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The Routledge Handbook of Health and Environmental Humanities

Edited by Amber Abrams, Victoria Bates, and Rocío Gomez

First published 2026

ISBN: 9781032505541 (hbk)

ISBN: 9781032520087 (pbk)

ISBN: 9781003404866 (ebk)

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How do monkeys make toast? Animal health and history in the environmental humanities

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Introduction

The humanities have traditionally been concerned with humans, though this is no longer the case. Scholars in the environmental humanities and animal studies fields have long incorporated non-human actors into their studies; the health and “medical” humanities have also engaged with non-human animals, such as Camille Bellet’s work on human-animal relationships and multi-sensory worlds of production animals, and the “non-human animals in the medical humanities” network (Bellet 2021, 2022, 2024). Furthermore, Woods *et al.* address the non-human and health head-on with their publication *Animals and the Shaping of Modern Medicine* (2018). This chapter builds on the existing literature, by furthering the case for considering animals as central both to health and the environment. It does so by presenting a history of feeding zoo animals. Specifically, this case study chapter focuses on the twentieth-century rise of zoo nutrition as an applied scientific field and its relationship to zoo animal health. It provides a story of enmeshed worlds, blurred boundaries, and the importance of animal health to both health and environmental humanities.

Zoo histories have increased over the years, though few have investigated the twentieth century, which was a period of significant change for zoos (Flack 2018; Kohlstedt 1996). Furthermore, the study of zoo nutrition or feeding has not previously been a focus of either social science or humanities research. Animal nutritional science – explored here specifically in zoos – shows the intricate relationships between food, humans, animals, and nutrition (McLennan 2020; Moore 2024). Investigations into the lived experiences of zoo animals, including feeding, fit with the increasing interest of the humanities and social sciences in a multispecies community, and furthers the call from scholars to decentre humans from historical enquiries (Haraway 2008; Mazanik 2023). It also fits with animal studies approaches that have, in general, sought to inform new historical understanding from animals as subjects, rather than objects, that are enmeshed within the history of war, politics, society, the environment, health, and science and technology (Shaw 2013; Specht 2016).

The ties between zoo feeding and health are clear. Ellen Dierenfeld, zoo nutritionist, points out that zoo nutrition has a history of managing animal health through extending life and as a result managing geriatric nutrition long before other animal industries (Dierenfeld 2022, interview). Zoo animals have, as a result, acquired an increasing number of health issues that are more common within humans and not knowingly present in the wild, such as diabetes, obesity, and cancer (Clauss and Müller 2023; Plowman 2013). Zoos actually also share a similar history to that of modern nutritional science for humans. Both are built upon colonialism, industrialisation, extractivist policies, and exploitation of both land and Indigenous populations (Haushofer 2023; McLennan 2020). Overall, the history of animal health provides a broader, more complete vision of the health-environmental humanities,

one that can identify the challenges of maintaining animal health within human-controlled and culturally-created environments, such as the zoo, both historically and in the present day.

Researching zoos

Zoos present an imagined nature for the education, pleasure, and the gaze of visitors, turning them into places of learning and leisure. Unlike earlier zoos of the late eighteenth and early nineteenth centuries, modern twentieth- and twenty-first-century zoos have blurred the boundaries between wild and non-wild. They have intertwined humans and non-humans in a multi-species bio-social fabric that amalgamates science, leisure, learning, the environment, human, non-human, nature, culture, the wild, and the non-wild (Flack 2018; Ritvo 2008). This context makes them fruitful sites for humanities research, though – as this section outlines – they also come with challenges.

Humanities-based research within zoos faces distinct obstacles that combine to make it a challenging endeavour. The first obstacle relates to the availability of written archival material. In Britain, for example, there is one publicly accessible zoo archive held at the Zoological Society of London's (ZSL) library and archives. There are potential archives held at some zoos in Britain and Ireland, but these are either poorly maintained and catalogued, or inaccessible (Moore 2024). Zoos themselves are historically poor at keeping records. Whilst since the early twenty-first century most animal records are now digitised, due to the sheer volume of animals and records in the past a lot of written records have not been kept in British zoos (Moore 2024). Zoo feeding records are temporally and spatially inconsistent. As a result, the zoo researcher with a health or environmental humanities lens attached must be resourceful in where and how they locate their required historical records. Thus, this chapter draws primarily on published scientific materials and records of scientific conferences, which necessitated connecting with relevant associations and professional groups.

