

Elephant References: Welfare and Tourism
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Boissy, A., G. Manteuffel, M. B. Jensen, R. O. Moe, B. Spruijt, L. J. Keeling, C. Winckler, B. Forkman, I. Dimitrov, J. Langbein, M. Bakken, I. Veissier and A. Aubert (2007). "**Assessment of positive emotions in animals to improve their welfare.**" *Physiology and Behavior* **92**(3): 375-397.

It is now widely accepted that good welfare is not simply the absence of negative experiences, but rather is primarily the presence of positive experiences such as pleasure. However scientific investigation of positive emotions has long been neglected. This paper addresses two main issues: first, it reviews the current state of scientific knowledge that supports the existence of positive affective states in animals and, second, it suggests possible applications of this knowledge that may enhance quality of life under animal management conditions. In the first part of the paper, recent advances in psychology and neuroscience are reviewed to provide pragmatic frameworks based on cognitive processes (such as positive anticipation, contrast and controllability) for further investigations of positive emotions in animals. Thereafter, the neurobiological bases of positive emotions are highlighted in order to identify behavioral and physiological expressions of positive experiences in animals. Monitoring both the autonomic nervous system (via heart rate and its variability) and the immune system could offer relevant tools to better assess emotional states in animals, complementary to classical adrenocortical measures. In the second part of the paper, useful strategies for enhancing positive experiences (such as physical, social and cognitive enrichment or putative genetic selection) are outlined. Then this paper emphasizes practical applications for assessing and promoting positive emotions that may help in providing animals with a better quality of life. Play, affiliative behaviors and some vocalizations appear to be the most promising convenient indicators for assessing positive experiences in laboratory and farm animals under commercial conditions. © 2007 Elsevier Inc. All rights reserved.

Cameron, E. Z. and S. J. Ryan (2016). "**Welfare at Multiple Scales: Importance of Zoo Elephant Population Welfare in a World of Declining Wild Populations.**" *PLoS ONE* **11**(7): e0158701.

Carlstead, K., J. A. Mench, C. Meehan and J. L. Brown (2013). "**An Epidemiological Approach to Welfare Research in Zoos: The Elephant Welfare Project.**" *Journal of Applied Animal Welfare Science* **16**(4): 319-337.

Multi-institutional studies of welfare have proven to be valuable in zoos but are hampered by limited sample sizes and difficulty in evaluating more than just a few welfare indicators. To more clearly understand how interactions of husbandry factors influence the interrelationships among welfare outcomes, epidemiological approaches are needed as well as multifactorial assessments

of welfare. Many questions have been raised about the housing and care of elephants in zoos and whether their environmental and social needs are being met in a manner that promotes good welfare. This article describes the background and rationale for a large-scale study of elephant welfare in North American zoos funded by the (U.S.) Institute of Museum and Library Services. The goals of this project are to document the prevalence of positive and negative welfare states in 291 elephants exhibited in 72 Association of Zoos and Aquariums zoos and then determine the environmental, management, and husbandry factors that impact elephant welfare. This research is the largest scale nonhuman animal welfare project ever undertaken by the zoo community, and the scope of environmental variables and welfare outcomes measured is unprecedented. © 2013 Copyright Taylor and Francis Group, LLC.

Chatkupt, T. T., A. E. Sollod and S. Sarobol (1999). "**Elephants in Thailand: determinants of health and welfare in working populations**

531." *J. Appl. Anim Welf. Sci* **2**(3): 187-203.

The Asian elephant (*Elephas maximus*) has played a prominent role in Thai history and society. However, in the face of modernization, elephant handlers have been struggling to justify their continued ownership. As a result, working elephants may still encounter situations in which their health and welfare are jeopardized. This study developed both a survey instrument and a visual assessment to describe and evaluate the health and living conditions of elephants encountered in a variety of work and living situations. These situations were found to be significantly associated with whether or not an elephant received proper husbandry or was in good body condition. These results may prove valuable in predicting the welfare of elephants according to work and living situations

Clubb, R. and G. Mason (2002). **A review of the welfare of zoo elephants in Europe: A report commissioned by the RSPCA.** Oxford,U.K.: 1-280.

Cockrill, W. R. (1989). **World Association for Transport Animal Welfare and Studies. Inaugural Meeting. Wolfson College Oxford, 12 December 1989. Working animals international.** World Association for Transport Animal Welfare and Studies. Inaugural Meeting. Wolfson College Oxford, 12 December 1989. Working animals international.

Dale, R. H. I. (2010). "**Birth statistics for African (*Loxodonta africana*) and Asian (*Elephas maximus*) elephants in human care: History and implications for elephant welfare.**" *Zoo Biology* **29**(2): 87-103.

African (*Loxodonta africana*) and Asian elephants (*Elephas maximus*) have lived in the care of humans for many years, yet there is no consensus concerning some basic parameters describing their newborn calves. This study provides a broad empirical basis for generalizations about the birth heights, birth weights, birth times and gestation periods of elephant calves born in captivity. I obtained data concerning at least one of these four characteristics for 218 newborn calves from 74 institutions. Over the past 30 years, newborn Asian elephants have been taller and heavier than newborn African elephants. Neonatal African elephants exhibited sex differences in both weight and height, whereas neonatal Asian elephants have exhibited sex differences only in height. Primiparous dams ex situ are at least as old as their in situ counterparts, whereas ex situ sires appear to be younger than sires in range countries. Confirming earlier anecdotal evidence, both African [N=47] and Asian [N=91] dams gave birth

most often at night. © 2009 Wiley-Liss, Inc.

