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After Dark: Investigating the Practice of Overnight Indoor Housing for Zoo Animals

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Abstract

One of the key focuses of modern zoos is to provide good welfare opportunities through choice and control for the animals that they house. One practice that is common across zoos globally is the housing of animals in indoor exhibits overnight. While widespread as a practice, the housing of animals indoors features rarely in the published literature, though it appears on occasion in grey literature such as animal husbandry guidelines. Anecdotally, housing of animals indoors overnight is linked to safety of the animals and public, and protection against weather conditions. However, housing of animals indoors restricts space availability and may impact sleep and activity patterns. Given the paucity of scientific literature on indoor housing, there is a need to evaluate why these practices occur, and how their impact can be scientifically investigated. This review draws together the existing literature on overnight housing to identify the key benefits of this practice, along with the animal welfare implications. Future directions in terms of zoo animal housing are considered.

Keywords: *animal behaviour, husbandry, sleep, welfare, wildlife park*

REVIEW ARTICLE

1. INTRODUCTION

Zoos play a key role in global conservation, whilst also striving to maintain good welfare for the animals that they house (Mellor et al., 2020). With over 10,000 species housed in captivity (Mason, 2010), zoos are tasked with the major challenge of identifying best practice husbandry methods for a diverse array of taxa large, charismatic mega fauna are common in zoos, and often these animals are often provided with both indoors and outdoors housing. Anecdotally, it is common practice to keep zoo animals indoors during the night, and to provide access to outdoor facilities during the zoo opening hours (Goodenough et al., 2019). While this practice features as a regular practice for many zoos globally, the practice is rarely featured as the topic of peer-reviewed literature (Brando & Coe, 2022). As a result, the true prevalence of this practice is largely unknown, with occasional, reference to housing animals indoors overnight in select species husbandry guidelines, and in the methods of papers when normal husbandry practices are defined (Goodenough et al., 2019). As such, indoor housing is rarely the subject of study: it is for only a select few charismatic mammals such as elephants (*Loxodona africana* and *Elephas maximus,* Posta et al., 2013), giraffes *(Giraffa camelopardalis,* Razal et al., 2017, 2024) and great apes (*Gorilla gorilla gorilla* and *Pan troglodytes,* Ayuso et al., 2023; Gartland et al., 2023) that housing impacts on welfare are regularly investigated.

In many zoos, keepers start work around 08:00 and finish between 17:00 and 18:30.The hours in which an animal may be kept in indoor housing could therefore exceed 15 hours per day (60% of entire day). In temperate climates, animals may be kept in for yet longer, particularly during frosty winters or stormy weather (Razal et al., 2024). The indoor environment could therefore have an enormous influence on welfare: a well-designed outdoor exhibit is of less welfare relevance if the animal has access to this resource for only 40% of its time (Brando, 2023). It is important, therefore, that the role of indoor housing for zoo animals is investigated from a scientific standpoint. As little empirical data are available on the justifications for indoor overnight housing, there is a need to compile what is known in this field. This scoping review aims to identify the key benefits of

maintaining animals inside overnight, evaluate what is known about the impact of these practices on animal welfare, and identify ways in which useful empirical data can be gathered.

2. Why House Animals Indoors Overnight?

While rarely the focus of published literature, reference to indoor housing overnight is briefly referenced in both published literature (McGuire et al., 2024) and grey literature, such as husbandry guidelines (EAZA, 2006). Anecdotal observations of zoos in Europe and North America suggest that this is commonly the case. In terms of species, this practice appears to be common when housing mammals, especially carnivorans, primates, elephants and ungulates, and is rarely relevant for reptiles, amphibians and invertebrates. As only passing mention to the practice is made in the literature, with a handful of exceptions (See Brando & Coe, 2022, Brando, 2023), the justifications for indoor housing overnight are rarely provided. As such, many of the reasons for this practice are based on anecdotal evidence. Examples of these reasons include weather, public safety and animal safety (Table 1).