The challenges around archival material meant that the methodology for this research had to be innovative and interdisciplinary, drawing on both traditional archival research and sociological methods. Rather than data collection, the approach was much more along the lines of data generation in conjunction with collected data; these are not binary activities but interdependent methods, epistemologically (Moore 2024). I collected data from research papers, institutional histories, and generated data from interviews, collecting stories of zoo feeding and nutrition in the past and the present. Scientific publication and conference proceedings records are essential and rich documents, which provide snapshots into the thinking of zoo scientists and professionals of the mid to late twentieth century within academic settings. I only gained knowledge of these sources through relationships developed with interviewees. Through this mixed-method approach, the distinction between data collection and data generation is important, as it acknowledges that the researcher does not hold a value-neutral position. Due to the lack of recorded information, the research was “actively constructing knowledge” (Mason 1996).

Accessing some zoos can also be challenging for humanities researchers, often requiring zoo association approval. Zoos are, understandably, geared towards the life sciences, so the proposal forms can appear to be written in a different language and indeed misunderstandings of language on disciplinary grounds can happen (Moore 2024). Furthermore, zoos are inundated with research requests from researchers at all academic levels and must balance their finite resources and priorities with the desires of hopeful researchers. The benefit of such processes, however, is that the zoos that do agree will likely become partners in the research, which is often an invaluable relationship.

This chapter draws on concepts from Science and Technology Studies to support analysis of the historical material. Such methods and theoretical frameworks can enable humanities scholars to fill in the gaps in archival material, or perhaps think with and through gaps and inconsistencies. Philosopher Annemarie Mol's concept of enactment argues that singular entities can be seen as multiple subjects whilst remaining singular in their own right (Mol 2002). Care related to zoo feeding is discussed throughout this chapter, although there is minimal space to unpack the theorisation of care. There are certain levels of regulatory or legislative care for zoo animals, such as via the UK Zoo Licensing Act (1981) and the Secretary of State's Modern Zoo Practices (2012). However, what is caring or how to care for zoo animals via feeding is a contested concept, which differs between zoo professionals. For this research ideas of care were informed by the work of Joan Tronto (1994), whose definition of care transported ideas of care to a more-than-human understanding of the concept. This work has been extended by other scholars, such as Maria Puig de la Bellacasa and her influential book *Matters of Care* (2017), Matthew Chrulew on care, biopolitics, and the zoo (2014), Thom van Dooren (2014; 2015) and Ebem Kirksey (2015) who both write on the challenges of care within conservation, and Camile Bellett's work on care and cows through digital surveillance (2024), amongst others. Such approaches allow the historical and present positions of zoo scientists and zoo professionals to co-exist, and to be better understood by historians.

When science feeds animals

From bread to "zoo cake"

In 2015, I came across the following Christmas cracker joke: "How do monkeys make toast?" "[They] put some bread under the gorilla!" For a researcher of the historical and sociological phenomenon of zoo animal feeding and nutrition, the monkey toast joke captures the anthropomorphic and entertainment undertones of zoo animal feeding. It evokes the anthropomorphic history of zoos, such as chimpanzee tea-parties, conflating the non-human animal eating as a human and as a result, a caricaturing of humanity (Allen, Park, and Watt 1994; Moore 2024). This anthropomorphic imagery is one that was and is realised within the modern zoo via foodstuffs and feeding. It also influences how animals are fed.

Zoo animal food has historically been guided by the foods that humans considered were good for animals, such as bread, because, as zoo nutritionist Andrea Fidgett notes, humans have successfully survived on these food items (Fidgett 2022, interview). In early modern zoos, food was provided with minimal knowledge of the animal's needs. Public feeding was unrestricted, allowing the feeding of buns on sticks to bears and peanuts thrown to monkeys by the public. During the late eighteenth century, the Tower of London Menagerie accepted cats or dogs as the entry fee, which were then fed to the lions (Mullan and Marvin 1987, p.102; Ritvo 1987, p.207). From the early twentieth century through to the post-war era, traditional practices linked to agriculture informed feeding practices, whilst public feeding began to be restricted (Allen, Park, and Watt 1994; Flack 2018).

