	1	1	3
Flamingo	-	-	1	-	-	1	-	2
Giraffe	-	-	-	1	1	-	-	2
Gibbon	-	1	-	-	1	-	-	2
Other	4	2	5	2	4	7	11	35
Total	9	9	11	9	14	19	19	90

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Elephant health and lifespan

Age
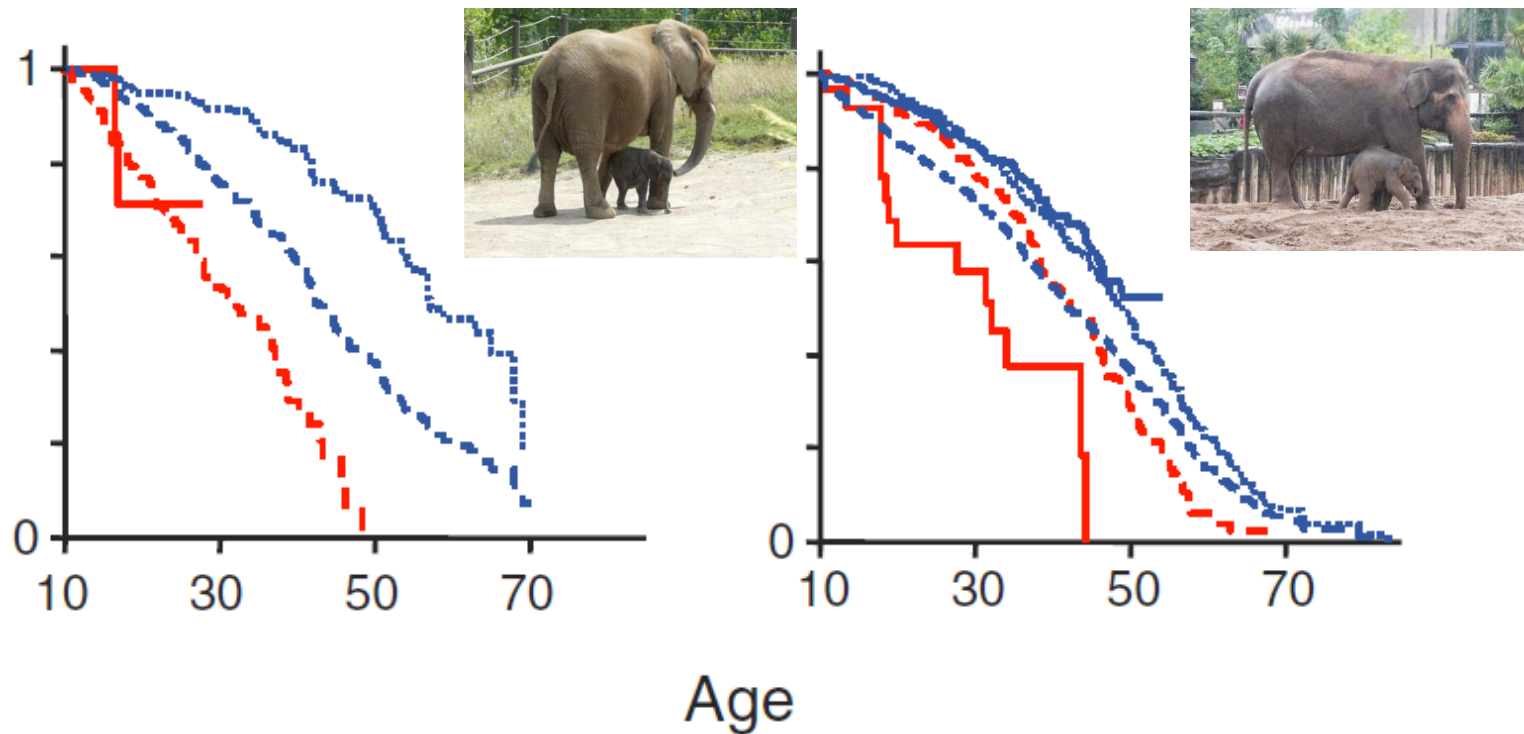
— Zoo captive-born   — Ref captive born
- - - Zoo wild-born   - - - Ref wild born
·········· Ref wild born, natural mortality

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How to measure elephant welfare? Mason and Veasey (2010)

- Definition of welfare?
  - Animal welfare is about feelings
- Available welfare indicators
  - all indices have their pros and cons
  - multiple, complementary, well-chosen indices
- Analysis
  - Two well-validated indices for elephants
    - corticosteroids
    - stereotypic behaviour
    - other indices have been suggested
    - other potential welfare indices
- Advice
  - Objective welfare indices need better developed
  - Central role in evidence-based elephant management

Indicators

- Validated indicators

- ***Stereotypies***
- ***Cortisol***
- Maternal behaviour and survival of young
- Lifespan/longevity

- Challenging indicators?
  - Play
  - Time budget (N/C)
  - Visitor's presence and noise
  - Space (used/non)
  - Naturalistic looks