Duffy, R. and L. Moore (2011). "**Global regulations and local practices: The politics and governance of animal welfare in elephant tourism.**" Journal of Sustainable Tourism **19**(4-5): 589-604.

This paper examines challenges associated with global regulation of the tourism industry via an analysis of the use of elephants for trekking and safaris in Thailand and Botswana. It highlights inherent problems in applying universal principles in diverse locations; it unpicks the North-South power dynamics involved in drawing up global standards for elephant welfare in tourism. The development and expansion of elephant riding raise important ethical issues around questions of animal welfare, especially definitions of acceptable and appropriate standards for working animals. This paper uses a political economy approach to understandings of global governance to analyse who has the power to govern, at what scale and with what effects. It examines the role of animal welfare NGOs as key epistemic communities shaping the debate on elephant welfare. It discusses the highly variable practices of working with elephants in Botswana and in Thailand. It concludes that attempts at global regulation need to seriously engage with local level practices if global standards are to be workable and acceptable for tour operators, animal welfare NGOs, elephant camp owners and tourists alike. It raises leading global governance issues and discussions of the role of NGOs in governance, in general. © 2011 Taylor & Francis.

Duffy, R. and L. Moore (2010). "**Neoliberalising nature? Elephant-back tourism in Thailand and Botswana.**" Antipode **42**(3): 742-766.

This paper examines the case of elephant-back safaris in Thailand and Botswana; it argues that tourism has extended and deepened neoliberalism by targeting and opening up new frontiers in nature. In essence tourism redesigns and repackages nature for global consumption. Through a cross comparison of the same product (the use of captive/trained elephants) in two very different contexts (Thailand and Botswana) this paper analyses the variations in "actually existing neoliberalisms" (Brenner and Theodore 2002) and demonstrates that the effects are not unremittingly negative (Castree 2008b). It also draws out the ways that neoliberalism is challenged and reshaped by context specific processes and so it does not completely displace existing ways of approaching nature. Instead, existing approaches mix with neoliberalism to create new ways of valuing and conserving elephants. © 2010 The Authors Journal compilation © 2010 Editorial Board of Antipode.

Ganguly, S., S. Rao and S. Varma (2006). **The crisis in captive elephant welfare and management in India: Report from an all-India survey.** Proceedings International Elephant Conservation & Research Symposium.

Ganswindt, A., J. L. Brown, E. W. Freeman, A. J. Kouba, L. M. Penfold, R. M. Santymire, M. M. Vick, N. Wielebnowski, E. L. Willis and M. R. Milnes (2012). "**International society for wildlife endocrinology: The future of endocrine measures for reproductive science, animal welfare and conservation biology.**" Biology Letters **8**(5): 695-697.

Hormone analysis is a precise and widely accepted tool for monitoring reproductive function and responses to stressors. Although hormones are present and can be measured in various biological matrices, non-invasive methods have gained popularity over the past 30 years as a

more practical approach for assessing ovarian, testicular and, more recently, adrenocortical activity in intractable wildlife species. Noninvasive hormone monitoring also has been key to understanding biological mechanisms related to observed behaviours of captive and free-ranging animals. Despite the increasing popularity of this research field, wildlife endocrinologists have not had a specific forum for sharing and discussing their latest findings, technical developments and common challenges. To provide such a communication platform, the International Society for Wildlife Endocrinology (ISWE) was established in 2010, followed by an international meeting held on 3-4 November 2011 at the Toronto Zoo, Canada. Over several sessions, keynote speakers and participants discussed recent developments of new and innovative methods for hormone monitoring, as well as the latest advances in basic endocrinology as applied to adrenal function, reproductive physiology, animal health, ecology and evolution. Here, we introduce ISWE to the scientific community and discuss how this new society will serve as a resource for wildlife endocrinologists worldwide. © 2011 The Royal Society.

Grandy, J. W. and A. T. Rutberg (2002). "**An animal welfare view of wildlife contraception.**" Reprod Suppl **60**: 1-7.

Although there is some dissent, the animal protection community generally supports the concept of wildlife contraception. However, some contraceptive agents, delivery mechanisms and specific applications will be opposed by animal welfare advocates on environmental, humane or other ethical grounds, and some animal rights advocates may oppose wildlife contraception entirely. The Humane Society of the United States (HSUS) has supported and conducted wildlife contraception studies for more than 10 years. In general, we have invested in contraceptive agents (such as porcine zona pellucida) that we believe will prove environmentally, physiologically and behaviourally benign, and in delivery mechanisms that are narrowly targeted. As we consider contraception to be a major intervention into natural processes, we believe that wildlife contraception should be applied judiciously, locally and in a manner that is sensitive to the needs of animals, humans and ecosystem function.

Gurusamy, V., A. Tribe and C. J. C. Phillips (2014). "**Identification of major welfare issues for captive elephant husbandry by stakeholders.**" Animal Welfare **23**(1): 11-24.

Holdgate, M. R., C. L. Meehan, J. N. Hogan, L. J. Miller, J. Soltis, J. Andrews and D. J. Shepherdson (2016). "**Walking Behavior of Zoo Elephants: Associations between GPS-Measured Daily Walking Distances and Environmental Factors, Social Factors, and Welfare Indicators.**" PLoS ONE **11**(7): e0150331.

