Odisee
DE CO-HOGESCHOOL

salto
Research Group Agro-Bio

University of Antwerp

Normes minimales et bien-être animale dans les zoos

Adapted presentation february 22-02-2021 for the Walloon Zoo Commission by Hilde Vervaecke, Odisee University of Applied Sciences, Belgium

(original version for the Zoo Inspiration Day in 2019 by Hilde Vervaecke & Jeroen Stevens)

1994 Limburg Zoo

Minimum standards (1999)

Espèces animales/ Diersoorten (1)	Nombre/ Aantal (2)	Dimensions minimales pour le nombre d'animaux indiqué Minimumafmetingen voor het aangegeven aantal dieren				Superficie ou volume supplémentaire par animal en plus/ Bijkomende oppervlakte of volume per bijkomend dier (3)		Exigences particulières/ Bijzondere eisen
		Enclos Extérieur/ Buitenverblijf (5)		Enclos Intérieur/ Binnenverblijf (5)				
		Superficie / Oppervlakte m^2	Volume m^3	Superficie/ Oppervlakte m^2	Volume m^3	à l'extérieur/ buiten	à l'intérieur/ binnen	
Alopex lagopus	1-2	40	-	-	-	10 m^2	-	gn
Canis lupus	3	1200	-	2/animal/dier	-	200 m^2	-	dg
Nyctereutes procyonoides	1-2	40	-	10	-	4 m^2	1 m^2	n
Speothos venaticus	1-2	100	-	-	-	10 m^2	-	cn
Vulpes vulpes	1-2	150	-	-	-	10 m^2	-	cn
Vulpes zerda	1-2	20	-	1/animal/dier	-	2 m^2	-	cde[10]g
Acinonyx jubatus	1-2	400	-	4/animal/dier	-	50 m^2	-	ade[10]l
Caracal caracal	1-2	-	-	30	90	-	-	ae[18]k
Felis chaus	1-2	-	-	30	90	-	-	ae[18]k
Felis silvestris	1-2	-	-	30	90	-	-	ae[15]f
Leopardus pardalis	1-2	-	-	40	120	-	-	ae[18]ku[3]
Leptailurus serval	1-2	-	-	40	120	-	-	ade[18]ku[3]
Lynx lynx Lynx rufus	1-2	60	180	-	-	20 m^2	-	alx
Puma concolor	1-2	60	180	-	-	5 m^2	-	alu[3]
Neofelis nebulosa	1-2	20	50	30	90	-	-	ae[0]n
Panthera leo	1-2	100	-	12/animal/dier	-	20 m^2	-	lu[3]
Panthera onca	1-2	60	180	12/animal/dier	-	-	-	ae[15]lu[3]
Panthera pardus	1-2	60	180	12/animal/dier	-	-	-	ae[15]lu[3]
Panthera tigris	1-2	100	-	15/animal/dier	-	-	-	ae[15]lou[3]f

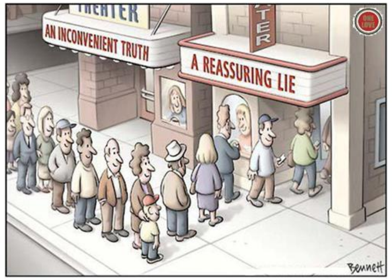
Revision needed

Some large discrepancies and inconsistencies between closely related taxa.

Serious progress in welfare science.

Expert groups (Burgman, 2016)

- Form diverse groups - experts with different opinions
- Clarify linguistic uncertainties: define concepts
- Share information
- Be aware of ethical standpoints, motivations, quick judgments, intuitions, cognitive dissonance



In the mean time in welfare-land

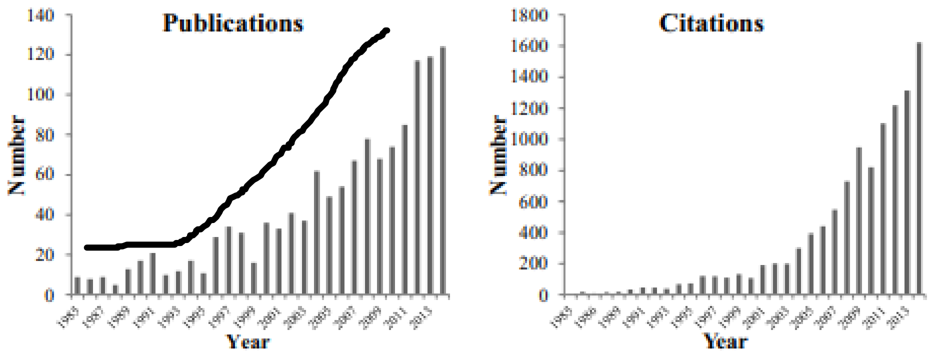


FIGURE 1 | Number of publications and citations of studies that include animal welfare and emotions over the time period 1985–2014 (Web of Science).

frontiers in Veterinary Science

SPECIALTY GRAND CHALLENGE
published: 28 May 2015
doi: 10.3389/fvets.2015.00016

The science of animal behavior and welfare: challenges, opportunities, and global perspective

*Jeremy N. Marchant-Forde**

United States Department of Agriculture – Agricultural Research Service, Livestock Behavior Research Unit, West Lafayette, IN, USA

Keywords: animal welfare, behavior, ethology, emotions, welfare assessment, ethics

Marchant-Forde, 2015

Welfare (Fraser, 1997)

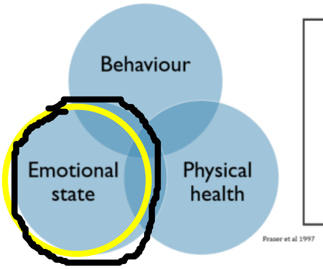
A SCIENTIFIC CONCEPTION OF ANIMAL WELFARE THAT REFLECTS ETHICAL CONCERNS

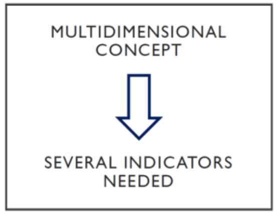
D Fraser[1†], D M Weary[1], E A Pajor[2] and B N Milligan[2]

Centre for Food and Animal Research, Building 94, Agriculture and Agri-Food Canada, Ottawa K1A 0C6, Canada