Table 1. *Potential justifications for maintaining animals indoors overnight in zoo facilities.*

Justification	Explanation
Fright	Some animals are naturally flighty, especially birds and antelope. When startled at night, these animals may act erratically and thus may cause themselves damage. There is anecdotal evidence of birds dying as a result of collision with enclosure fencing and furnishings following fright by fireworks. Keeping animals indoors may reduce the amount of disturbance from the environment whilst also reducing the distance that an animal can travel before colliding with an enclosure boundary.
Predation risk	While zoos aim to maintain their animals safely, risks may emerge when maintaining animals with outdoor access overnight. For example, predators such as foxes (*Vulpes vulpes)* or opportunistic pests such as rats (*Rattus norvegicus*) may take advantage of sleeping animals in exhibits. Previous discussions with keepers have identified loss of animals through such predation: this includes a large flock of flamingos (*Phoenicopterus* spp.) lost to a predator during a single night. Indoor housing reduces this risk, especially when animals are housed in naturalistic, open-topped enclosures.
Protection from public	Zoos may on occasion be the subject of burglary and vandalism from the public. For example, a white rhinoceros (*Ceratotherium simum)* was short in 2017 in a French zoo (Willsher, 2017). Other examples include attempts at theft of small primates or rare birds. By placing animals inside locked buildings, theft or vandalism attempts are more challenging.
Public safety	Zoos often maintain species that are capable of causing harm or even killing members of the public; examples include large felids, camels, elephants and ursids. Legislatively, zoos therefore are required to put protection measures in place for both visitors and keepers (Scott et al., 2000). During zoo open hours, members of the keeping team are present, and many zoos require their keeping staff to be firearms trained for protection (Scott et al., 2000). During the night when keeping staff are absent, zoos may have a limited ability to identify attempted escapes, or to act accordingly. Locking of dangerous animals indoors reduces the chances of an animal successfully escaping from its exhibit.
Surveillance	Outdoor animal enclosures may be difficult to monitor, especially when the environment is complex. Closed Circuit Television (CCTV) cameras are now available and in use in many large mammal enclosures, though their use is sometimes limited to the indoor facilities. Keeping animals indoors can allow keepers to record behaviour for better non-invasive monitoring of sleep and welfare parameters (Walsh, 2017). This may be especially important for pregnant animals that are soon to give birth.
Weather protection	Temperatures tend to drop overnight, and the reduction in temperature also results in an increase in relative humidity, resulting in condensation. Some zoo-housed species are sensitive to cold, especially small mammals and birds, and so cooler temperatures may pose a threat to health (Wissman, 2014). Condensation may further cool animals, resulting in either increased energy consumption or hypothermia in very cold climates. Indoor exhibits are often heated, and so temperatures can be much higher than the temperate winter climates.

3. Animal Welfare

While there are clearly management benefits when maintaining animals indoors, there may be potential impacts on animal sleep quality and space use and therefore welfare. For example, many felids are crepuscular or nocturnal, and so these animals may be most active during their indoor period. The indoor environment provides fewer opportunities for movement, and so restriction may

potentially lead to frustration and stereotypy (Breton & Barrot, 2014). Additionally, size restrictions in indoor exhibits sometimes necessitate animals to be separated into solitary housing (Gartland et al., 2023; Smith et al., 2023). In social animals such as primates and ungulates, this separation could lead to stress. Ultimately, the challenge remains that empirical evidence has not been collected on the impact of indoor housing on welfare. With limited literature available, there is limited quantification of the wider impact. Behavioural or physiological study may aid in bridging the gap in welfare understanding. The impact of this stress may not be reported in the literature so commonly, as stereotypy that occurs during late night or early morning will not be observed unless CCTV is installed, and regularly watched.