Research with humans and other animals suggests that walking benefits physical health. Perhaps because these links have been demonstrated in other species, it has been suggested that walking is important to elephant welfare, and that zoo elephant exhibits should be designed to allow for more walking. Our study is the first to address this suggestion empirically by measuring the mean daily walking distance of elephants in North American zoos, determining the factors that are associated with variations in walking distance, and testing for associations between walking and welfare indicators. We used anklets equipped with GPS data loggers to measure outdoor daily walking distance in 56 adult female African (n = 33) and Asian (n = 23) elephants housed in 30 North American zoos. We collected 259 days of data and determined associations between distance walked and social, housing, management, and demographic

factors. Elephants walked an average of 5.3 km/day with no significant difference between species. In our multivariable model, more diverse feeding regimens were correlated with increased walking, and elephants who were fed on a temporally unpredictable feeding schedule walked 1.29 km/day more than elephants fed on a predictable schedule. Distance walked was also positively correlated with an increase in the number of social groupings and negatively correlated with age. We found a small but significant negative correlation between distance walked and nighttime Space Experience, but no other associations between walking distances and exhibit size were found. Finally, distance walked was not related to health or behavioral outcomes including foot health, joint health, body condition, and the performance of stereotypic behavior, suggesting that more research is necessary to determine explicitly how differences in walking may impact elephant welfare.

Kontogeorgopoulos, N. (2009). "**Wildlife tourism in semi-captive settings: A case study of elephant camps in northern Thailand.**" *Current Issues in Tourism* **12**(5-6): 429-449.

Due to improved transportation and communication technology, changing social attitudes towards nature and wildlife, and the physiological benefits of interaction with animals, tourism centred on wildlife in captive and semi-captive settings is becoming increasingly popular. One example of wildlife tourism in a semi-captive setting is the proliferation of 'elephant camps' in Thailand, where tourists interact in a variety of ways with domesticated elephants. Though work in elephant camps can be difficult for elephants, tourism provides the only viable legal option for elephant owners and handlers to earn income. This study examines the characteristics, preferences, and values of the visitors of three elephant camps in the vicinity of Chiang Mai in northern Thailand and argues that despite reflecting divergent worldviews on, and practical approaches to, animal rights, each type of camp makes significant contributions to the overall welfare of Thailand's domesticated elephants. © 2009 Taylor & Francis.

Laws, N., A. Ganswindt, M. Heistermann, M. Harris, S. Harris and C. Sherwin (2007). "**A case study: Fecal corticosteroid and behavior as indicators of welfare during relocation of an Asian elephant.**" *Journal of Applied Animal Welfare Science* **10**(4): 349-358.

This study was a preliminary investigation of an enzyme immunoassay for measuring fecal glucocorticoid metabolites in a male Asian elephant (*Elephas maximus*) by investigating changes in behavior and cortisol metabolite excretion associated with a putative stressful event. The study collected fecal samples for 10 days prior to, and 10 days after, 24-hr transport and relocation of the elephant to a new herd. The study measured cortisol metabolites using 2 enzyme immunoassays indicating a 389% and 340% increase in cortisol metabolite excretion following relocation. Maximal cortisol metabolite excretion occurred 2 days after relocation and remained elevated during establishment of the new herd. Stereotypic behavior increased approximately 400% after relocation. The relocation disturbed sleep patterns, the elephant spent less time sleeping during the night, and the elephant slept standing up. These results provide preliminary evidence that noninvasive monitoring of fecal cortisol metabolites can be used to investigate adrenal activity in Asian elephants and may be a safe, practical, and accurate welfare indicator. Copyright © 2007, Lawrence Erlbaum Associates, Inc.

Maciejewski, K. and G. I. Kerley (2014). "**Understanding tourists' preference for mammal species in private protected areas: is there a case for extralimital species for ecotourism?**" *PLoS ONE* **9**(2):

e88192.

Private Protected Areas (PPAs) often use wildlife-based ecotourism as their primary means of generating business. Achieving tourist satisfaction has become a strong driving goal in the management of many PPAs, often at the expense of biodiversity. Many extralimital species, those which historically did not occur in an area, are stocked in PPAs with the intention of increasing ecotourism attractions. Even though the ecological and economic costs of stocking these species are high, the social benefits are not understood and little information exists globally on the ecotourism role of extralimital species. This study assessed the value of stocking extralimital species using questionnaire-based surveys and observing tourists in Shamwari Private Game Reserve in the Eastern Cape Province of South Africa. No difference was found between indigenous and extralimital species with regards to the tourists' weighted scoring system, average amount tourists were willing to pay, total viewing time, average viewing time or the likelihood of stopping to view species when encountered on game drives. During game drives a strong preference was found for the elephant (*Loxodonta africana*), lion (*Panthera leo*), leopard (*Panthera pardus*) and cheetah (*Acynonix jubatus*). With the exception of the cheetah, these species are all members of the "big five" and are indigenous. Species availability and visibility, however, may influence the amount of time tourists spend at an animal sighting. Our analysis suggests that certain extralimital species (typically larger and charismatic species) contribute to tourist satisfaction, while particularly the smaller extralimital species add little to the game viewing experience, but add to the costs and risks of the PPAs. We recommend that extralimital species introductions for ecotourism purposes should be approached with caution with regards to the risks to the sustainability of PPAs.

Maciejewski, K. and G. I. H. Kerley (2014). "**Elevated elephant density does not improve ecotourism opportunities: convergence in social and ecological objectives.**" *Ecological Applications* **24**(5): 920-926.