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Wolf pacing

Stereotypy (traditional)
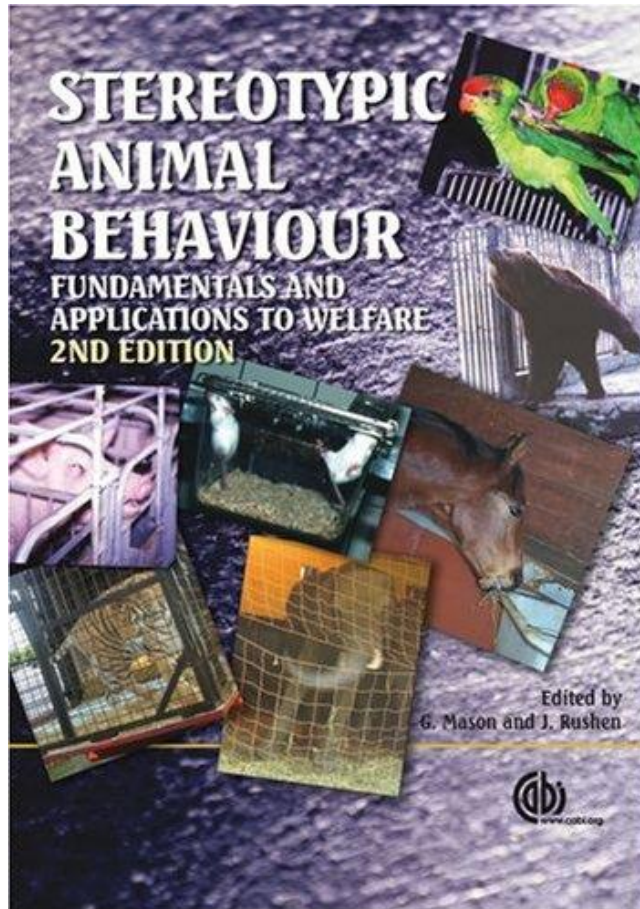
- A repeated, relatively invariant sequence of movements which has no obvious purpose (Ödberg, 1978

- Specific for each individual (Wiepkema, 1990)

- Many investigations started after the review on stereotypic behaviour of Mason (1991)

- Cause and function are still in discussion: "we still don't know exactly" (Mason, 2005).

Animal groups and stereotypies
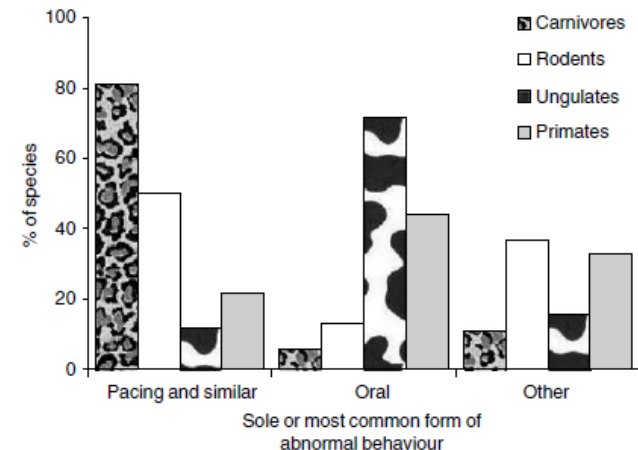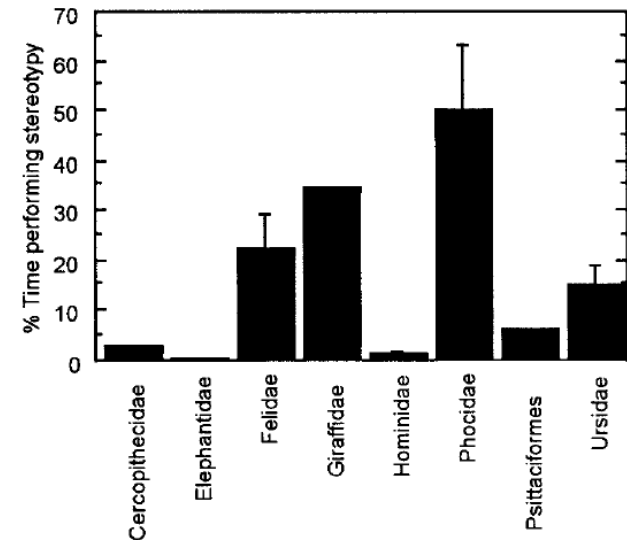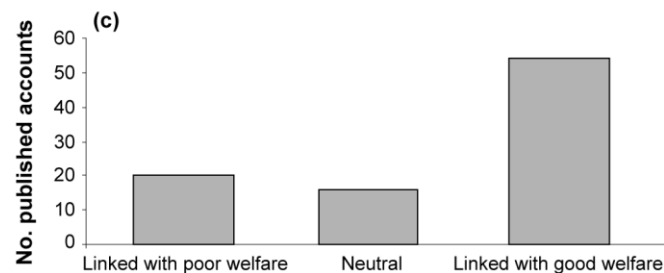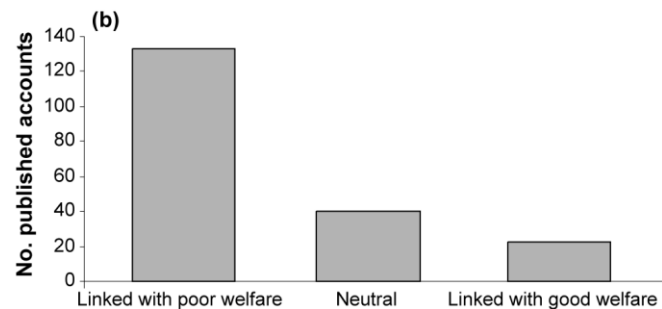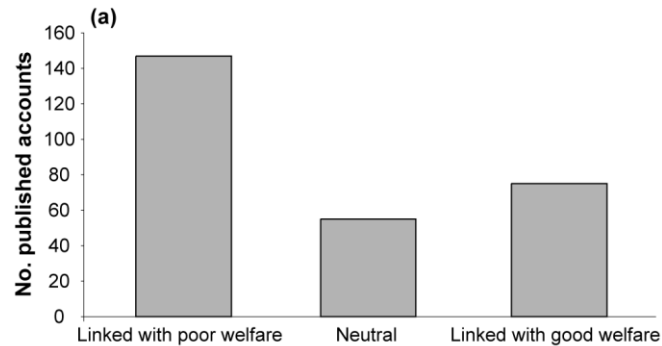
WQ (animal-based)