→ played a major role in welfare research

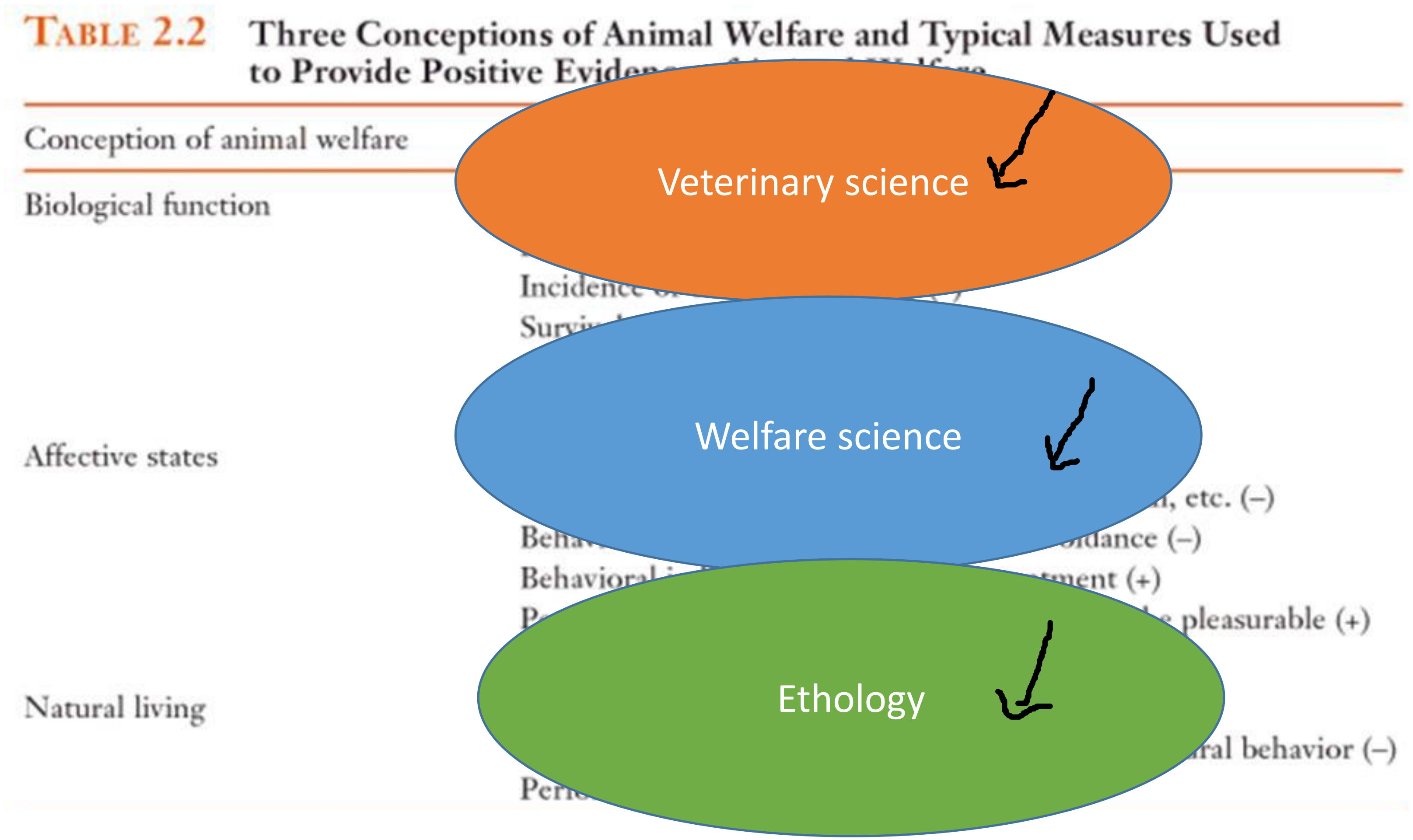
- basic health and functioning of the animal - physical health
- affective state of the animal - mental health
- ability to live in a way that suits the animal's adaptations - naturalness





It is necessary to recalibrate our understanding of animal welfare centred around the affective or emotional states of animals … "(Veasey, 2013)

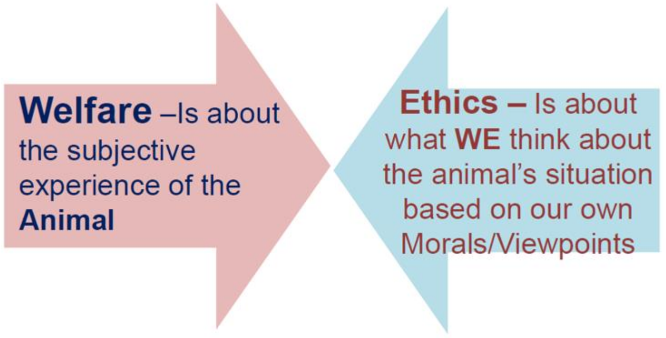
Paradigm shift



Fraser & Weary, 2005

Welfare assessment has an ethical component

- Every welfare assessment has ethical component
  - What is our impact on animals ? Science
  - How should we treat animals ? Ethics
- Ethics (Bas Haring, 2019; Broom, 2008)
  - Utilitarianism
  - Principles - deontological
  - Personal actions and motivations



Trends in welfare land

- Goals (ethics)
  - Zero tolerance for stereotypical behaviour (Abnormal repetitive behaviour)
  - Promoting positive welfare (EAZA)
  - Importance of control (eg. Leotti et al., 2010)

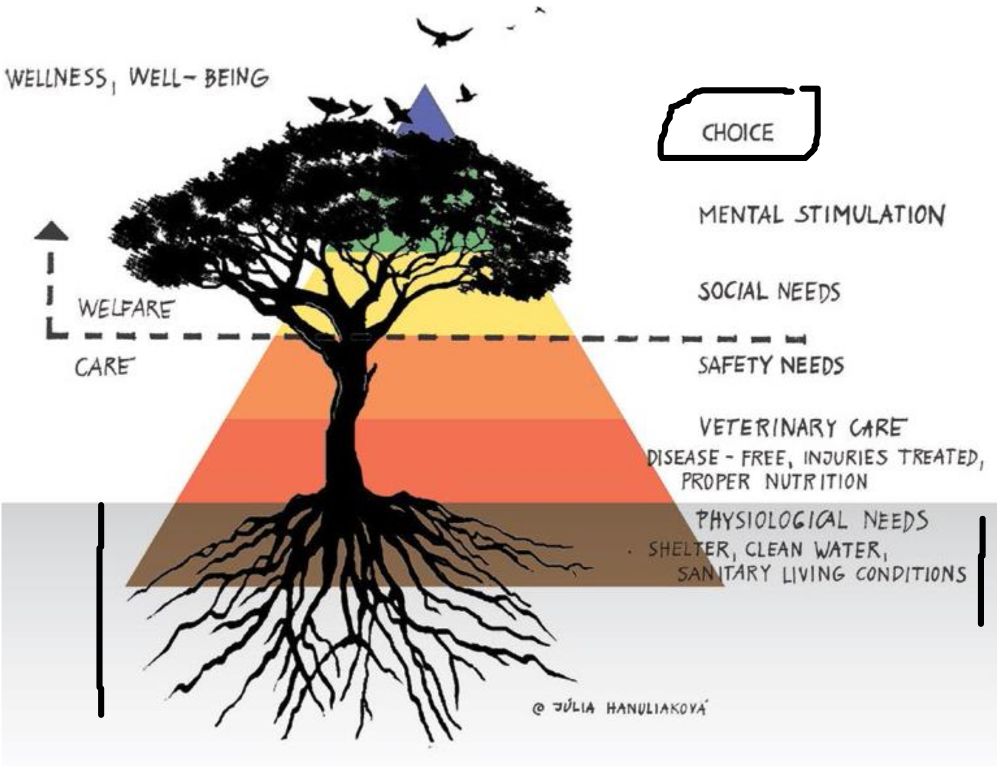
- Methods
  - Animal based
  - Welfare quality protocols based on 12 freedoms (eg. Salas et al, 2016) ; five domains model (Mellor & Beausoleil, 2015; Mellor, 2020); 24/7 approach to promoting optimum welfare (Brando & Buchanan-Smith, 2018)
  - Validation of multiple measures

EAZA & WAZA welfare standards

EAZA is committed to promoting the positive welfare of animals in not only our member institutions but also supporting zoos and aquaria which are currently working towards reaching EAZA's accreditation standards. EAZA Members are proactive in both undertaking and applying animal welfare scientific research, contributing to EAZA being a recognised organisation in animal welfare best-practice.