Magda, S., O. Spohn, T. Angkawanish, D. A. Smith and D. L. Pearl (2015). "**Risk factors for saddle-related skin lesions on elephants used in the tourism industry in Thailand.**" *Bmc Veterinary Research* **11**.

Background: Lesions related to working conditions and improper saddle design are a concern for a variety of working animals including elephants. The objectives of the present study were to determine the prevalence of cutaneous lesions in anatomic regions (i.e., neck, girth, back, tail) in contact with saddle-related equipment among elephants in Thailand working in the tourism industry, and to identify potential risk factors associated with these lesions. Data for this cross-sectional study were collected between May 2007 and July 2007 on 194 elephants from 18 tourism camps across Thailand. Results: There was a high prevalence (64.4 %; 95 % CI 57.3 - 71.2) of active lesions, most often located on the back region. Using multilevel multivariable logistic regression modelling containing a random intercept for camp we identified the following risk factors: increasing elephant age, the use of rice sacks as padding material in contact with the skin, and the provision of a break for the elephants. Working hours had a quadratic relationship with the log odds of an active lesion where the probability of an active lesion initially increased with the number of working hours per day and then declined possibly reflecting a "healthy worker" bias where only animals without lesions continue to be able to work these longer hours. Conclusions: While we recognize that the cross-sectional nature of the study posed some inferential limitations, our results offer several potential intervention points for the prevention of these lesions. Specifically, we recommend the following until longitudinal

studies can be conducted: increased monitoring of older elephants and the back region of all elephants, working less than 6 hours per day, and the avoidance of rice sacks as padding material in contact with skin.

Manteuffel, G., B. Puppe and P. C. Schön (2004). "**Vocalization of farm animals as a measure of welfare.**" *Applied Animal Behaviour Science* **88**(1-2): 163-182.

Emotionally relevant external events, hormone concentrations affecting mood and appetitive behaviour, thirst and hunger are able to stimulate a complex central nervous network that regulates endocrine feedback and behaviour in order to maintain or regain homeostasis. Particular states of mood or emotion may thus be accompanied by specific behaviours, vocalization being one of them. Hence, in farm animals vocalizations may supply us with hints on their well-being in an easy way, given that the meanings of the respective calls are well-established. Then, it is possible to judge acoustically uttered current needs and impaired welfare by non-invasive, continuous monitoring. Vocalizations may also modulate emotions of the receivers such that welfare may also be affected in conspecifics hearing distress utterances, e.g., in an abattoir. For these reasons, the analysis of farm animal vocalization has gained increasing interest in the last years and a variety of attempts to decode the meaning has been made. Concentrating on important farm animal species (pig, cattle, poultry) an overview of the present state-of-the-art in this discipline is given and present problems as well as possible future developments are discussed. Modern techniques of sound analysis have provided tools to discriminate, analyse and classify specific vocalizations. Taking advantage of this, future bioacoustical research for welfare assessment should focus on comprehensive studies of a broad spectrum of species specific distress vocalizations. Increasingly precise attributions of such utterances to environments, behavioural contexts and relevant physiological parameters will lead to a deeper understanding of their meaning and significance with respect to well-being of farm animals. The result will offer applicable acoustic tools for farming environments where non-invasive techniques for welfare judgements are urgently needed. © 2004 Elsevier B.V. All rights reserved.

Maple, T. L. (2007). "**Toward a science of welfare for animals in the zoo.**" *J. Appl. Anim Welf. Sci* **10**(1): 63-70.

Although the accredited institutions of the Association of Zoos and Aquariums have all committed to enhancing the welfare of nonhuman animals, acceptable standards and best practices are still under debate. Currently, experts from zoos and the field hold widely divergent opinions about exhibition and management standards for elephants. Standards and practices for managing nonhuman primates provide a model for other nonhuman creatures exhibited in zoos and aquariums. Examining the key issues for primates demonstrates the value of applying scientific data before promulgating standards. The field of applied behavior analysis provides a wealth of information to frame the debate. Animal behaviorists have contributed to an emerging science of animal welfare, which may provide a foundation for empirical zoo management, standards, and practices

Mason, G. J. (2010). "**Species differences in responses to captivity: Stress, welfare and the comparative method.**" *Trends in Ecology and Evolution* **25**(12): 713-721.

Approximately 26 billion animals, spanning over 10 000 species, are kept on farms and in zoos,

conservation breeding centers, research laboratories and households. Captive animals are often healthier, longer-lived and more fecund than free-living conspecifics, but for some species the opposite is true. Captivity is a very long way from the ideal 'common garden' often assumed by evolutionary and ecological researchers using data for captive animals. The use of comparative methods to investigate the fundamental biological causes of these species differences would help to improve husbandry and enclosure design, and might even reveal relationships between susceptibilities to poor captive welfare and susceptibilities to anthropogenic threat in the wild. Studies of these species differences could also inspire and facilitate 'evo-mecho' research into the functions of behavioral control mechanisms. © 2010 Elsevier Ltd.

Mason, G. J. and J. S. Veasey (2010). "**What do population-level welfare indices suggest about the well-being of zoo elephants?**" *Zoo Biology* **29**(2): 256-273.