Table 1: Giving welfare principles and criteria (from Keeling and Veissier, 2005).

Principles		Welfare criteria
Good feeding	1.	Absence of prolonged hunger
	2.	Absence of prolonged thirst
Good housing	3.	Comfort around resting
	4.	Thermal comfort
	5.	Ease of Movement
Good health	6.	Absence of injuries
	7.	Absence of disease
	8.	Absence of pain induced by management procedures
Appropriate behaviour	9.	Expression of social behaviours
	10.	Expression of other behaviours
	11.	Good human-animal relationship
	12.	Absence of general fear

Welfare Quality protocol Wolf

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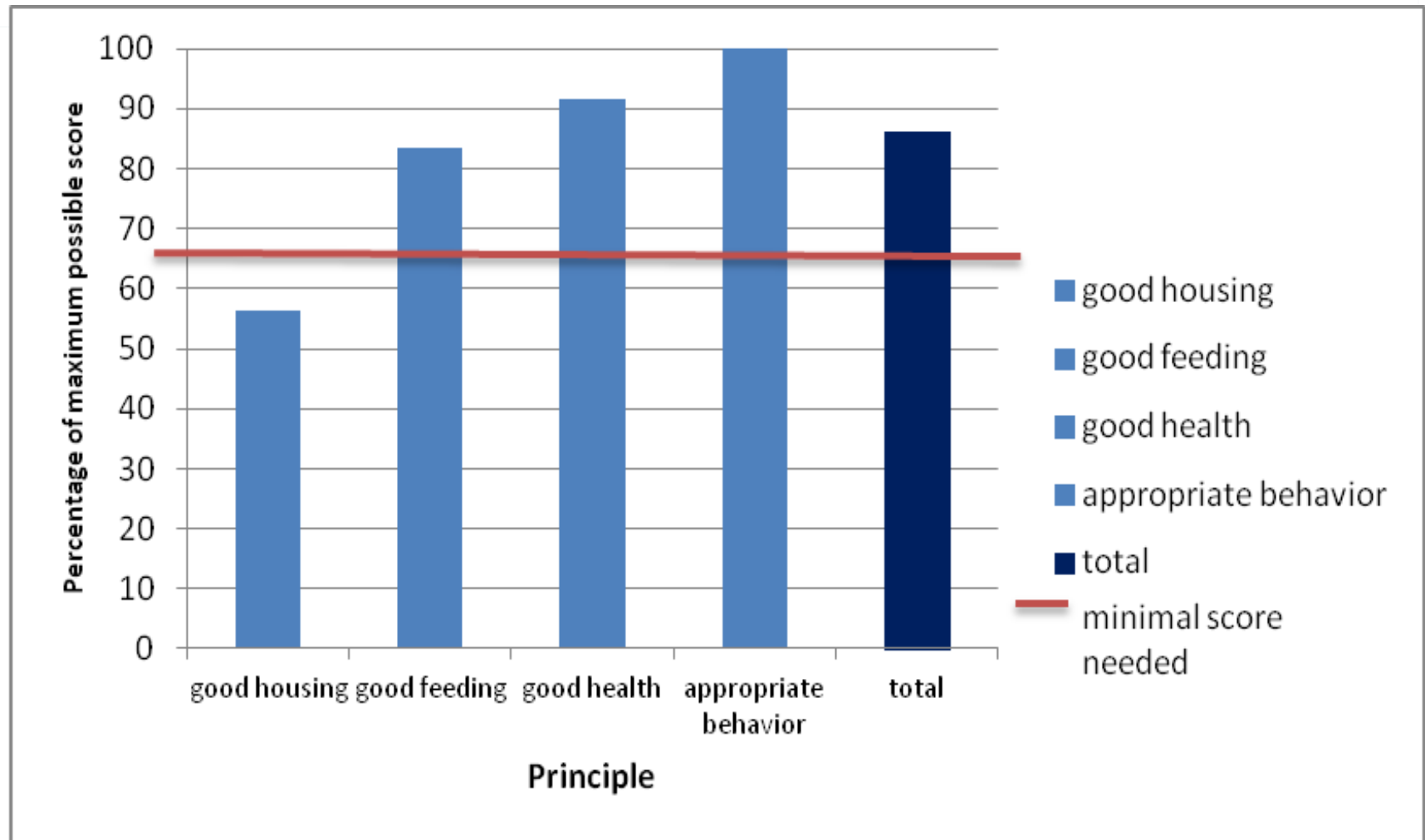
Suitability to be kept?