What is welfare?

Animal welfare refers to the physiological and psychological well-being of animals – effectively, this is how the individual animal is coping, both mentally and physically, at a particularly point in time. This means adopting a multi-disciplined, scientifically evidence-based approach to assure that the animal's needs and wants are met. This should include, for example, the provision of effective veterinary care, meeting dietary requirements, providing individuals with the opportunity to perform their species-specific behavioural repertoire and promoting positive emotional states.

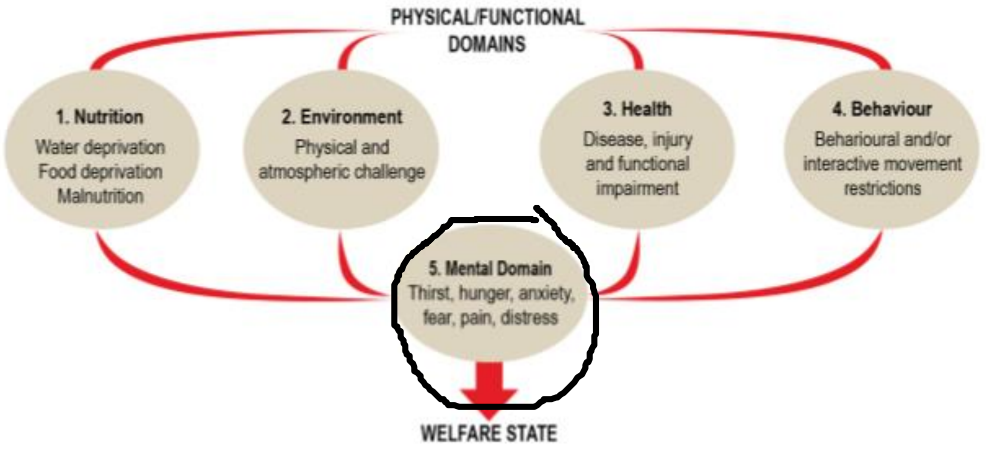


(WAZA

In doing this, WAZA calls on its members and all zoos and aquariums to:

- strive to achieve high welfare standards for the animals in their care;
- be animal welfare leaders, advocates and authoritative advisers; and
- provide environments that focus on the animals' physical and behavioural needs.

Five domains model



Behavioural Interactions and their Associated Affects

INTERACTIONS WITH THE ENVIRONMENT			
Exercise of 'agency' is impeded:	*Negative affects:*	*Exercise of 'agency' is promoted*	*Positive affects:*
Invariant, barren, confined environment (ambient, physical, biotic)	Boredom, helplessness Depression, withdrawal	Varied, novel environment	Interested, pleasantly occupied
Inescapable sensory impositions	Various combinations: startled by unexpected events, neophobia, hypervigilance, anger, frustration, negative cognitive bias	Congenial sensory inputs	Likes novelty, post-inhibitory rebound
Choices markedly restricted		Available engaging choices	Calm, in control
Environment-focussed activity constrained		Free movement	Engaged by activity
Foraging drive impeded		Exploration, foraging	Energised, focussed

⇨ Translation into Welfare Assessments

animals MDPI

Article

An Animal Welfare Risk Assessment Process for Zoos

Sally L. Sherwen [1,*], Lauren M. Hemsworth [2], Ngaio J. Beausoleil [3], Amanda Embury [1] and David J. Mellor [3]

Back to our exercice

- Evaluation on-the-spot must be possible
- Method:
  - Based on science
  - Check knowledge in practical guidelines
  - Resource-based + opportunities for the animal –> animal centered

Method based on biological criteria

- Natural history & behavioural biology
- Needs & adaptive potential

ELSEVIER

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APPLIED ANIMAL BEHAVIOUR SCIENCE

Applied Animal Behaviour Science 102 (2007) 303–328

www.elsevier.com/locate/applanim

Natural behavioural biology as a risk factor in carnivore welfare: How analysing species differences could help zoos improve enclosures ☆

Ros Clubb [a], Georgia Jane Mason [b,*]

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Available online 2 August 2006

Review

Cell PRESS

Species differences in responses to captivity: stress, welfare and the comparative method

Georgia J. Mason

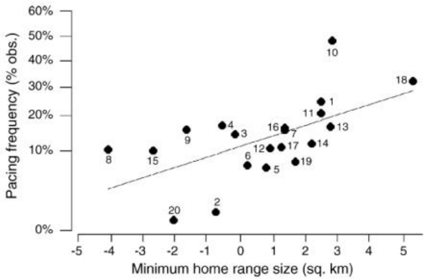


Fig. 1. Minimum home-range size (accounting for body size) and median % pacing frequency in affected individuals. Stereotypy data was arcsine transformed but units on the y-axis are given in the raw form for clarity. Species are labelled as follows: (1) *Acinonyx jubatus*; (2) *Alopex lagopus*; (3) *Caracal caracal*; (4) *Leopardus pardalis*; (5) *Lynx canadensis*; (6) *Lynx lynx*; (7) *Melursus ursinus*; (8) *Mustela vison*; (9) *Oncifelis geoffroyi*; (10) *Panthera leo*; (11) *Panthera onca* (12) *Panthera pardus*; (13) *Panthera tigris*; (14) *Puma concolor*; (15) *Suricata suricatta*; (16) *Ursus americanus*; (17) *Ursus arctos*; (18) *Ursus maritimus*; (19) *Ursus thibetanus*; (20) *Vulpes vulpes*.

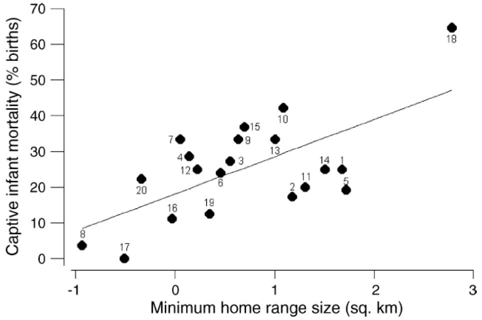


Fig. 3. Minimum home-range size (with body size partialled out) and median captive infant mortality rate over days 1–30. Species are labelled as in Fig. 1.