To assess zoo elephants' welfare using objective population-level indices, we sought data from zoos and other protected populations (potential "benchmarks") on variables affected by poor well-being. Such data were available on fecundity, potential fertility, stillbirths, infant mortality, adult survivorship, and stereotypic behavior. Most of these can also be affected by factors unrelated to well-being; therefore, for each, we analyzed the potential role of these other factors. Population-level comparisons generally indicate poor reproduction, and poor infant and adult survivorship in zoos compared with benchmark populations (with some differences between zoo regions and over time). Stereotypic behavior also occurs in c. 60% of zoo elephants; as the population-level welfare index least open to alternative interpretations, this represents the strongest evidence that well-being is/has been widely compromised. Poor well-being is a parsimonious explanation for the diverse range of population-level effects seen, but to test this hypothesis properly, data are now needed on, for example, potential confounds that can affect these indices (to partition out effects of factors unrelated to well-being), and causes of the observed temporal effects, and differences between species and zoo regions. Regardless of whether such additional data implicate poor well-being, our findings suggest that elephant management has generally been sub-optimal. We also discuss the selection and utilization of benchmark data, as a useful future approach for evaluating such issues. © 2010 Wiley-Liss, Inc.

Meehan, C. L., J. A. Mench, K. Carlstead and J. N. Hogan (2016). "**Determining Connections between the Daily Lives of Zoo Elephants and Their Welfare: An Epidemiological Approach.**" *PLoS ONE* **11**(7): e0158124.

Concerns about animal welfare increasingly shape people's views about the acceptability of keeping animals for food production, biomedical research, and in zoos. The field of animal welfare science has developed over the past 50 years as a method of investigating these concerns via research that assesses how living in human-controlled environments influences the behavior, health and affective states of animals. Initially, animal welfare research focused on animals in agricultural settings, but the field has expanded to zoos because good animal welfare is essential to zoos' mission of promoting connections between animals and visitors and raising awareness of conservation issues. A particular challenge for zoos is ensuring good animal welfare for long-lived, highly social species like elephants. Our main goal in conducting an epidemiological study of African (*Loxodonta africana*) and Asian (*Elephas maximus*) elephant welfare in 68 accredited North American zoos was to understand the prevalence of welfare

indicators in the population and determine the aspects of an elephant's zoo environment, social life and management that are most important to prevent and reduce a variety of welfare problems. In this overview, we provide a summary of the findings of the nine papers in the collection titled: Epidemiological Investigations of North American Zoo Elephant Welfare with a focus on the life history, social, housing, and management factors found to be associated with particular aspects of elephant welfare, including the performance of abnormal behavior, foot and joint problems, recumbence, walking rates, and reproductive health issues. Social and management factors were found to be important for multiple indicators of welfare, while exhibit space was found to be less influential than expected. This body of work results from the largest prospective zoo-based animal welfare study conducted to date and sets in motion the process of using science-based welfare benchmarks to optimize care of zoo elephants.

Melfi, V. A. (2009). "**There are big gaps in our knowledge, and thus approach, to zoo animal welfare: a case for evidence-based zoo animal management.**" *Zoo Biol* **28**(6): 574-588.

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, as good quality evidence increases the likelihood that these decisions result in good zoo animal welfare.

Menargues, A., V. Urios and M. Mauri (2008). "**Welfare assessment of captive Asian elephants (*Elephas maximus*) and Indian rhinoceros (*Rhinoceros unicornis*) using salivary cortisol measurement.**" *Animal Welfare* **17**(3): 305-312.

The measurement of salivary cortisol allows non-invasive assessment of welfare in captive animals. We utilised this technique to test the effect of zoo opening on six Asian elephants and two Indian rhinoceros at the Terra Natura Zoological Park, Alicante, Spain, during pre-opening, opening and post-opening periods. Salivary cortisol concentrations were found to be significantly higher during the opening period than during pre- and post-opening periods for both species. This method could prove a useful tool in monitoring the success of decisions taken to improve the welfare of captive animals.

Menargues, A., V. Urios, R. Liminana and M. Mauri (2012). "**Circadian rhythm of salivary cortisol in Asian elephants (*Elephas maximus*): a factor to consider during welfare assessment.**" J Appl Anim Welf Sci **15**(4): 383-390.

Elevated glucocorticoid levels during an extended time period might be a stress indicator in nonhuman animals. Therefore, knowledge of the circadian pattern of cortisol secretion is very important to correctly interpret data obtained for welfare assessment of animals in captivity through salivary cortisol. In order to define the circadian rhythm of salivary cortisol secretion in the Asian elephant (*Elephas maximus*), morning and evening saliva samples of 3 Asian elephants were collected and analyzed by radioimmunoassay. Significantly higher salivary cortisol concentrations were found in the morning than in the evening in all individuals. These results show that salivary cortisol of Asian elephants follows a diurnal pattern of secretion, which could be taken into account when using this methodology to assess welfare in captive Asian elephants.

Naidoo, R., B. Fisher, A. Manica and A. Balmford (2016). "**Estimating economic losses to tourism in Africa from the illegal killing of elephants.**" Nature Communications **7**.

Recent surveys suggest tens of thousands of elephants are being poached annually across Africa, putting the two species at risk across much of their range. Although the financial motivations for ivory poaching are clear, the economic benefits of elephant conservation are poorly understood. We use Bayesian statistical modelling of tourist visits to protected areas, to quantify the lost economic benefits that poached elephants would have delivered to African countries via tourism. Our results show these figures are substantial (similar to USD \$25 million annually), and that the lost benefits exceed the anti-poaching costs necessary to stop elephant declines across the continent's savannah areas, although not currently in the forests of central Africa. Furthermore, elephant conservation in savannah protected areas has net positive economic returns comparable to investments in sectors such as education and infrastructure. Even from a tourism perspective alone, increased elephant conservation is therefore a wise investment by governments in these regions.