The nineteenth-century British zoo was largely a statement of power and mastery over the natural world, with beasts from all corners of various empires (Ritvo 1987). As a result, knowledge of the causes of disease and illness within the zoo was poorly known and the causes were not always important to zoo administrators. As zoos focused on the display of exotic animals from across the globe, their health and immediate environment were not of particular concern. Replacement animals could be sourced, often at less expense than

changes to improve animal health. Some efforts were made to identify health issues within zoo animals at this time. In 1881, John Bland Sutton, for example, was commissioned by the Pathological Society of London to investigate health issues in zoo animals. His work revealed the cause of rickets in chimpanzees and lion cubs (Bland Sutton 1931; Woods 2018). However, whilst the cubs recovered due to a diet of cod liver oil, the cost of the supplements was equal to that of a new lion (Woods 2018). The health decisions made at this time were fiscally informed and not for the benefit of zoo animal health.

This lack of interest in animal nutrition was not the case everywhere. Improving the health of the zoo's animals was a priority at Penrose Laboratory at Philadelphia Zoo (henceforth Penrose), which was set up in 1901 (Fox 1923).¹ Veterinary pathologists at Philadelphia Zoo endeavoured to extend zoo animals lives by combatting nutritional disease, because it so often led to death (Crissey 2001; Moore 2024). Despite the interest of Bland Sutton and the Penrose lab in improving the health of zoo animals, the animal is curiously absent as scientists homogenised animals into feeding typologies, statistics, records of success and failure in living, and as vessels of disease and death. Early innovations in zoo animal nutrition science were battles against disease to enable animals to live longer – how that life was lived was not documented by zoo scientists at the time. Furthermore, the approach and homogenising of animals leave little insight into which animals were of most concern. Charismatic animals, such as primates – especially great apes – and big cats seem to feature consistently within the scientific literature. Arguably this is likely due to the connection between early zoo nutrition work being undertaken by individuals who were trained in human medicine and transitioned to pathology work in zoos (Woods 2018).² The focus was on mammals and birds, as can be seen by Herbert Fox's work *Diseases in captive wild mammals and birds* (1923), which foregrounded the work at Penrose on complete feeds for the zoo collection at Philadelphia Zoo.³

Pathologists looked inside the dead body and this looking *into* the dead animals' body helped them identify nutritional deficiencies and nutrition related diseases. The results of these investigations helped to develop "complete" diets that would alleviate nutrition issues. Complete feeds were first designed by Dr Ellen Corsen-White to combat bone disease within primates at Philadelphia Zoo in 1918 (Crissey 2001). This research underpinned the rise of zoo animal nutrition as an applied science and area of scientific enquiry in the 1920s. From the 1930s, Dr Herbert Ratcliffe, also of Penrose, extended manufactured "complete" feed from primates to three broad animal feeding types: omnivores, carnivores, and herbivores. Ratcliffe designed a "zoo cake" by coalescing knowledge from both Corsen-White's research on bone disease, a decade of autopsy reports on malnutrition, and agricultural knowledge (Ratcliffe 1940). The "zoo cake", as Ratcliffe called it, was a complete feed in the sense that it provided key nutrients and minerals for the zoo animals. It was a nutritional technology that embodied the reductionist ideology of *nutritionism*, in which health and well-being are reduced to how and why nutrients and minerals work within the body (Scrinis 2013). "Zoo cake" was constructed with a variety of ingredients and as a tool of uniformity, cost-reduction, and efficiency.

The types of "zoo cake" differed little between the zoo animal feeding types with the only variable being the use and quantity of horsemeat. For herbivorous animals, horsemeat was replaced with beet pulp and chopped vegetables, while carnivorous animals were given a lower percentage (30 per cent) of the "zoo cake" as part of their total diet, with the remaining 70 per cent consisting of raw ground horsemeat (Ratcliffe 1940). Primates were also treated to an amended diet with the addition of uncooked fruits and vegetables; anthropoid apes were given milk; and gorillas had uncooked ground horsemeat and boiled horse liver.

Ratcliffe celebrated the success of the “zoo cake” diet by measuring it against the birth and mortality rates and reduction of disease in the animals at Philadelphia Zoo. For example, bird species saw a reduction in tuberculosis, which Ratcliffe claimed resulted from the improved quality and quantity of dietary protein. Furthermore, primates developed a greater level of resistance to gastrointestinal disease after the change to the complete feed (Ratcliffe 1966). The diets produced, which spearheaded the use of complete diets in zoos, were predicated on the failures of animal bodies through their deaths and the success of living animal bodies in reproducing and living longer.