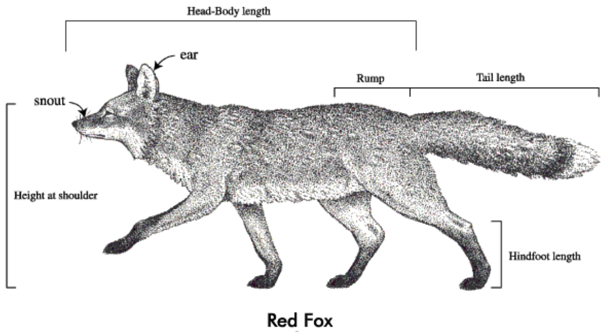
Surface and space

- Quality versus quantity: you need both
- Space should allow for :
  - all locomotion types
  - social distances
  - keeping distance to public
  - structural variation in “living space”: offering room for a variety of functions, …

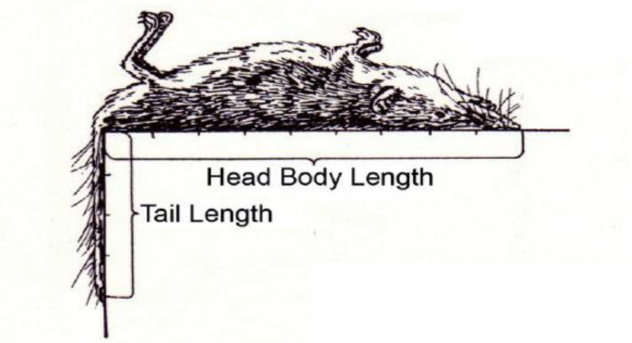
Group sizes and requirements

- Group size: focus on social needs
- Behavioural opportunities translated in codes eg. possibility to swim, bathe, climb, dig, nest, hide, sleep, etc….
- Inspirational on-line codex

Surface: body length as biological criterion



- To determine minimum enclosure size
- Data available for all species
- Rough correlation body length, home range size and locomotory needs



Surface & body length criterion (BLC)

- New Zealand Department of Primary Industries

Husbandry Guidelines
for

Hamadryas Baboon

Papio hamadryas

(Mammalia: Cercopithecidae)

Compiler: Lauren Turner
Date of Preparation: February 2009
Western Sydney Institute of TAFE, Richmond
Course Name and Number: Certificate III in Captive Animals, RUV30204
Lecturer: Graeme Phipps, Jacki Salkeld, Brad Walker

Formulae used to calculate the minimum dimensions (values are rounded to nearest 0.5 metres:

- For group housing of 2 or 3 animals (most species)
- Length of the enclosure = 15 x maximum body length
- Width of enclosure = 10 x maximum body length
- All roofed enclosures Minimum height of roof and fence = 2.4m + (2 x maximum body length)
- All enclosures Minimum height of climbing structures = 2.4m + (2 x maximum body length)

Minimum sizes have been based on the animal's body size and activity patterns, but no internationally agreed formula currently exists to calculate size requirements. These figures are the best fit from information available. They may be subject to change should new information come to light. Exhibitors should refrain from basing enclosure designs solely on the minimum size however. In order to provide an appropriate environment, many factors must be provided for, space being just one of these. The size of the enclosure must be based on ability to provide all of the factors including; social grouping, climbing structures, nesting and feeding station and predicted growth of the group (Department of Primary Industries 2010).

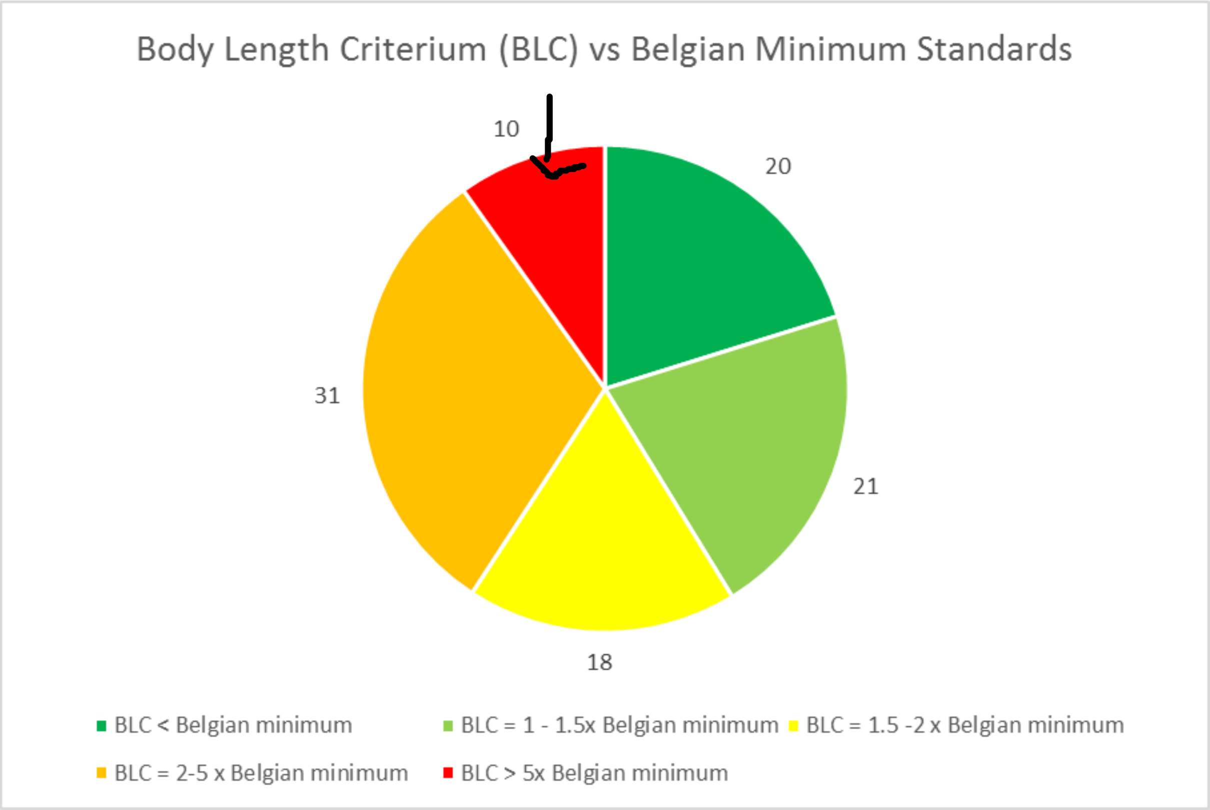
Corrections and extra requirements

- BLC-surface corrected downward for 3-dimensional use of volume: eg tree-dwelling animals, aquatic mammals, …
- Allows for some movement but too small for species at risk of ARB. BLC-surface needs to be corrected upwards: species at risk of locomotory stereotypies
- Phylogenetic relatedness & shared traits allow for generalisations

Body length criterion

(BL x 10)x(BLx15) for 3 individuals

- Looking for possible biases in 1999 minimum surfaces
- Comparison 1999 norms to body length formula



Eg *Canis aureus*:

- Guidelines? No. Guidelines similar species? Large Canids WAZA recommends 500m² for 2
- BL: (BLx10)x(BLx15) for 3 inds: 735 for 3 → 490 for 2

- Check guidelines? Large Canid AZA guidelines: Le « large canid manual » suggère pour des espèces similaires (eg coyote : *Canis latrans, dhole : Cuon alpinus*), de ne pas aller sous 465m² (primary enclosure for long-term holding). A site on keeping of exotic pets warns: as carnivore it is prone to excessive stereotypic behavior.
- Pour les dholes, EAZA suggère (Canid and Hyaenid Taxon Advisory Group, 2017) : "As general recommendation, new outdoor enclosure sizes starting from 500 m² onwards are the minimum for two non-reproducing animals. ….. For additional dholes 100m² per individual are recommended, leading to a minimum size of 1000m² for seven non-reproducing dholes."