Rahman, S. A., L. Walker and W. Ricketts (2005). "**Global perspectives on animal welfare: Asia, the Far East, and Oceania**" 536. Rev. Sci. Tech **24**(2): 597-612.

In Asia and the Far East, livestock undergo major suffering due to malnutrition, overloading, and ill-treatment. At slaughter animals are handled roughly and watch other animals being killed; stunning is not practised. Cruelty to other animals such as elephants, horses, donkeys, bears, dogs, and circus animals has largely been prevented through the efforts of animal welfare organisations. Governments have taken initiatives to establish Animal Welfare Boards and enact laws for the prevention of cruelty to animals, but their efforts are far too limited to be of any significance and financial constraints and lack of personnel inhibit the implementation of the laws that do exist. In New Zealand and Australia, legislation and strong consultation procedures at governmental and community level strive to regulate and improve the welfare of animals in all spheres, but in other Oceanic countries there is a need for both an update in, or establishment of, legislation covering animal welfare. Limited progress has been made due to the status of the Veterinary Services and a lack of resources. Although some public and educational awareness programmes are carried out, increasing exposure to international media and attitudes of visiting tourists suggest that further awareness work needs to be undertaken.

To address the problems of animal welfare in developing countries, it would be inappropriate to adopt the international standards that are implemented in the developed countries. Each developing country should evolve its own standards based on its own individual priorities

Ranaweerage, E., A. D. G. Ranjeewa and K. Sugimoto (2015). "**Tourism-induced disturbance of wildlife in protected areas: A case study of free ranging elephants in Sri Lanka.**" Global Ecology and Conservation **4**: 625-631.

Tourism-induced disturbance is a growing concern in wildlife conservation worldwide. This case study in a key protected area in Sri Lanka, examined the behavioral changes of Asian elephants in the context of elephant watching tourism activities. Observations of different age-sex-group classes of elephants were conducted focusing on the feeding activity of elephants in the presence vs. absence of tourists. Frequency and duration of alert, fear, stress and aggressive behaviors of elephants were significantly high in the presence of tourists and these behaviors occurred at a cost of feeding time. Tourist behavior, vehicle noise, close distances and time of the tours were closely associated with the behavioral changes of elephants. It is important to monitor tourism effects on endangered species such as Asian elephants and to take proper measures including controlled tourist behavior and vehicle activity in protected areas in order to reduce disturbance of wildlife behavior. © 2015 The Authors.

Rees, P. A. (2003). "**The welfare and conservation of Asian elephants – a reply to Sukumar.**" Oryx **37**(1): 25-25.

Since my summary of the global fate of Asian elephants in zoos (this issue) was written Clubb & Mason (2002) have published a review of the welfare of zoo elephants in Europe, commissioned by the Royal Society for the Prevention of Cruelty to Animals in the UK. In an attempt to collect data on behaviour, reproduction, group composition, welfare and other aspects of husbandry, they sent questionnaires to the directors of the 18 zoos in the UK that hold elephants. Professor Sukumar doubts my contention that zoo directors lack the commitment necessary to manage the zoo elephant population as viable breeding units. Why then did none of the zoos contacted by Clubb & Mason reply?

Rees, P. A. (2009). "**The sizes of elephant groups in zoos: Implications for elephant welfare.**" Journal of Applied Animal Welfare Science **12**(1): 44-60.

This study examined the distribution of 495 Asian elephants (*Elephas maximus*) and 336 African elephants (*Loxodonta africana*) in 194 zoos, most of which were located in Europe (49.1%) and North America (32.6%). Cows outnumbered bulls 4 to 1 (*Loxodonta*) and 3 to 1 (*Elephas*). Groups contained 7 or fewer: mean, 4.28 ($\sigma = 5.73$). One fifth of elephants lived alone or with one conspecific. Forty-six elephants (5.5%) had no conspecific. Many zoos ignore minimum group sizes of regional zoo association guidelines. The American Zoo and Aquarium Association recommends that breeding facilities keep herds of 6 to 12 elephants. The British and Irish Association of Zoos and Aquariums recommends keeping together at least 4 cows over 2 years old. Over 69% Asian and 80% African cow groups - including those under 2 years - consisted of fewer than 4 individuals. Recently, Europe and North America have made progress with some zoos no longer keeping elephants and with others investing in improved facilities and forming larger herds. The welfare of individual elephants should outweigh all other considerations; zoos should urgently seek to integrate small groups into larger herds.

Schmidt-Burbach, J., D. Ronfot and R. Srisangiam (2015). "**Asian Elephant (*Elephas maximus*), Pig-Tailed Macaque (*Macaca nemestrina*) and Tiger (*Panthera tigris*) Populations at Tourism Venues in Thailand and Aspects of Their Welfare.**" *PLoS ONE* **10**(9).