It is noteworthy that neither Corsen-White nor Ratcliffe evidenced any interest in innate natural behaviours or the lived experience of zoo animals and their wild counterparts. Ratcliffe, in particular, appeared unable to view the animal beyond a cadaver on the pathologist’s table, a subject, a body, a disease, or population statistics. This approach established zoo animal nutrition as an applied scientific field founded upon *looking inside* the (dead) animal body to inform the health of the living animal body. The knowledge produced was influenced and informed by non-natural environments, such as the pathologist’s lab and the zoo. Later in the century, the emerging field of zoo biology contested this approach, and instead, zoo biologists were called to focus on looking *at* the living animal and observing their lived experience in captivity and in the wild (Hediger 1966). As this chapter will go on to show, these philosophies then combined in the last decades of the twentieth century to create a more balanced approach to zoo animal feeding.

The challenge of the wild

The development of “zoo cake” led to a new practice and philosophy: the Philadelphia Nutrition System (PNS). This system supported the feeding of manufactured complete feeds to zoo animals. This new technology and approach, along with the rise of zoo biology, created a key debate for zoo nutrition going into the mid-to-late twentieth century, centred on the question of the most caring way to feed zoo animals. PNS wasn’t aiming to replicate wild feeding behaviours or wild foodstuffs but instead to provide the internal bodily needs of the animal within their civilised state of captivity. Zoo biologists believed the wild behaviours and feeding strategies of zoo animals should be considered in how and what they were fed.

What “wilderness” and “wildness” meant, and how these translated into care practices of feeding, was (and remains) a hot topic within zoo animal feeding. Two opposing philosophies on the question are highlighted by the 1966 special issue on nutrition in the newly established zoo journal, *The International Zoo Yearbook (IZYB)*. Ratcliffe used this as a place to celebrate the success of his “zoo cake” 30 years on. Hans Wackerangel, science advisor at Basel Zoo, echoed Ratcliffe’s sentiments of the appropriateness and success of the nutrition system. However, the 1966 nutrition special introduced a counter argument: that of the externally observed life of the zoo animal and their lived experience, from the father of zoo biology, Heini Hediger (Chrulaw 2018; Kawata 2008). Hediger directly criticised Ratcliffe’s markers of success (death, disease reduction, birth rates). Finally Richard Fiennes, the pathologist for the London Zoo, closed the debate through attempting to take a neutral position (Fiennes 1966).

The 1966 debate delivered a dichotomy of philosophical approaches to zoo feeding. Broadly speaking, these constituted a difference of epistemological positions about what a wild animal should eat in a non-wild environment, based on considerations for their long-term health. Ideas of what is natural, what is wild, and what is best for zoo animals – for a flourishing life of quality, longevity, and high standards of health – were enmeshed within the philosophies of feeding for different life scientists.

Hediger was a zoo biologist and zoo director, who spent his research time looking *at* living animals both in the zoo and the wild (de Bont 2022). Ratcliffe was a veterinary pathologist, who spent his research time looking *in* the dead bodies of animals in the laboratory. Both scientists visualised zoo animals as scientific objects but in different ways. Ratcliffe viewed the zoo animals of Philadelphia Zoo in categories: as organisms, disease, statistics, and cadavers. Healthy, living animals were – in this framework – the outcome of Ratcliffe’s work on the pathologist’s table or in the laboratory formulating feeds to fight disease and death. For Hediger, the story was more complex. His categorisation of zoo animals was predicated on time spent looking at animals in captivity and in the wild. Environmental historian Raf de Bont (2022) argues that Hediger visualised zoo animals beyond the objectivities of science. Animals, in Hediger’s view, were part of a subjective world who, in captivity and the wild, mapped out their territories, giving purpose and meaning to different locations as feeding places, food stores, and places to urinate and defecate (de Bont 2022). Hediger believed that zoo animals should also act, or at least be given the opportunity to act, in these “wild” ways for the benefit of their health. His primary complaint about Ratcliffe’s PNS was that it prevented these “natural” behaviours from occurring and put zoo animals on a path to domestication: “[e]very care must be taken to preserve zoo animals from the effects of domestication and every effort must be made to provide them with living conditions that are as natural as possible” (Hediger 1966, p.38).