Extras:

- un sol résilient couvrant la quasi-totalité de la surface d'au moins 90% du logement
- des lieux de repos spécifique à l'espèce (n+1)
- la possibilité de creuser sur au moins 20% de la surface.
- un enclos avec une partie ouverte et une partie avec des structures qui offrent des possibilités de se cacher : un réseau d'arbustes.
- un « vista » donnant la possibilité de scanner l'environnement du hauteur.

New minimum legislation on primates

Species	Inds	outdoor m²	height	indoor m²	height	m²/extra ind		Extra requirements
Hylobates spec.	2	20	3,5	20	3,5	5	5	a b c $d^{(15)}$ $f^{(175)}$ k $l^{(5)}$
Nomascus leucogynes	2	15	4	15	4	5	5	a b c $d^{(15)}$ $f^{(200)}$ k $l^{(5)}$
Nomascus gabriellae	2	15	4	15	4	5	5	a b c $d^{(15)}$ $f^{(200)}$ k $l^{(5)}$
Pongo spec.	2	75	5	75	5	30	30	a b c $d^{(18)}$ e $f^{(250)}$ i k $l^{(2)}$
Gorilla spec.	3	175	4	175	4	30	30	a b c $d^{(18)}$ e $f^{(200)}$ k $l^{(3)}$
Pan paniscus	4	100	4	100	4	20	20	a b c $d^{(18)}$ e $f^{(200)}$ k $l^{(4)}$
Pan troglodytes	4	100	4	100	4	20	20	a b c $d^{(18)}$ e $f^{(200)}$ k $l^{(4)}$

Tabel 2. Bijzondere eisen

Klimmogelijkheid met beweeglijke elementen.	a
Slingermogelijkheden.	b
Manipuleerbare bodembedekking over ten minste 90% van de oppervlakte van het verblijf.	c
De dieren hebben permanent toegang tot een ruimte waarin de temperatuur niet daalt onder de temperatuur in graden Celsius die tussen haakjes is aangegeven.	$d^{(...)}$
Geschikt nestmateriaal.	e
Alle dieren hebben op elk moment een soortspecifieke rustplaats ter beschikking die ten minste op een hoogte, die tussen haakjes in centimeter is aangegeven, boven de bodem van het verblijf is geplaatst.	$f^{(...)}$
Voor elk dier is in een individueel slaaphok voorzien dat ten minste op de hoogte, die tussen haakjes in centimeter is aangegeven, boven de bodem van het verblijf is geplaatst.	$g^{(...)}$
Alle dieren hebben op elk moment een slaaphok ter beschikking dat ten minste op de hoogte, die tussen haakjes in centimeter is aangegeven, boven de bodem van het verblijf is geplaatst.	$h^{(...)}$
Mannelijke dieren kunnen tijdelijk in een geschikt verblijf van de groep afgezonderd worden als dat noodzakelijk is om het welzijn van alle dieren te garanderen. De noodzaak en de tijdelijkheid worden gedocumenteerd.	i
Als de dieren compatibel zijn, mogen ze in groep gehouden worden. In dat geval wordt de minimale oppervlakte, vermeld in de kolom 'minimumafmetingen voor het aangegeven aantal dieren', vermenigvuldigd met het aantal dieren.	j
De dieren hebben de mogelijkheid om soortgenoten en het publiek te mijden en om zich te verstoppen. Er is een visuele barrière.	k
Als de groep groter is dan of gelijk is aan het getal tussen haakjes, wordt het binnenverblijf opgedeeld in twee compartimenten. Per veelvoud van het getal tussen haakjes wordt in een extra compartiment voorzien. Elk compartiment is minstens even groot als de minimumoppervlakte die voor het aanwezige aantal dieren voorgeschreven is, gedeeld door het aantal voorgeschreven compartimenten. Elk compartiment is altijd toegankelijk en heeft minstens twee bruikbare toegangen.	$l^{(...)}$
De minimumhoogte van het dak van het verblijf boven de standplaats van de bezoekers is tussen haakjes aangegeven in meter.	$m^{(...)}$

Objection: BL & corrections are rough & arbitrary criteria

- Available
- Applicable
- Objective
- Biological relevance (social spacing & locomotion)
- Validation in certain species
- Alternative?

Zoo animals are not domesticated

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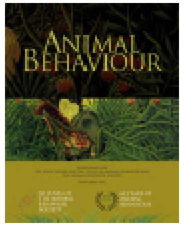

Special Issue

Plastic animals in cages: behavioural flexibility and responses to captivity

Georgia Mason [a,*], Charlotte C. Burn [b], Jamie Ahloy Dallaire [a], Jeanette Kroshko [a], Heather McDonald Kinkaid [a], Jonathan M. Jeschke [c]

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Table 4
Domesticate-like changes in wild animals after multiple generations in captivity and within a single generation in captivity