This study focused on determining the size and welfare aspects of Asian elephant, pig-tailed macaque and tiger populations at facilities open to tourists in Thailand. Data were gathered from 118 venues through direct observations and interviews with staff. A score sheet-based welfare assessment was used to calculate scores between 1 and 10, indicating each venue's welfare situation. Factors such as freedom of movement for the animals, access to veterinary care, environmental noise quality, hygiene standards and work intensity were included in the score sheet. 1688 elephants, 371 macaques and 621 tigers were found at the venues. 89 venues exclusively kept elephants, 9 designated 'Monkey schools' offered macaque shows, 4 venues kept primarily tigers, mostly for petting and photo opportunities, and the remaining venues kept a mix of these animals. A strong imbalance in female to male gender ratios was recorded with about 4: 1 for adult elephants and 1: 4 for adult macaques. Severely inadequate welfare conditions were common, with 75% of macaques and 99% of tigers being kept at venues with scores less than 5. 86% of elephants were kept in inadequate conditions at venues with scores between 3 and 5, but a significant number of venues with scores above 5 were found. 4.6% of elephants were provided commendable conditions, reaching assessment scores of 8 and above. 71% of venues did not offer any sort of education about animals to visitors. This study is the first to assess welfare aspects of captive wild animals at tourism venues across Thailand. It concludes that significant concerns exist about the welfare of wild animals in the tourism sector of Thailand. Urgent attention needs to be given to address these concerns and prevent further suffering. But also to ensure the demand for wild animals doesn't have a negative impact on wild populations.

Soltis, J. and J. L. Brown (2010). "**Special issue--the care and welfare of elephants in AZA institutions.**" *Zoo Biol* **29**(2): 85-86.

Talukdar, B. N. (2003). Practices on welfare and prevention of cruelty: legal provisions related to elephant. **Healthcare, Breeding and Management of Asian Elephants**. D. Das. New Delhi, Project Elephant. Govt. of India: 180-190.

Tipprasert, P. (2002). Elephants and ecotourism in Thailand. **Giants on Our Hands: Proceedings of the International Workshop on the Domesticated Asian Elephant, Bangkok, Thailand, 5-10 February 2001.**

I. Baker and M. Kashio. Bangkok; Thailand, FAO Regional Office for Asia and the Pacific (RAPA): 156-172.

The numbers of elephants used at particular locations in Thailand, the activities for which they are used and the conditions under which they are kept are presented in tabular form. The Thai Elephant New World Project, which aims to integrate elephant ecotourism and conservation is described. Recommendations for the regulation and support of the use of elephants in ecotourism are given.

Vanitha, V., K. Thiyagesan and N. Baskaran (2011). "**Social life of captive Asian elephants (*Elephas maximus*) in Southern India: implications for elephant welfare.**" *J Appl Anim Welf Sci* **14**(1): 42-58.

Asian elephants in the wild live in complex social societies; in captivity, however, management

often occurs in solitary conditions, especially at the temples and private places of India. To investigate the effect of social isolation, this study assessed the social group sizes and the presence of stereotypies among 140 captive Asian elephants managed in 3 captive systems (private, temple, and forest department) in Tamil Nadu, India, between 2003 and 2005. The majority of the facilities in the private (82%) and temple (95%) systems held a single elephant without opportunity for social interaction. The forest department managed the elephants in significantly larger groups than the private and temple systems. Among the 3 systems, the proportion of elephants with stereotypies was the highest in temple (49%) followed by private system (26%) and the forest department facility (6%); this correlates with the social isolation trend observed in the 3 systems and suggests a possible link between social isolation and abnormal elephant behavior separate from other environmental factors. The results of this study indicate it would be of greater benefit to elephant well being to keep the patchily distributed solitary temple and private elephants who are socially compatible and free from contagious diseases in small social groups at "common elephant houses" for socialization.

Vanitha, V. and N. Baskaran (2010). "**Seasonal and roofing material influence on the thermoregulation by captive Asian elephants and its implications for captive elephant welfare.**" *Gajah* 33: 35-40.

Vicino, G. A. and E. S. Marcacci (2015). "**Intensity of play behavior as a potential measure of welfare: A novel method for quantifying the integrated intensity of behavior in African elephants.**" *Zoo Biology* 34(5): 492-496.

To the authors' knowledge there is currently no discrete index to measure the integrated intensity of a play bout in mammals, despite the potential for using intensity and duration of play bouts as a measure of physical activity and welfare. This study was developed to test an equation that quantified the intensity and duration of play bouts in a particularly gregarious mammal, African elephants (*Loxodonta africana*) housed at the San Diego Zoo Safari Park in Escondido, CA. To quantify these behaviors, we created a scale of intensity and a subsequent equation that produces an index value, giving each unique bout a score. A compilation of these scores provides a range of intensity of play behavior that is a representative value for that particular herd at that point in time, and thus a database to which later bouts can be compared. It can be argued that play behavior is an indicator of positive welfare, and if quantifiable, it is our belief that it can be used as an additional measure of positive welfare in zoo housed animals. Here we present the methods and technique used to calculate a standardized Integrated Play Index (IPI) that has potential for use in other socially living species that are known to exhibit play behavior. *Zoo Biol.* 34:492-496, 2015. (c) 2015 Wiley Periodicals, Inc.

Wehnelt, S. (2001). **The New Elephant Exhibit at Chester Zoo - High Husbandry and Welfare Standards.** A Research Update on Elephants and Rhinos; Proceedings of the International Elephant and Rhino Research Symposium, Vienna, June 7-11, 2001, Schuling Verlag.

Wemelsfelder, F., E. A. Hunter, M. T. Mendl and A. B. Lawrence (2000). "**The spontaneous qualitative assessment of behavioural expressions in pigs: First explorations of a novel methodology for integrative animal welfare measurement.**" *Applied Animal Behaviour Science* 67(3): 193-215.