Hediger (1966) also argued that “zoo cake” alone could not explain improvements to animal health. Instead, he pointed out that many developments in zoos around enclosure design, husbandry changes, and advances in pathology contributed to the improved health and well-being of zoo animals. Hediger highlighted the success of other zoos, such as Edinburgh Zoo, in breeding even in the absence of manufactured or complete diets. Hediger also complained about the arrival of new diseases within the zoo, such as arteriosclerosis (thickening and hardening of the walls of the arteries, restricting blood flow) (Hediger 1966). Ratcliffe claimed that these diseases were not a by-product of PNS, but rather an outcome of longevity of life and social pressure and social interaction (Ratcliffe 1966).

Despite Hediger’s comprehensive rebuttal of Ratcliffe’s claimed success of PNS, the Special Issue leaned towards celebrating Ratcliffe’s work and its achievements. Richard Fiennes, whilst attempting to present a neutral position, implicitly favoured complete or manufactured feeds. His argument was based on the opinion that natural feeding wasn’t sufficient: “[m]any supposed natural feeding regimes offer inadequate vitamins, minerals and other essentials to keep animals in health” (Fiennes 1966, p.64). The debate pivoted on the idea of what was natural and what was not. The question remained: did a zoo animal, genetically, biologically, of the wild need a wild, lived feeding experience to achieve optimum health?

Zoo feeding practices from the 1960s through to the 1980s were, then, dominated by philosophies of caring for the internal animal. These practices enacted the internal animal as wild, but did not account for the enactment of the external “wild” animal. The physiological needs and foraging strategies of the external animal were not a priority, and they were commonly seen as distinct from the fight against disease or illness and improving reproduction. This approach began to change when zoo academics came together from the 1980s, which led to a more holistic approach to feeding and nutrition and spear-headed the “nutritional turn” of the 1990s and early 2000s (Moore 2024).

The nutritional turn: Enacting the wild with non-wild food

The nutritional turn was a period of 15 to 25 years from the 1980s into the early 2000s, in which (I argue) the polarising debates highlighted by the 1966 IZYG nutrition debate

were amalgamated (Moore 2024). The nutritional turn built upon key knowledge from studies of internal animals and observations of external animals alike. The nutritional turn brought together the philosophies of Herbert Ratcliffe and Heini Hediger for the benefit of zoo animals, increasing their wellbeing and health in captivity. This section of the chapter explains the historical significance of two conferences that led the way to a more balanced approach in zoo animal feeding philosophy: the Dr Scholl Nutrition Conference held between 1980 and 1991; and the first zoo nutrition conference in Europe at Rotterdam Zoo in 1999.

Shortly after Herbert Ratcliffe's death in late 1980, Dr Scholl sponsored a conference specifically on zoo nutrition at Lincoln Park Zoo for academics, representatives from zoos, and feed manufacturers. Whilst these were mostly from North America, a contingent of European academics and zoo professionals were present at some of the conferences (Dierenfeld 2022, pers. comm). Over the nine conferences, 136 paper presentations or group discussions were held specifically on the fight for zoo animal health and the reduction of death and disease through nutrition science. Topics ranged from specific species nutrition issues and nutritional deficiencies, such as vitamins E or A, as well as broader discussions on the challenges of zoo feeding. The conferences themselves act as a timeline of change within zoo feeding and nutrition as the field moved from enacting the internal animal, to a more holistic view of the animal and the importance of replicating foraging behaviours of the wild.

The first meeting of the Dr Scholl Conference focused on the enactment of health from within the animal's body. The inaugural conference opened with a paper by Dr Wilbur Amand, director and senior veterinarian of the Philadelphia Zoo. Amand (1980) extolled the virtues of the PNS as a philosophy that was fundamentally good and – in his view – the correct route to pursue in fighting disease resistance within zoo animals. Although Amand did concede that some stats had been manipulated in favour of PNS, he still argued that this was in defence of the philosophy rather than “selling a product” (Amand 1980). Other speakers similarly focused on traditional models of animal health, focused on bodies rather than behaviours. Dr Duane Ullrey, a leading animal nutritionist of the twentieth century, presented a paper on his foundational work on white-tailed deer in Minnesota, and argued that this work could inform feeding and nutrition for zoo animals who were similar in their gut morphology, such as bison or giraffe (Ullrey 1980). Ullrey's work was an appropriation of wild but native ruminant animals in North America, applied to the wild and non-native zoo animal. The considerations for the zoo animal were based on the internal workings of the animal, as opposed to the natural foraging strategies and physiological needs of their wild origins.