Domesticate-like changes	Populations captive bred (but not artificially selected) for multiple generations over recent years/decades	Animals developing in captivity (F0 or F1), compared to F0 wild-caught adults placed into captivity
Improved survival	Bank voles, *Clethrionomys glareolus* (Sørensen & Randrup 1986) Pigtailed macaques, *Macaca nemestrina* (Ha et al. 2000)	
Improved reproduction (e.g. earlier sexual maturation; more fecund; better infant survivorship)	Golden hamsters, *Mesocricetus auratus* (Fritzsche et al. 2006) Rhesus monkeys, *Macaca mulatta* (Casebolt et al. 1985) Atlantic salmon, *Salmo salar* (Domagala et al. 2005) Various waterfowl (Batt & Prince 1978)	Gorillas, *Gorilla gorilla* (Ryan et al. 2002) Woolly monkeys, *Lagothrix lagotricha* (Mooney & Lee 1999) Possibly golden-lion tamarins, *Leontopithecus rosalia* (De Vleeschouwer et al. 2003)
More docile (e.g. less fearful/friendlier to humans/easier to handle)	Leopard geckos, *Eublepharis macularius* (Indiviglio 2007) Brook trout (Fraser 2008) Coonstripe shrimp, *Pandalus danae* (Marliave et al. 1993) Zebra finches, *Taenopygia guttata* (Ewenson et al. 2001) Diverse snakes (Cheek & Richards 2003)	Pigtailed macaques (Crockett et al. 2000) African striped mice, *Rhabdomys pumilio* (Jones et al. 2011) European starlings, *Sturnus vulgaris* (Feenders et al. 2011) Possibly black stilts, *Himantopus novaezelandiae* (van Heezik et al. 2005) Black rhinoceros, *Diceros bicornis* (Carlstead et al. 1999) In blue jays, *Cyanocitta cristata*, less route tracing, a stereotypic behaviour related to being enclosed (Keiper 1969)
Reduced endocrine responses to captivity/restraint etc	Sea trout, *Cynoscion nebulosus* (Lepage et al. 2000)	Marsh deer, *Blastocerus dichotomus* (Christofoletti et al. 2010) Southern white rhinoceros, *Ceratotherium simum simum* (Metrione & Harder 2011) African striped mice (Jones et al. 2011) Gilbert's potoroo, *Potorous gilbertii* (Stead-Richardson et al. 2010) Possibly spider monkeys (*Ateles* spp.: Ange-van Heugten et al. 2009) Possibly owl monkeys (*Aotus* spp.: Weller et al. 1994).
Healthier and feeding more readily	Coonstripe shrimp (Marliave et al. 1993) Falcons (Müller et al. 2000) Diverse snakes (Cheek & Richards 2003)	Iberian lynx, *Lynx pardinus* (García-Bocanegra et al. 2010) Gorillas: less coprophagy (Akers & Schildkraut 1985); less regurgitation and reingestion of stomach contents (Gould & Bres 1986)
Melanin loss	Coonstripe shrimp (Marliave et al. 1993) Leopard geckos (Indiviglio 2007) Lymnaea snails (Orr et al. 2008)	
Smaller brains	Many species (Price 2002; Guay & Iwaniuk 2008)	Lions and tigers (Yamaguchi et al. 2009) Trinidadian guppies, *Poecilia reticulata* (Burns et al. 2009) Chickadees: reduced hippocampal volumes (LaDage et al. 2009a, b)
Reduction of antipredator responses (and other behaviours needed in the wild but not in captivity)	Oldfield mice, *Peromyscus polionotus* (McPhee 2004) Red junglefowl, *Gallus gallus* (Håkansson & Jensen 2008) Several salmonids (Fraser 2008)	Rhesus monkeys (Joslin et al. 1964) Blue crabs, *Callinectes sapidus* (Davis et al. 2004) Trinidadian guppies (Kelley & Magurran 2003) Also poorer abilities to process challenging natural foods, e.g. nuts: bank voles (Mathews et al. 2005)
Morphological changes reflecting reduced use (e.g. shorter, lighter intestines)	Shorter, lighter intestines: Squirrel monkeys (*Saimiri* spp.: Chivers 1991) Brown teal, *Anas chlorotis* (Moore & Battley 2006)	Smaller, lighter intestines: Grouse and capercaillie (*Tetrao* spp.: Moss 1972; Liukkonen-Anttila et al. 2000) Shorter limb bones: black-footed ferrets, *Mustela nigripes* (Wiseley et al. 2005)

Zoo animals are not domesticated

- Not systematically selected for tameness
- Not pre-adapted
- Some species show some domesticated traits, not domestication-complex

Do we need natural history information?

- Natural history traits predict adaptability & poor wellbeing in captive wild species

There are no problems with that species

There Are Big Gaps in Our Knowledge, and Thus Approach, to Zoo Animal Welfare: A Case for Evidence-Based Zoo Animal Management

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There are gaps in knowledge that hinder our ability within zoos to provide good animal welfare. This does not mean that zoos cannot or do not provide good welfare, only that currently this goal is hindered. Three reasons for these gaps are identified as: (1) there is an emphasis on the identification and monitoring of indicators that represent poor welfare and it is assumed that an absence of poor welfare equates to good welfare. This assumption is overly simplistic and potentially erroneous; (2) our understanding of how housing and husbandry (H&H) affects animals is limited to a small set of variables determined mostly by our anthropogenic sensitivities. Thus, we place more value on captive environmental variables like space and companionship, ignoring other factors that may have a greater impact on welfare, like climate; (3) finally, whether intentional or not, our knowledge and efforts to improve zoo animal welfare are biased to very few taxa. Most attention has been focused on mammals, notably primates, large cats, bears, and elephants, to the exclusion of the other numerous species about which very little is known. Unfortunately, the extent to which these gaps limit our ability to provide zoo animals with good welfare is exacerbated by our over reliance on using myth and tradition to determine zoo animal management. I suggest that we can fill these gaps in our knowledge and improve our ability to provide zoo animals with good welfare through the adoption of an evidence-based zoo animal management framework. This approach uses evidence gathered from different sources as a basis for making any management decisions,

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Gap: Current Housing and Husbandry Practice Is Based Largely on Promulgation of Myth and Tradition

A review of national and regional zoo association H&H guidelines found that most recommendations for best practice are based on ‘‘current’’ practice and not supported by empirical evidence (Melfi et al., 2007).

“Much zoo husbandry and housing provision is based on what has worked previously (or is working currently) and this “status quo” is then adopted into best-practice guidelines, instead of from an evidence-based approach.” (Wolfensohn et al., 2018)

There are no problems with that species

- welfare concepts & evaluation not part of formal training of significant zoo persons
- working with animals is not a guarantee for positive attitude towards welfare
- linguistic unclarity about welfare

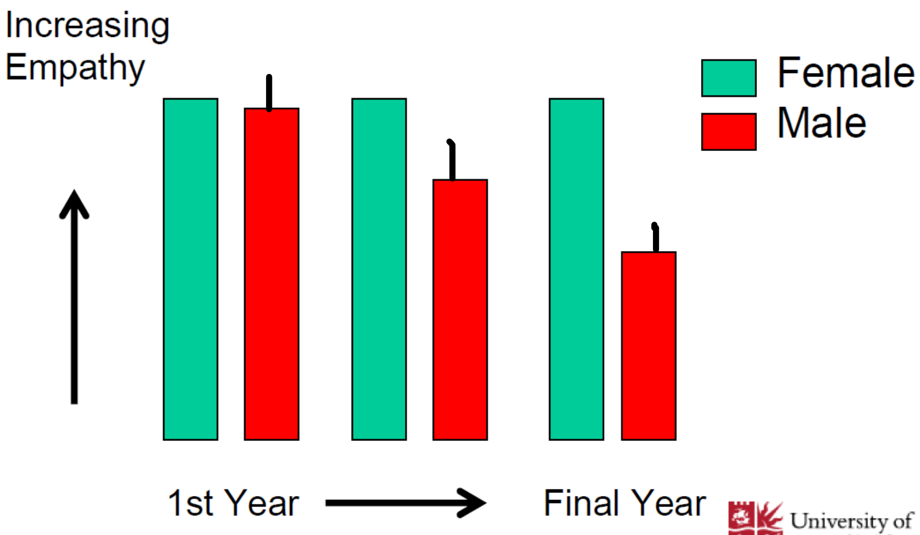
Objection: There are no problems with that species