Koene et al, 2012

Wageningen UR Livestock Research
Partner in livestock innovations

Rapport 701

Zoogdiersoorten die geschikt zijn als gezelschapsdier
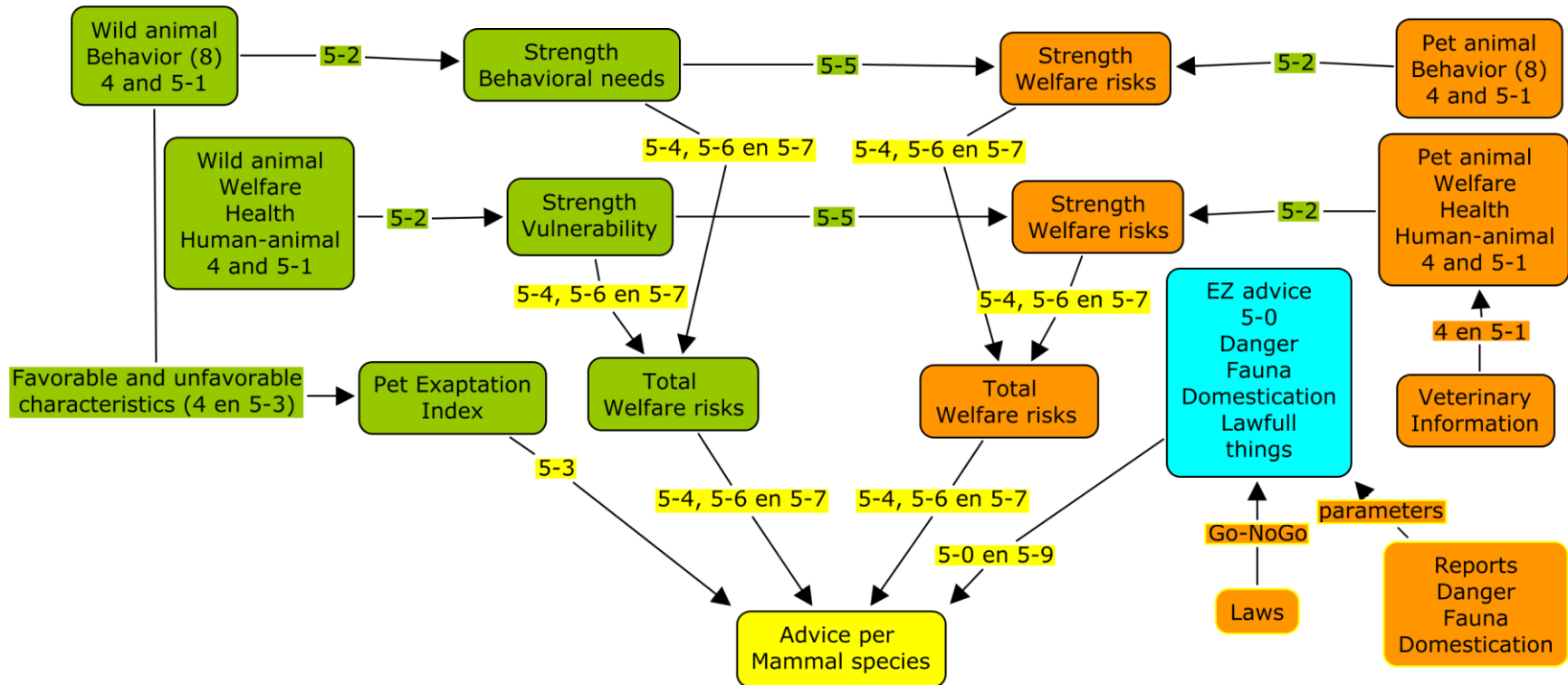
Zoogdiersoorten als gezelschapsdier

Mei 2013

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Report 701 presented to the parliament

Sci. Name	Eng. Name	Experts	PEIndex	Danger for people
Macropus agilis	Agile wallaby	0.88	0.529	6
Lama glama	Llama	0.75	0.669	3
Cervus nippon	Sika deer	0.69	0.562	2
Galea musteloides	Common yellow-toothed cavy	0.69	0.597	6
Paradoxurus hermaphroditus	Asian palm civet	0.69	0.714	5
Acomys dimidiatus	Eastern spiny mouse	0.63	0.692	6
Cricetulus barabensis	Chinese striped hamster	0.63	0.499	6
Macropus eugenii	Tammar wallaby	0.63	0.534	6
Acomys russatus	Golden spiny mouse	0.50	0.699	6
Camelus bactrianus	Bactrian camel	0.50	0.624	1
Cavia aperea	Brazilian guinea pig	0.50	0.715	6
Chaetophractus vellerosus	Screaming hairy armadillo	0.50	0.513	6
Microtus guentheri	Günther's vole	0.50	0.638	6
Mus minutoides	African pygmy mouse	0.50	0.583	6
Phodopus campbelli	Campbell's dwarf hamster	0.50	0.480	6
Vicugna pacos	Alpaca	0.50	0.685	3
Wallabia bicolor	Swamp wallaby	0.50	0.459	6
Dolichotis salinicola	Kleine mara	0.38	0.451	6