4. Future Directions

Clearly, the keeping of animals indoors overnight requires a cost: benefit analysis, in which the potential benefits to an animal's welfare are weighed against the risks from an animal and human health perspective. These discussions should be considered in greater depth in the published literature, given that some zoo animals may spend the majority of their time indoors. In order to address this, the following future directions would be useful for study:

1. Nocturnal behaviour. Studies could investigate the behavioural diversity and space use (Brereton et al., 2023) of megafauna when provided with outdoor access, or when indoors overnight. These studies could focus on welfare indicators such as stereotypy or positive behaviour in order to identify whether outdoor access is beneficial.
2. Heart rate and sleep quality. Several studies have investigated sleep quality in animals: this could be investigated using remote monitoring of behaviour (Walsh, 2017), or by using worn devices, for example in domesticated species.
3. Glucocorticoids. Non-invasive studies of stress hormone metabolites could be conducted when providing animals with outdoor access or when housing indoors. These metabolites could reveal whether animals are more stressed when provided with the option to use outdoor areas, or vice versa.

5. Conclusion

Clearly, there are major benefits in terms of housing zoo animals indoors, and the stakeholders involved in the decision to house individuals indoors overnight include not only the animal, but also the keeping team and the wider public. The decision to house indoors therefore should be based on a solid benefit-risk analysis. There are potential challenges associated with keeping animals indoors, especially where space and opportunities for social interaction are limited during this time. Zoos should consider holistically how long their animals are being maintained indoors on a daily basis, and what the impact of this is in terms of animal welfare. If housing indoors is unavoidable, funding may be best placed in maximising the amount of opportunity and space in indoor housing, rather than investing in better outdoor facilities. Ultimately, the amount of research on indoor housing is currently limited, and as such collaborative research is required to better understand the impact on animal welfare, though also on staff work and health and safety. We encourage researchers to consider the housing of animals indoors overnight as a topic worthy of further study given the potential impact this practice may have on welfare, so that a foundation of evidence is built with which to make decisions.

References

[1] Ayuso, P. R., Feliu, O., Riba, D., & Crailsheim, D. (2023). Listening to Their Nights: Sleep Disruptions in Captive Housed Chimpanzees Affect Their Daytime Behavior. *Animals*, *13*(4), 696. https://doi.org/10.3390/ani13040696

[2] Brando, S., & Coe, J. (2022). Confronting Back-of-House Traditions: Primates as a Case Study. *Journal of Zoological and Botanical Gardens*, *3*(3), 366–397. https://doi.org/10.3390/jzbg3030029

[3] Brando, S., Vitale, A., & Bacon, M. (2023). Promoting Good Nonhuman Primate Welfare outside Regular Working Hours. *Animals*, *13*(8), 1423. https://doi.org/10.3390/ani13081423

[4] Brereton, J. E., Jones, E. M., McMillan, C., & Perkins, K. (2023). Visitors and observers otter-ly influence the behavior and enclosure use of zoo-housed giant otters. *Zoo Biology*, 42(4), 509-521.

[5] Breton, G., & Barrot, S. (2014). Influence of enclosure size on the distances covered and paced by captive tigers (*Panthera tigris). Applied Animal Behaviour Science*, 154, 66-75.

[6] Coe, J., & Hoy, J. (2020). Choice, Control and Computers: Empowering Wildlife in Human Care. *Multimodal Technologies and Interaction*, *4*(4), 92. https://doi.org/10.3390/mti4040092

[7] EAZA. (n.d.). *EAZA Husbandry and Management Guidelines: <i>Giraffa camelopardalis<i/> 2006*. Retrieved June 6, 2024, from https://library.giraffeconservation.org/download/eaza-husbandry-and-management-guidelines-giraffa-camelopardalis-2006/

[8] Fernandez, E. J., Brereton, J. E., & Coe, J. (2023). How do we plan for the zoo exhibit of the future? *Applied Animal Behaviour Science*, *268*, 106085. https://doi.org/10.1016/j.applanim.2023.106085