Article

Familiarity and Interest in Working with Livestock Decreases the Odds of Having Positive Attitudes towards Non-Human Animals and Their Welfare among Veterinary Students in Italy

Chiara Mariti [1,*], Federica Pirrone [2], Mariangela Albertini [2], Angelo Gazzanc
Silvana Diverio [3]

Empathy in veterinary students



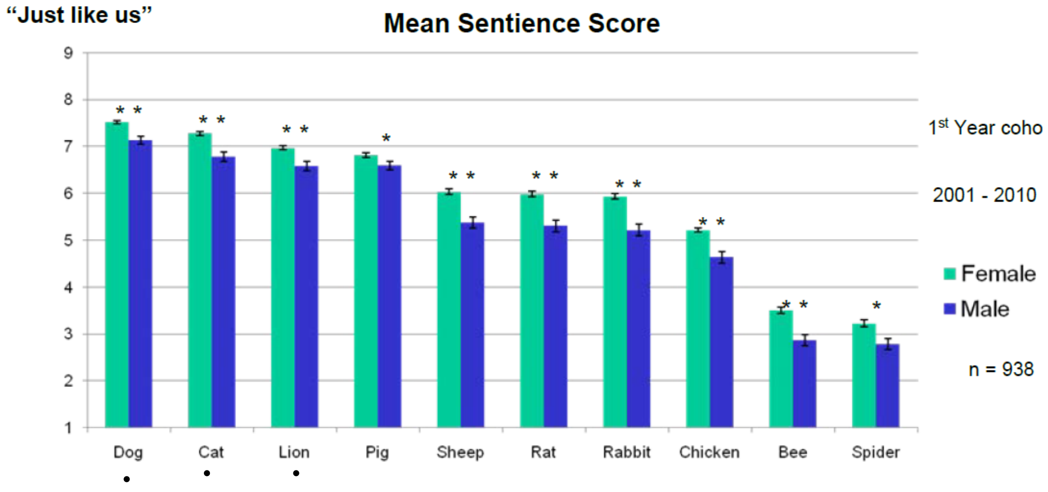
Attitudes in vet students (Paul & Podbersbeck 2000)

University of BRISTOL

Belief in Sentience : affected by gender

Nancy Clarke, David Main, Elizabeth Paul

WSPA World Society for the Protection of Animals



MANOVA F = 6.063, P<0.001
Error bars show standard error
*P≤0.01, ** P< 0.001

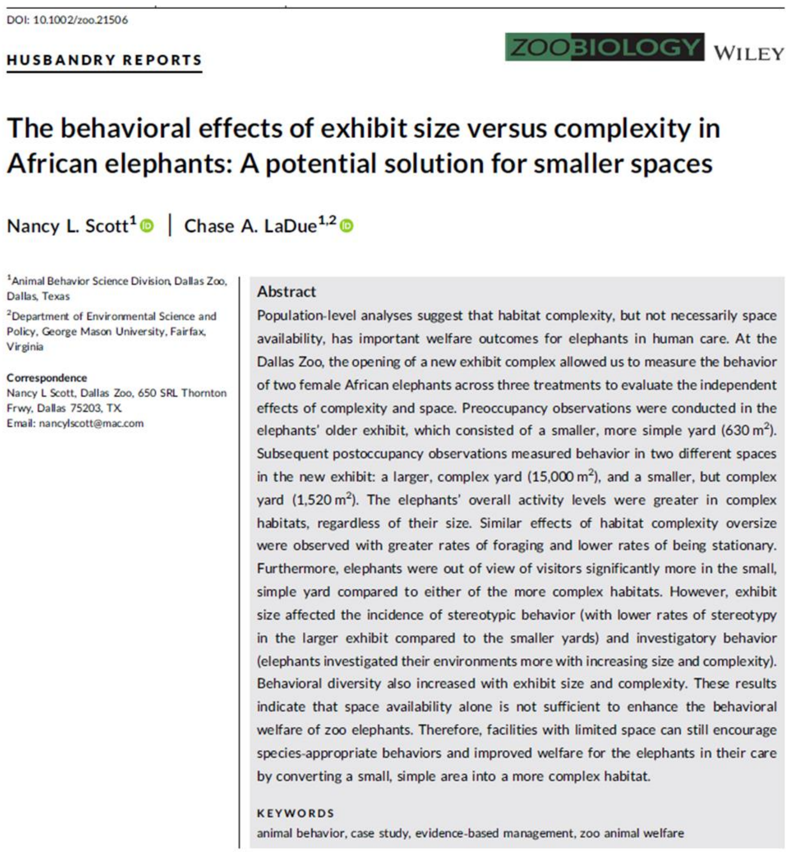
University of BRISTOL

Objection:“It is not about quantity but quality”

- Evidence on benefits of complexity
- Evidence on benefits of larger space with regard to behaviour and affect (activity budgets, locomotion, social needs, …)
- Space needs to functional & qualitatively well-designed

→Share evidence

Objection: “We all know you can prove anything with science”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HUSBANDRY REPORTS

ZOOBIOLOGY WILEY

The behavioral effects of exhibit size versus complexity in African elephants: A potential solution for smaller spaces

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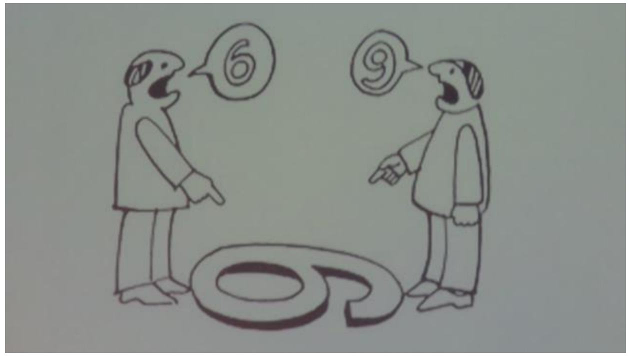
Abstract

Population-level analyses suggest that habitat complexity, but not necessarily space availability, has important welfare outcomes for elephants in human care. At the Dallas Zoo, the opening of a new exhibit complex allowed us to measure the behavior of two female African elephants across three treatments to evaluate the independent effects of complexity and space. Preoccupancy observations were conducted in the elephants' older exhibit, which consisted of a smaller, more simple yard (630 m^2). Subsequent postoccupancy observations measured behavior in two different spaces in the new exhibit: a larger, complex yard (15,000 m^2), and a smaller, but complex yard (1,520 m^2). The elephants' overall activity levels were greater in complex habitats, regardless of their size. Similar effects of habitat complexity oversize were observed with greater rates of foraging and lower rates of being stationary. Furthermore, elephants were out of view of visitors significantly more in the small, simple yard compared to either of the more complex habitats. However, exhibit size affected the incidence of stereotypic behavior (with lower rates of stereotypy in the larger exhibit compared to the smaller yards) and investigatory behavior (elephants investigated their environments more with increasing size and complexity). Behavioral diversity also increased with exhibit size and complexity. These results indicate that space availability alone is not sufficient to enhance the behavioral welfare of zoo elephants. Therefore, facilities with limited space can still encourage species-appropriate behaviors and improved welfare for the elephants in their care by converting a small, simple area into a more complex habitat.