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Framework for assessment

Scientific assessment of suitability

Independent-Samples Moses Test of Extreme Reaction
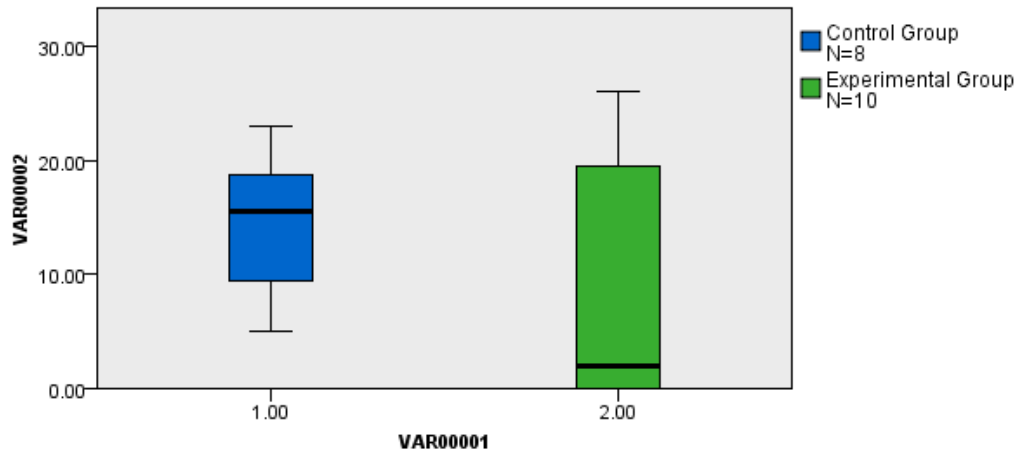
Total N		18
Observed Control Group	Test Statistic[1]	10.000
	Exact Sig. (1-sided test)	.008
Trimmed Control Group	Test Statistic[1]	7.000
	Exact Sig. (1-sided test)	.032
Outliers Trimmed from each End		1.000

[1]The test statistic is the span.
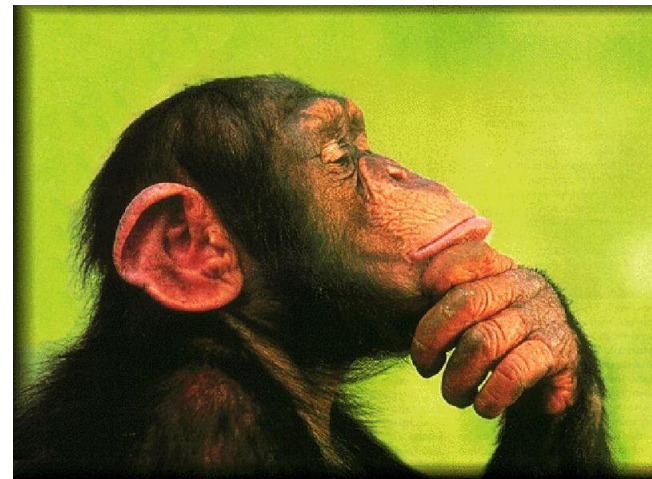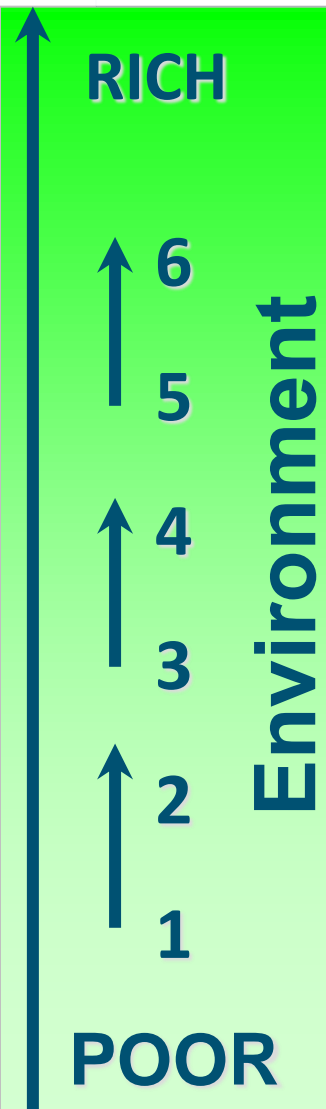
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Behaviour and welfare profiles