At the second conference in 1982, the burgeoning debate on what was “natural” for a zoo animal to eat and how best to care for them continued. On this occasion, the key speech was delivered by Dr Mary Allen from Michigan State University. Allen (1982) compared complete feeds, like those provided by PNS, to more natural food systems. She suggested the concept of a cafeteria system of feeding, which provided the illusion of a more natural food system by providing a wide range of fresh food. In a similar vein to Lane-Petter nearly 20 years earlier, though, Allen warned against the illusion of non-manufactured food being considered natural, writing, “[w]e must be cautious in claiming that we feed ‘natural’ diets when an orange is no more natural to an elephant than grass hay, perhaps even less so” (Allen 1982, p.2; Lane-Petter 1966). Allowing “natural” behaviours – such as seeking out and choosing food sources – did not necessarily mean that animals were receiving “natural” diets. The Dr Scholl Conferences continued in a similar fashion, with a focus on the science of zoo nutrition and questions about zoo animal care.

The zenith for zoo nutrition, as an applied science, was in the 1990s with the formation of zoo animal nutrition research groups. The Association of Zoos and Aquariums (AZA) in North America formed the Nutrition Advisory Group (NAG) and in Europe the Rotterdam conference in 1999 brought European zoo professionals together that highlighted the importance of the internal and external animal, which founded the European Association of Zoos and Aquariums European Nutrition Group (Dierenfeld 2022, interview). Werner Kaumanns, Karen Hampe, and Christoph Schwitzer (2000) presented a paper from the perspective of zoo practice on primate nutrition at the Rotterdam conference that signified this new, more balanced approach. The paper highlighted the importance of combining both the *looking in* and *looking at* of zoo animals, through an assessment of two hundred primate diets across European zoos. The core argument from the paper was that “[f]eeding is regarded as complex functional system, which includes a number of physiological and behavioural subsystems. The development of appropriate concepts for primate nutrition must start at this point” (Kaumanns, Hampe, and Schwitzer 2000, p.92). The paper highlights the move of zoo animal nutrition as an applied science to a more holistic view of the animal, considering the internal and external needs of the zoo animal.

In this more holistic model of zoo feeding, the need to care for zoo animals through what they ingested and how they foraged, sniffed, touched, manipulated, obtained, and handled food was as seen as being just as important (Fidgett 2022, interview; Maple *et al.* 1983). Feeding a zoo animal became more than just putting food in an enclosure; it was how food met the needs of the animal cognitively, behaviourally and nutritionally. The conferences and research undertaken at the end of twentieth century show a development of zoo nutrition from the desire to fight and reduce disease and death in zoo animals, to extending animal life through quality of health and encouraging reproduction.

Animal lived experiences in zoo (feeding) history and the present

The history of zoo nutrition science provides insights into why zoo animals have been fed food designed for humans. This has had a real, tangible impact on animals themselves, and the animals – as living, embodied, sentient beings – and this must not be forgotten in this story. Enabling animal health in the zoo has centred on scientific philosophies on animal needs, anthropomorphic ideals such as the value of human-consumed food, and the enactment of the animal body. This insight provides an understanding of the history of animal health and its wider implications. Captive primates develop gut microbiomes similar to human microbiomes, rather than the natural microbiomes of their wild counterparts, and their microbiomes are important for holistic health; this is known within the scientific literature and was highlighted to me by Amy Plowman, former Chief Science Office of Paignton Zoo (Clayton *et al.* 2018; Plowman 2022, interview).

The observant reader will have noticed that in these stories of scientific care of zoo animals in the twentieth century, the animal is curiously missing. However, the history of animal feeding cannot be told without acknowledgement of the affected animals’ lives day to day. It is important to put the animals back into this picture as sensory, mobile, engaged beings, and to recognise that feeding practices are part of a more-than-human history of care and wellbeing. There are, of course, limits to the “knowability” of animals’ inner lives – past and present. However, it is important to think beyond the human concepts of “wildness” and “nature” that so dominated scientific discussions. Histories of zoo feeding invite inquiry into animals’ daily lives and how feeding practices shaped human-animal relations (particularly with zookeepers), the temporalities of the zoo, the spaces with which they engaged, their sensory or tactile relationships to food and more. It is also notable that

whilst zoo nutrition science developed during the late twentieth century, that does not mean it was applied in all zoos universally.