[9] Gartland, K. N., Bovee, E., & Fuller, G. (2023). Impact of alternating overnight housing conditions on welfare measures in a bachelor group of western lowland gorillas (*Gorilla gorilla gorilla*). *American Journal of Primatology*, *85*(3), e23443. https://doi.org/10.1002/ajp.23443

[10] Goodenough, A. E., McDonald, K., Moody, K., & Wheeler, C. (2019). Are "visitor effects" overestimated? Behaviour in captive lemurs is mainly driven by co-variation with time and weather. *Journal of Zoo and Aquarium Research*, *7*(2), 59–66. https://doi.org/10.19227/jzar.v7i2.343

[11] Mason, G. J. (2010). Species differences in responses to captivity: stress, welfare and the comparative method. *Trends in Ecology & Evolution*, *25*(12), 713–721. https://doi.org/10.1016/j.tree.2010.08.011

[12] McGuire, A., Kienlen, M., Emory, R., & LaDue, C. A. (2024). Overnight monitoring reveals the behavioral rhythms of a geriatric male elephant: an animal-centered case study of rest and stereotypy. *Frontiers in Conservation Science*, *5*. https://doi.org/10.3389/fcosc.2024.1362313

[13] McGuire, M., & Vonk, J. M. (2020). In or out: Response slowing across housing conditions as a measure of affect in three Western lowland gorillas (*Gorilla gorilla gorilla*). *PeerJ*, *8*, e9525. https://doi.org/10.7717/peerj.9525

[14] Mellor, D. J., Beausoleil, N. J., Littlewood, K. E., McLean, A. N., McGreevy, P. D., Jones, B., & Wilkins, C. (2020). The 2020 Five Domains Model: Including Human–Animal Interactions in Assessments of Animal Welfare. *Animals*, *10*(10), 1870. https://doi.org/10.3390/ani10101870

[15] Posta, B., Huber, R., & Moore Iii, D. E. (2013). The Effects of Housing on Zoo Elephant Behavior: A Quantitative Case Study of Diurnal and Seasonal Variation. *International Journal of Comparative Psychology*, *26*(1). https://doi.org/10.46867/ijcp.2013.26.01.05

[16] Razal, C., Bryant, J., & Miller, L. (2017). Monitoring the behavioral and adrenal activity of giraffe (*Giraffa camelopardalis*) to assess welfare during seasonal housing changes. *Animal Behavior and Cognition*, *4*(2), 154–164. https://doi.org/10.12966/abc.03.05.2017

[17] Razal, C., Bryant, J., & Miller, L. (2024). Assessing Giraffe Welfare During Seasonal Habitat Changes in Northern US Zoos. *Journal of Zoo and Aquarium Research*, *12*(1), 9–15. https://doi.org/10.19227/jzar.v12i1.762

[18] Scott, P., Stevenson, M., Cooper, J., & Cooper, M. (2000). *Secretary of State's Standards of Modern Zoo Practice*. Her Majesty's Stationary Office, Norwich.

[19] Smith, K. D., Snider, R. J., Dembiec, D. P., Siegford, J. M., & Ali, A. B. (2023). Effects of a modern exhibit design on captive tiger welfare. *Zoo Biology*, *42*(3), 371–382. https://doi.org/10.1002/zoo.21746

[20] Walsh, B. (2017). Asian elephant (Elephas maximus) sleep study – long-term quantitative research at Dublin Zoo. *Journal of Zoo and Aquarium Research*, *5*(2), 82–85. https://doi.org/10.19227/jzar.v5i2.174

[21] Willsher, K. (2017, March 7). Rhino shot dead by poachers at French zoo. *The Guardian*. https://www.theguardian.com/world/2017/mar/07/rhino-shot-dead-by-poachers-at-french-zoo

[22] Wissman, M. A. (2014). Husbandry and Medical Care of Callitrichids. *Journal of Exotic Pet Medicine*, *23*(4), 347–362. https://doi.org/10.1053/j.jepm.2014.07.014

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