Koene et al, 2012
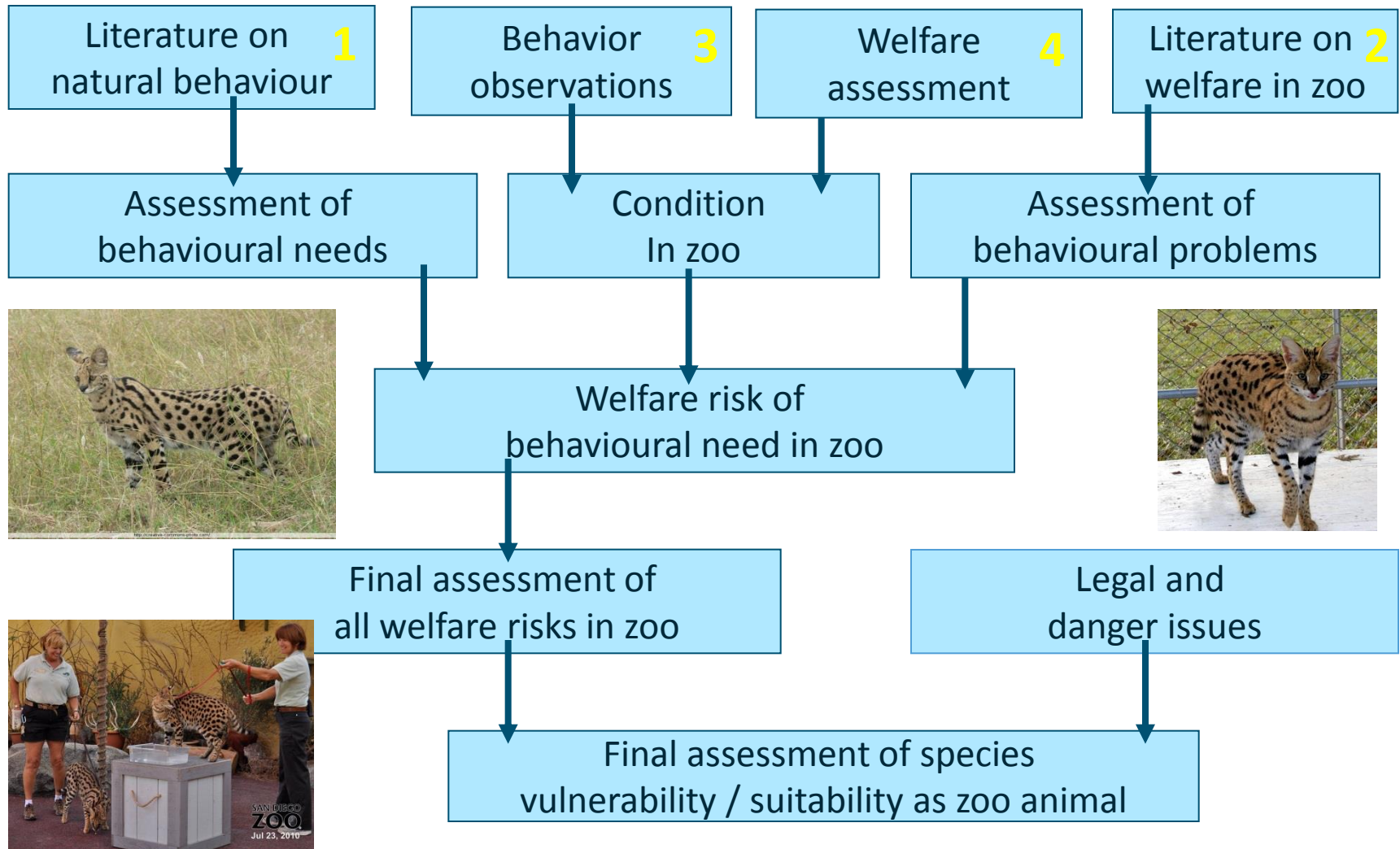
Reducing stereotypies (SBs)

RICH

Environment

6

5

4

3

2

1

POOR

- First priority is to provide the animal with all its basic needs and so eliminate or reduce states of suffering :

- It may be possible to reduce many of these by environmental manipulation (1-2, 2-3)

- That's

- *NOT environmental enrichment*
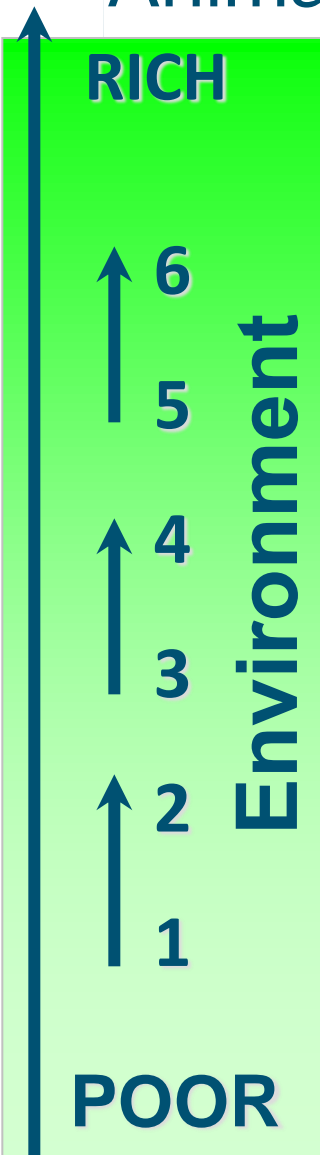
- **That's**

- *providing environmental requirements*

GOOD

Welfare

6

5

4

3

2

1

POOR

CAWA

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Animal pleasure

RICH

Environment

6

5

4

3

2

1

POOR

- When states of suffering have been reduced or eliminated, it may be possible to enhance quality of life further to states of pleasure

