

## Narrative 11: Zoo animal and exotic pet nutrition and husbandry

### Our work on pellet formulation

Berndt, ..., Hummel, **Clauss (2004)** The formulation of a beet pulp-based pelleted food for captive wild ruminants and preliminary experiences. *Proc Eur Ass Zoo Wildl Vet* 5: 371-372

### and on using browse silage

Hatt, **Clauss (2006)** Browse silage in zoo animal nutrition – feeding enrichment of browsers during winter. In: Fidgett A, Clauss M, Eulenberger K, Hatt JM, Hume I, Janssens G, Nijboer J (eds) *Zoo animal nutrition III*. Filander Verlag, Fürth, Germany, pp. 201-204

contributed to developments in the design of commercial pelleted diets for, and to changes in the feeding regime of, zoo animals.

Being involved in feeding recommendations for both zoo animals and exotic pets led to the formulation of husbandry guidelines, e.g. for giraffe

Hummel & **Clauss (2006)** Feeding. In: *EAZA husbandry and management guidelines for Giraffa camelopardalis*. Burger's Zoo, Arnhem, pp. 29-61

and to

several invited lectures on zoo animal nutrition at conferences as well as seminars at specific institutions, including the International Conference on Diseases of Zoo and Wild animals, Warsaw, Poland, 2014 on *Nutritional diseases*, the 4<sup>th</sup> Symposium on Wild Animals and Exotics, IAAS\_UTAD, Villareal, Portugal, 2015 and 2021, on *Zoo animals and bear nutrition*, the Nordic Wild and Zoo Veterinary Conference, Eksilstuna, Sweden, 2019, on *Zoo animal nutrition*, or the 43<sup>rd</sup> Brazilian Conference of Zoo Animal Medicine, Belo Horizonte, Brazil, 2019 on *Challenges in zoo animal nutrition*.

as well as invited reviews, e.g. for rabbit husbandry

**Clauss & Hatt (2017)** Evidence-based rabbit housing and nutrition. *Vet Clin N Am - Exotic Anim Pract* 20: 871-884

During this work, we developed and applied several body condition scores for various zoo animals, e.g. for elephants in the multi-paper doctoral thesis of Christian Schiffmann

Schiffmann, **Clauss et al. (2018)** Body condition scores in European zoo elephants (*Elephas maximus* and *Loxodonta africana*) - status quo and influencing factors. *J Zoo Aquar Res* 6:91-103.

Schiffmann, **Clauss et al. (2020)** Weigh and see – body mass recordings versus body condition scoring (BCS) in zoo elephants (*Loxodonta africana* and *Elephas maximus*). *Zoo Biol* 39: 97-108

For his thesis and the distinct additional contributions and services, Christian Schiffmann was awarded the Annual Award of the Vetsuisse Faculty of the University of Zurich, 2019.

or other animals, e.g.

Clavadetscher, ..., **Clauss (2021)** Development of an image-based body condition score for giraffes (*Giraffa camelopardalis*) and a comparison of zoo-housed and free-ranging individuals. *J Zoo Aquar Res* 9: 170-185

Starting from the elephant comparison of body weights in free-ranging and zoo specimens, we developed a process of comparing such data systematically

Garand, ..., **Clauss, et al. (2024)** Larger than life? Body mass records of zoo-managed giant anteaters (*Myrmecophaga tridactyla*). *Zoo Biol* 43: 537-544.

Involvement in studies on vitamin and mineral status of zoo animals, in particular with respect to iron storage disease, led to the

invitation to participate in the 2011 and 2016 Workshops on Iron Storage Disease in black rhinoceros hosted by Disney's Animal Kingdom, Florida, USA

with a resulting review publication

**Clauss & Paglia (2012)** Iron storage disease in captive wild mammals – the comparative evidence. *J Zoo Wildl Med* 43: S6-S18

but the work also covers aspects of fatty acids, tannins, and other nutritional or non-nutritional diseases (partially in the framework of the peculiar teaching unit 'Zoo Research Camp').

Amongst the different works on various nutritional and husbandry aspects, one on a case series in flamingos

Hammer, ..., **Clauss (2007)** Bill impaction in a group of captive Caribbean flamingos (*Phoenicopiterus ruber ruber*). *J Zoo Wildl Med* 38: 465-470

and on seemingly narcoleptic elephants

Schiffmann, ..., **Clauss, Hatt (2018)** When elephants fall asleep: a literature review on elephant rest with case studies on elephant falling bouts, and practical solutions for zoo elephants. *Zoo Biol* 37: 133-145

are especially appealing, and in a theoretical work we assessed how the design of a scoring system can influence the outcome of surveys

Ertl, ..., **Clauss (2019)** Theory of medical scoring systems and a practical model for the foot health of Asian elephants (*Elephas maximus*) in European zoos. *Anim Welf* 29: 163-176

## Our work on water intake in rabbits

Partially funded by a grant from the Swiss Federal Veterinary Office in 2008
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e.g., Tschudin, Clauss et al. (2011) Preference of rabbits for drinking from open dish vs. nipple drinkers. <i>Vet Rec</i> 168: 190-190a achieved attention both from the editors of the journal as well as of several institutional bodies
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The publication "Preference of rabbits for drinking from open dish vs. nipple drinkers" was given an <b>editorial</b> of its own in the same issue of the Veterinary Record.
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For her dissertation thesis, Anja Tschudin received the <b>Award Semesterpreis der Universität Zürich 2010</b> and the <b>Award of the Gesellschaft Schweizer Tierärztinnen und Tierärzte 2011</b> .
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Survey of current husbandry practices, while academically not particularly challenging, are important to document not only the status quo, but also progress in that husbandry. Therefore, since my own doctoral thesis in 2000 that represented a comprehensive evaluation of husbandry practices for moose, we are continuously interested in performing similar surveys to understand, and possibly influence, current animal husbandry practice.

Kleinlugtenbelt, ..., Clauss (2023) Large carnivore feeding in European zoos. *Zool Garten NF* 91: 9-39

Samet, ..., Clauss (2025) Current practices in dietary management and disease incidence in red panda (*Ailurus fulgens*) across European Zoos. *J Zoo Aquar Res* (online)

This engagement is also represented by guest lectures given (for free) in zoological gardens upon request to foster progress in zoo animal nutrition and husbandry.

Most recently, ENG member Anouk Fens and me published an overview that summarizes both, the history of zoo animal nutrition (with indicators that allow individual zoos to gauge where they are in this historical process) as well as its relevance not only for physiological but psychological wellbeing

Fens, Clauss (2024) Nutrition as an integral part of the behavioural management of zoo animals. *J Zoo Aquar Res* 12: 196-204

A part of this work is my commitment as one of the core members of the European Zoo Nutrition Group (ENG) of the European Association of Zoos and Aquaria (EAZA), which organizes a bi-annual conference on zoo animal nutrition and regularly contributes a nutrition session to the annual EAZA conference. In 2024, our group was granted the (somewhat prestigious) plenary session of the EAZA conference, celebrating our 25<sup>th</sup> anniversary and hopefully setting out zoo animal nutrition as a major husbandry improvement that does not cost much but just requires a certain mental concept.

Currently, we are investigating body mass differences between free-ranging and zoo mammals in different taxa. We are exploring ways to feed zoo carnivores in more challenging ways, including the option of failure (mimicking unsuccessful hunts) and using species-specific peculiarities, e.g. the propensity of polar bears for long periods of motionless waiting during their predation on seals.

Additionally, we want to address the socio-cultural aspects that seem to stand between scientifically sound diet choices and the diets actually chosen by some zoo managers for their animals.