The historical record covered in this chapter can only tell us about feeding behaviours, and acceptability of the complete diets to the animals via what the scientists themselves claim. Ratcliffe (1966, p.18), for example, claimed that “[o]ur experience and the experience of other zoos has been that opposition to the new diets comes more from the keepers than from the animals”. However, he makes no further mention of the animals’ lived experience or the impact of changing feeding practices. Hediger provides a little more insight as a zoo biologist who observed captive and wild animals. Specifically, he lamented the damage to the animals’ innate wild inclinations due to a diet based on complete feeds. Recalling the arrival of a six-year-old tiger in 1957 at Zurich Zoo from Philadelphia Zoo, Hediger (1966, p.47) commented that the tiger could not eat meat on the bone, stating “to me a tiger which does not begin to know how to tear up meat is no longer a tiger”.

There is minimal detail in the historic scientific literature covered regarding the impact of changes in feeding practices within zoos or elucidating the human-animal relationship. Interviews with zoo nutritionists did reveal that their thinking goes beyond the science and interprets the journey of the food on, in, and through the animal body, or as zoo nutritionist Andrea Fidgett put it: “[t]hey’re [nutritionists] thinking about the form of the food, the gastrointestinal tract, all of the anatomy of the feeding apparatus from the mouth to the rectum you know and making sure that the health of that system within the body is maintained”. However, this is rarely captured within scientific literature.

For zookeepers, the human-animal relationship can be more practically directed but centred around sensory, spatial, and temporal practices. From using food to move the animal from one spot to another to allow cleaning, there is a tendency to project the animal’s happiness based on their feeding. As Aisleen Green, a zookeeper and veterinary nurse mentions: “once you’ve got a full tummy, you are a happy animal” (Greene 2022, interview). To bring the animal back, it is the intimate and more direct relationship between zoo animal and their human carers that can shed light and add to the scientific practices of zoo feeding. Zookeeping, as a profession, is a key source where this more intimate, less clinical story can be found, for example, through interviews about experiences and memories. Furthermore, the late twentieth century provides memoirs from zoo directors, zookeepers, and owners who had deep and personal relationships with their wards.

Twentieth-century zookeepers had a far more hands-on approach to animal husbandry care than their twenty-first-century counterparts. Chimpanzees, for example, at Edinburgh Zoo in the 1930s, smoked and drank alcohol, such as Philip the chimpanzee, who enjoyed port in the library with guests (Gillespie 1964, p.56) This may not have been a one-off. Helen Clarke, a zookeeper and the daughter of a zookeeper recalls that animals at Dublin Zoo in the 1960s would receive a daily sip of Guinness and would often be given freshly baked potatoes (Clarke 2022, interview). Gerald Durrell, the founder of Jersey Zoo, discusses the experiences of zoo animals eating: from allowing monkeys to gorge on peaches, to chimpanzees screaming for their evening milk, and geckos stalking dishes of mealworms (Durrell 1964, pp. 29, 33, 36). He recalls the intimacy of nursing sick primates back to health in front of the fire in his lounge with chocolate biscuits (Durrell 1964, pp.107–116). Durrell’s effulgent writing also highlights his interpretation of animal-to-animal relationships, such as Lulu the chimpanzee’s delight at receiving a banana when her partner Chumley did not (Durrell 1964, p.108). Such recollections also provide another strand to the story of twentieth-century zoo feeding, an experience away from the clinical, precise, data-driven science. The work of Penrose and the founding of zoo biology both founded a

scientific approach to feeding zoo animals but the common denominator in both approaches is always the human animal and from that historians can reveal the lived experience and the relationships of the animals both as scientific object but also as caring subject.