- It may be possible to induce states of pleasure by environ-mental manipulations (4-5, 5-6)
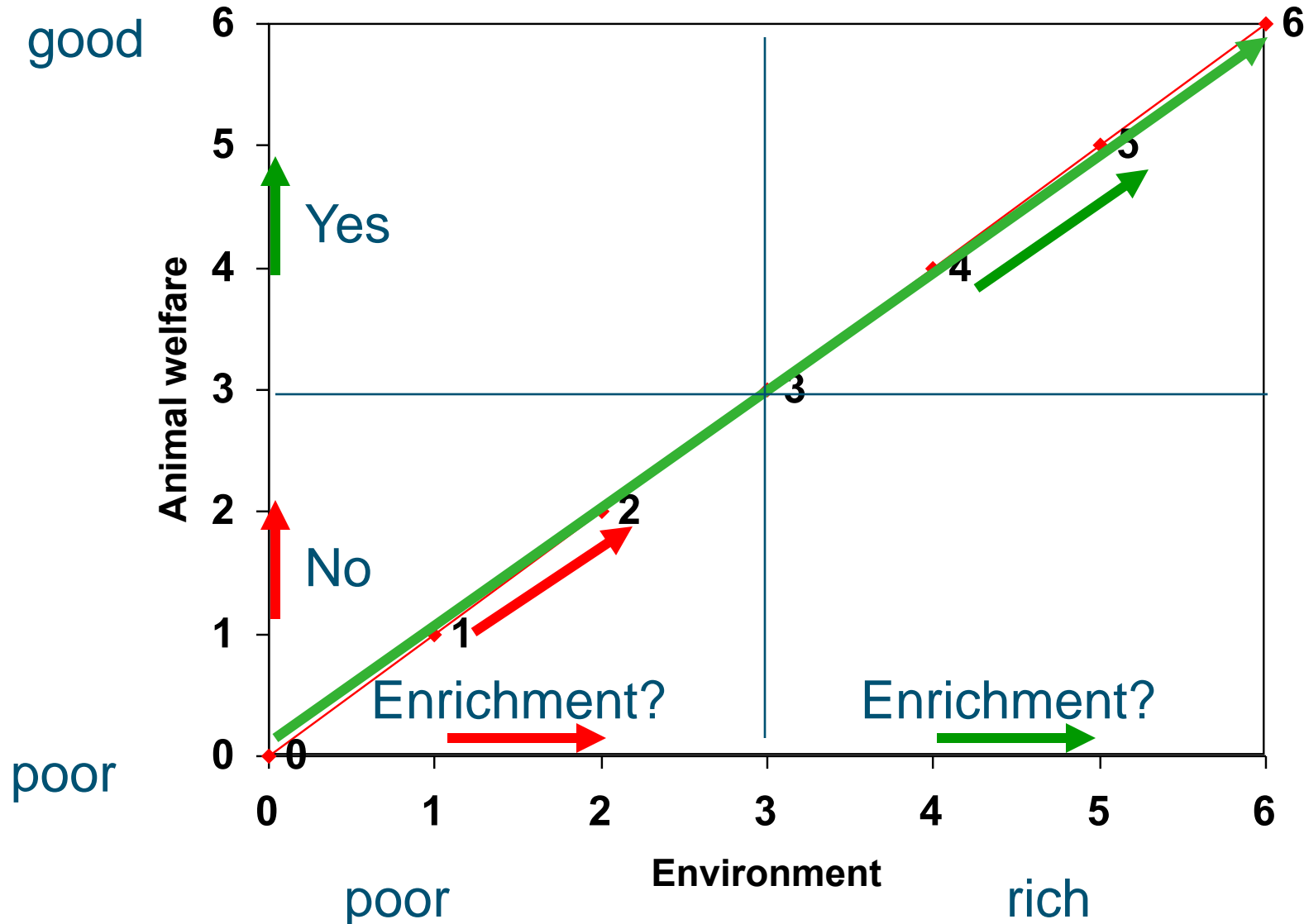
- **That's**

- *environmental enrichment*

GOOD

Welfare

6

5

4

3

2

1

POOR

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Match of animal and environment