Qualitative assessments of behaviour integrate and summarize the different aspects of an animal's dynamic style of interaction with the environment, using descriptors such as 'timid' or

'confident'. Although such qualitative terms are widely used in the study of animal temperament and personality, their use in relation to questions of animal welfare has yet to be formally explored. The terms used in integrative assessment (e.g., content, distressed) tend to have expressive, welfare-related connotations, and lie at the heart of the lay public's concern for animal suffering. For this reason they are frequently dismissed as 'anthropomorphic' and unscientific. However, in theory it is possible that these terminologies reflect observable aspects of behavioural organization. They may therefore be liable to scientific analysis, and be of use as integrative welfare measurements. A first step in investigating this hypothesis is to examine the inter-observer reliability of assessments of behavioural expression. This study investigated the extent to which 18 naive observers showed agreement when given the opportunity to qualitatively describe, independently and in their own words, the behavioural expressions of 20 individual growing pigs. Pigs were brought singly into a test pen and given the opportunity to interact with a human squatting in the centre of the test pen. Observers were instructed to first observe each pig and then to write down terms which adequately summed up the emergent qualities of that pig's behaviour. Data thus consisted of 18 sets of individually generated descriptive terms, attributed to 20 pigs. This procedure was repeated a month later with the same observers but using a new group of 20 pigs. To analyze the resulting 36 sets of descriptive terms, pigs in each set were given a score for each term. This score was either 0 (term not used for that pig) or 1 (term used for that pig). These data were analyzed with Generalized Procrustes Analysis (GPA), a multivariate statistical technique which finds a consensus between observer assessment patterns (the 'pig consensus profile'), and provides a measure of observer agreement. Results show that for each group of 20 pigs, the 'pig consensus profile' differed significantly from an analysis of the same data in randomized form ($p < 0.001$), indicating that the consensus profiles were not artifacts of the GPA procedures. It can therefore be concluded that observers showed significant agreement in their spontaneous assessment of pig expressions, which suggests that these assessments were based on commonly perceived and systematically applied criteria. The extent to which these shared criteria reflect observable aspects of behaviour now requires further study. (C) 2000 Elsevier Science B.V.

Whitham, J. C. and L. J. Miller (2016). "**Using technology to monitor and improve zoo animal welfare.**" Animal Welfare **25**(4): 395-409.

While the international zoological community is committed to enhancing the welfare of individual animals, researchers have yet to take full advantage of the tools available for non-invasively tracking behavioural and physiological indicators of welfare. We review technology currently being applied in studies of zoo, farm and laboratory animals to regularly monitor welfare status, as well as to evaluate responses to particular stimuli and situations. In terms of behavioural measures, we focus on automated assessments that offer insight into how animals - even those that are nocturnal or elusive - behave when humans are not present. Specifically, we provide an overview of how animal-attached technology (accelerometers, global positioning systems, radio frequency identification systems) can be implemented to generate activity budgets, examine use of space, conduct gait assessments, determine rates of movement and study social dynamics. We also emphasise the value of bioacoustics, as the rate and acoustic structure of certain vocalisations may vary across contexts and reflect an animal's internal state. While it can be challenging to identify non-invasive methods for investigating physiological welfare indicators, we discuss approaches (thermography, tracking measures of heart rate) that

may be especially useful for monitoring affective states and psychophysiological functioning. Finally, we make a concerted effort to highlight tools that allow welfare scientists to consider measures of positive welfare. Ultimately, zoos can ensure that each animal has the opportunity to thrive by employing technology to create baseline behavioural and physiological profiles, conduct ongoing monitoring schemes and assess responses to specific conditions, events and stimuli. © 2016 Universities Federation for Animal Welfare The Old School, Brewhouse Hill, Wheathampstead, Hertfordshire AL4 8AN, UK.

Willemen, L., A. J. Cottam, E. G. Drakou and N. D. Burgess (2015). **"Using Social Media to Measure the Contribution of Red List Species to the Nature-Based Tourism Potential of African Protected Areas."** PLoS ONE **10**(6).

Cultural ecosystem services are defined by people's perception of the environment, which make them hard to quantify systematically. Methods to describe cultural benefits from ecosystems typically include resource-demanding survey techniques, which are not suitable to assess cultural ecosystem services for large areas. In this paper we explore a method to quantify cultural benefits through the enjoyment of nature-based tourism, by assessing the potential tourism attractiveness of species for each protected area in Africa using the IUCN's Red List of Threatened Species. We use the number of pictures of wildlife posted on a photo sharing website as a proxy for charisma, popularity, and ease of observation, as these factors combined are assumed to determine how attractive species are for the global wildlife tourist. Based on photo counts of 2473 African animals and plants, species that seem most attractive to nature-based tourism are the Lion, African Elephant and Leopard. Combining the photo counts with species range data, African protected areas with the highest potential to attract wildlife tourists based on attractive species occurrence were Samburu National Reserve in Kenya, Mukogodo Forest Reserve located just north of Mount Kenya, and Addo Elephant National Park in South-Africa. The proposed method requires only three data sources which are freely accessible and available online, which could make the proposed index tractable for large scale quantitative ecosystem service assessments. The index directly links species presence to the tourism potential of protected areas, making the connection between nature and human benefits explicit, but excludes other important contributing factors for tourism, such as accessibility and safety. This social media based index provides a broad understanding of those species that are popular globally; in many cases these are not the species of highest conservation concern.