Richard Johnstone-Scott, the keeper for Jambo the gorilla – famous for his gentleness towards Levan Merritt, a child who fell into Jambo's enclosure at Jersey Zoo in 1986 – delves into the behaviours of Jambo in his memoir of this famous gorilla. Johnstone-Scott details Jambo's balanced diet of fruit, vegetables, an "ape pellet" (a complete feed, like zoo cake), eggs, yoghurt, browse (leaves and branches), and the occasional treat of a coconut (Johnstone-Scott 1995, p.92). The practices involved in feeding Jambo are noted as aiming to encourage wild behaviours and human efforts made to get the animal to "work for their food" (Johnstone-Scott 1995, p.93). Despite this awareness of the "wildness" of Jambo and innate wild behaviours that need to be encouraged in the spatial confines of the zoo, we also learn of Jambo's personality and anthropomorphised behaviours caused by captivity. One example is Jambo's sensitivity to *how* he is fed, preferring his fruit to be placed in his hands when being fed inside rather than in a metal dish; failure to adhere to this would result in "grunts of irritation" (Johnstone-Scott 1995, p.97).

These intimate interactions reveal not only the human-animal relationship but also provide insights about the sensory, spatial, and temporal freedom of individual animals in twentieth century zoos. Tony Dobbs, a senior zookeeper, notes that – despite the distance the modern zookeeper may now have from their wards – feeding still provides an opportunity to observe and assess their animals for general health and wellbeing (Dobbs 2022, interview). This is one area where the story of animals' lived experience can be told, albeit by human voices. Interviewing zookeepers revealed the need for the human-animal relationship to be considered when ensuring the health and wellbeing of zoo animals – a voice mostly absent from the scientific literature.

Conclusions

This chapter has presented a case study on zoo animal feeding, to make the case that the health and environmental humanities are about more than just human health. Modern zoos matter within discussions for the health and environmental humanities because they provide a lens into how society constructs, acts out, and practises matters of care related to non-humans (Rose *et al.* 2012; de la Bellacasa 2017).

Zoo history shows how animals were situated in scientific knowledge, and how this was influenced by the epistemological positions of the different life scientists involved in zoo nutrition. Furthermore, it provides insight into the global and academic cultures of scientific zoo research in the late twentieth century. This chapter has also shown that zoo history can be helpfully understood using concepts such as enactment. Enactment assists in the conceptualisation of how zoo scientists and zoo professionals imagined (and imagine) the wild and the natural, which enables new knowledge on what influenced (and influences) decisions on the health of zoo animals and their lived experiences. This is particularly important for historic investigations where there is limited recorded material available, as the historian can then take what is available (mostly scientific publications) to chart changing approaches to zoo animal health.

However, to tell the story of feeding zoo animals it is also important to look beyond the science and the focus of scientist efforts in caring for zoo animals. Whilst it is not possible to ever have a full understanding or knowability of the animals' inner lives, memories and recollections of those intimately bound with them in their care (namely zookeepers) can reveal more depth to their spatial, sensory, and temporal lived experiences. Animals as

actors, as subjects, rather than just objects, helps to further our understanding of why and how they were cared for, in this case via changes and differences to feeding practices.

Ultimately, this chapter has highlighted how researching a unique social phenomenon, like zoo nutrition, can help broaden understandings of health from a non-human perspective, and the environment from a perspective of displacement.

Ethics statement

This project received ethics approval from the University of Exeter, College of Social Sciences and International Studies Ethics Committee on 2 April 2022, reference 513500. All participants interviewed received detailed information on the research and signed consent forms to confirm prior to the interview taking place. Consent was obtained for their participation, recording, and use of the interview for research purposes, although this did not extend to this data being publishable for some participants. Participants were given the option to be pseudonymised, anonymised, or to use their name.

Funding

This project was funded by Wellcome Trust 219889_Z as part of the “From Feed the Birds to Do Not Feed the Animals” project.

Related chapters

- 2. Nature and the Environment
- 10 Objects

Further reading

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Notes

- 1 In his book, *Diseases in captive wild mammals and birds* (1923), Herbert Fox refers to the laboratory as “[t]he laboratory of Comparative Pathology at this Garden”. In the foreword Charles Penrose mentions that the work to produce the book started in 1901. When the laboratory was officially named the Penrose Research Laboratory is not clear. However, it is likely to have happened between 1925, when Charles Penrose died, and 1940, when Herbert Ratcliffe first began to publish as the Director of Penrose Research Laboratory.
- 2 There is a strong connection between medical education at the University of Pennsylvania, the Penrose Research Laboratory, and Philadelphia Zoo. This is outside the purview of this chapter but deserves consideration for future research akin to the work of Abigail Wood’s publication “Doctors in the Zoo” (2018).
- 3 My own research focused on great apes and primates primarily as a route to achieve approval from the British and Irish Association of Zoos and Aquariums (BIAZA).

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