Koene & Duncan, 2001

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Asking an orang about R/R

	Water	Sugar	Fibre
Wild fruit	81.0	13.9	33.6
Domestic fruit	84.8	34.0	10.0

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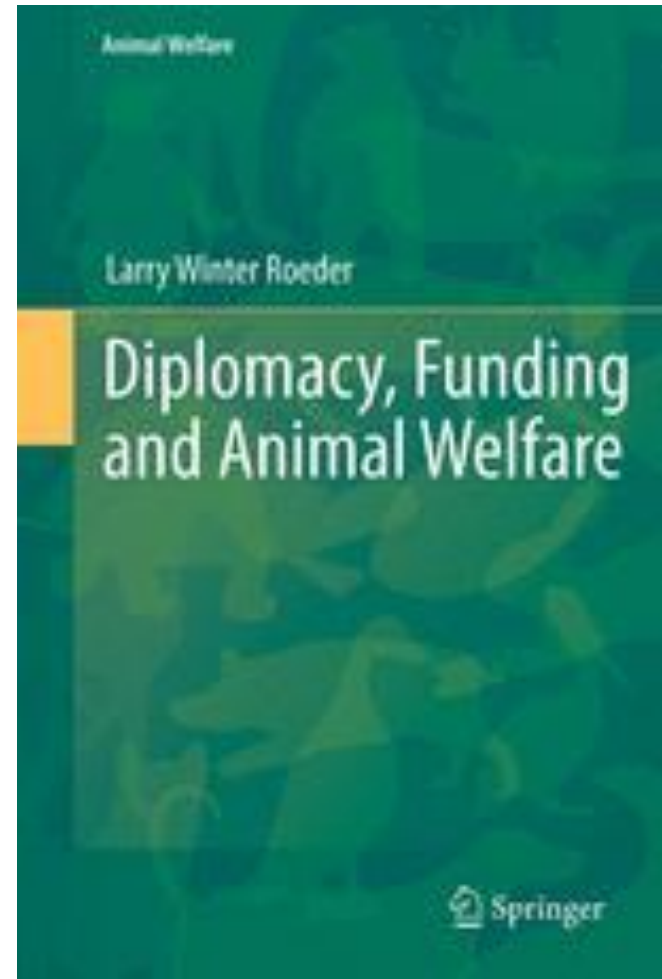
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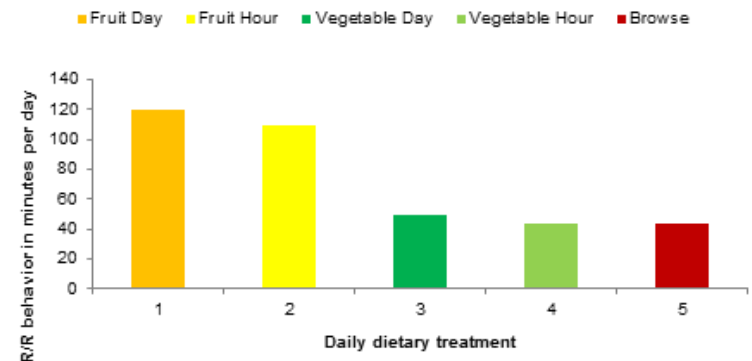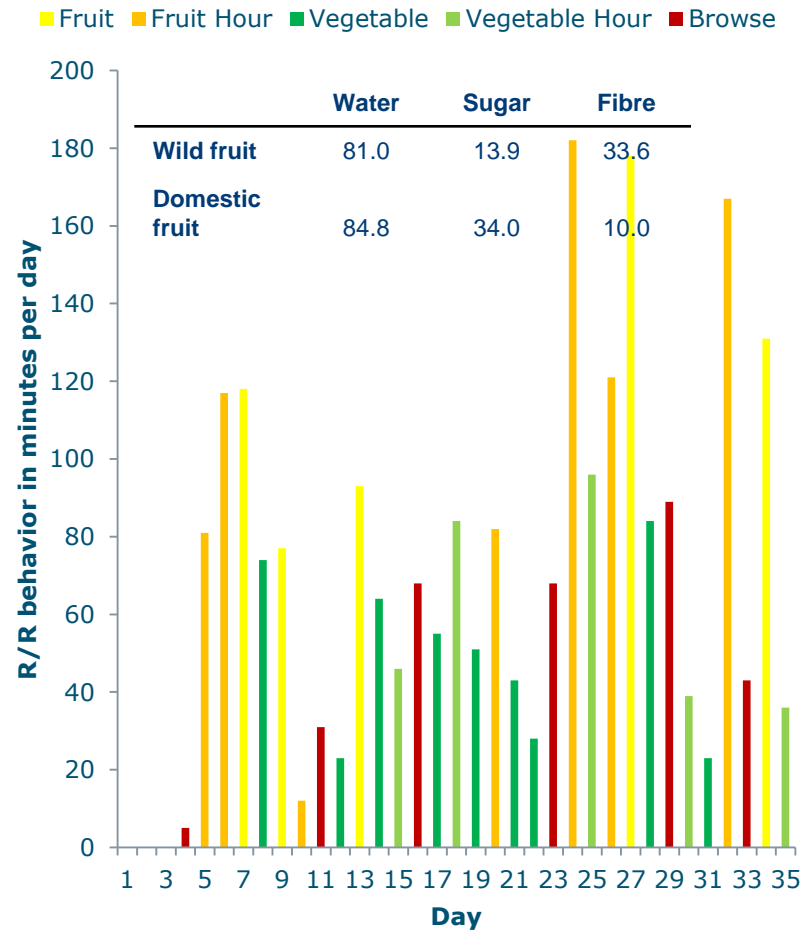
Research funding animal welfare

Take home messages

- Zoo Animal Welfare (ZAW)
    - 5 Freedoms outdated (→ + and animal-based)
- Zoo Animal Welfare Assessment (ZAWA)
    - Behavioural needs (→ +) and stereotypies (-)
    - WQ in development (index)
    - Measure! (Specific Measurable Acceptable Realistic Time bound)
- Stereotypies
    - Indication of a suboptimal environment
    - Best solution for individuals in a suboptimal environment
- "Environmental Enrichment" (EE)
    - "enrichment" is relieving impoverishment (term = fraude)
    - Ask animals relevant questions (f.e. about changes)
- Are all species / Is the species - suitable to be kept in a zoo?
- Funding Animal Welfare Research or Animal Welfare → value in euro's?

Ac*knowledge*ments

- Ouwehand zoo
  - Jose Kok
- Advisory group
- Many students
- Colleagues
  - Kathy Carlstead
  - Nadja Wielebnowski
  - Georgia Mason
- Research Funding
  - Ministry of Economic Affairs
  - Zoo animal welfare indicators
  - Stereotypies in zoo animals

- Thanks

- Questions?