KEYWORDS
animal behavior, case study, evidence-based management, zoo animal welfare



Share the facts & clarify standpoints

Objection: “Welfare/zoo science is bad science”

- Zoo research: small sample sizes & multiple variables → correct questions & designs & robust stats.
- Many measures developed on laboratory & farm animals.
- Welfare is a complex concept: scientists working on validation of welfare measures

Objection: “Welfare/zoo science is bad science”

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ARTICLE

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Advances in Applied Zoo Animal Welfare Science

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ABSTRACT
Nonhuman animal welfare science is the scientific study of the welfare state of animals that attempts to make inferences about how animals *feel* from their behavior, endocrine function, and/or signs of physical health. These welfare measurements are applicable within zoos yet inherently more complex than in farms and laboratories. This complexity is due to the vast number of species housed, lack of fundamental biological information, and relatively lower sample sizes and levels of experimental control. This article summarizes the invited presentations on the topic of “Advances in Applied Animal Welfare Science,” given at the Fourth Global Animal Welfare Congress held jointly by the Detroit Zoological Society and the World Association of Zoos and Aquariums in 2017. The article focuses on current trends in research on zoo animal welfare under the following themes: (a) human–animal interactions and relationships, (b) anticipatory behavior, (c) cognitive enrichment, (d) behavioral biology, and (e) reproductive and population management. It highlights areas in which further advancements in zoo animal welfare science are needed and the challenges that may be faced in doing so.

KEYWORDS
Research; behavior; human–animal interaction; cognitive enrichment; management

animals

MDPI

Review

How Can We Assess Positive Welfare in Ruminants?

Silvana Mattiello [1,*], Monica Battini [1], Giuseppe De Rosa [2], Fabio Napolitano [3] and Cathy Dwyer [4]

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Simple Summary: The concern for better farm animal welfare has been greatly increasing among scientists, veterinarians, farmers, consumers, and the general public over many years. As a consequence, several indicators have been developed to assess animal welfare, and several specific protocols have been proposed for welfare evaluation. Most of the indicators developed so far focus on the negative aspects of animal welfare (e.g., lameness, lesions, diseases, presence of abnormal behaviours, high levels of stress hormones, and many more). However, the lack of negative welfare conditions does not necessarily mean that animals are in good welfare and have a good quality of life. To guarantee high welfare standards, animals should experience positive conditions that allow them to live a life that is really worth living. We reviewed the existing indicators of positive welfare for farmed ruminants and identified some gaps that still require work, especially in the domains of Nutrition and Health, and the need for further refinement of some of the existing indicators.

Welfare science is growing exponentially - it is an expertise in itself that needs to be incorporated in zoo management

Discussion

Minimal standards

- Pros:
- minimum standard
- animal centered
- clarity for controlling organism
- Cons:
- legislation is slow, not always in line with current insights
- may promote to only aim for minimum
- may promote a status-quo
- not yet animal-based criteria

Discussion

Challenges

- Culture of care for welfare
- Control

  - indoor/outdoor choice
    - Polar bears: less stereotypical behaviour & more social play (Ross,2006)
    - Pandas: less agitation, lower cortisol (Owen et al., 2005)
    - Choice is vehicle for control, control important for welfare (Leotti et al., 2010)
    - Importance of retreat to reduce stress (Sherwen & Hemsworth 2019)

Discussion

Compensations (eg AZA Sun bear guidelines)?

Dynamic adaptations

Table 4. Point system used to evaluate behavioral opportunities provided to bears within enclosures

Points	Description
5	Sunny areas:~25% of exhibit is in full sun
5	Heated areas: heated rocks/limbs or heaters in shelters
5	Simple climbing structure: tall [<3.05 m (10 ft)] multi-limbed, tiered, single unit
5	Multi-leveled landscape: large rocks, hills, multiple tiers
5	Multiple nesting/resting sites: hammocks, platforms, wide horizontal logs
5	Large or multiple shelters: wind, rain protected, partially enclosed
5	Training station: on or off view training area (mesh, sleeves, weight platform) where training is performed routinely
5	Permanent water features: streams, shallow wading pools, waterfalls
5	Exhibit Modifications: browse holders, misters (bear experience)
5	Complex feeding sites: termite mounds, programmable/permanent mechanized dispensers (honey, live fish, fruit)
5	Simple feeding sites: cavities, wells, attachments for puzzle feeders, permanent non-mechanized dispensers
5	Digging pits: smaller sections of substrate for digging or deep mulch pit
5	Vegetation/temporary "forest": some growing vegetation is present within exhibit, or it is regularly filled with leafy non-toxic branches creating a "forest"
5	Temporary items: smaller logs, water tubs, browse
5	Exhibit enrichment program: enrichment is done routinely (5–7x/week)
5	Foraging on exhibit: >60% of diet is regularly, widely dispersed/hidden on exhibit
5	Bedding (exhibit and holding): hay, woodchips, wood wool, leaves etc.
5	Holding area training: off view animal training program
5	Holding area enrichment: off-view enrichment is done routinely (5–7x/week)
5	Exhibit size 279 to 465 m² (3,000 to 5,000 ft²)
10	Exhibit size 465 to 929 m² (5,000 to 10,000 ft²)
10	Access to holding or an indoor enclosure : bears have indoor or outdoor access except when being serviced
10	Direct multiple animal entryways into the exhibit (avoid tunnels or hallways)
10	Vegetation: a combination of live plants, trees, tall grasses covering most of the exhibit
10	Substrate: soil, mulch, [5.08–10.15 cm(2–4 in.)] etc. covering >50% of exhibit
10	Shaded areas: ~25% of exhibit is in full shade
15	Complex climbing structure: tall [3.05–6.10m(10–20 ft)] multi-limbed/tiered, 2–3 connected units (ideal, but difficult to do in smaller exhibits as walls are too close)
15	Additional indoor (on-view) enclosure: with many of the elements listed above (recommended for both but especially sun bears)

The true value of larger exhibit size lies in its ability to foster more and better examples of the elements listed in Table 4. The total score for an enclosure can provide an in-house assessment of how well the space will meet the behavioral and physical needs of sun and sloth bears and where improvements can be made. Table 5 lists three program levels based on number of points an enclosure scores.

Table 5. Point ranges for exhibit and program levels

	Points	Description
Level 1	~50	It is recommended to try to improve point total by at least 50 points
Level 2	~100	Adequate, but room for improvement; it's recommended to try to gain 15–25 points
Level 3	~175	Ideal, great all around bear program

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