

## Recent Publications on Asian Elephants

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If you need additional information on any of the articles, please feel free to contact me. You can also let me know about new (2014) publications on Asian elephants.

J. Borges-Costa & M. da Luz Martins

### ***Trichophyton erinacei* skin infection after recreational exposure to an elephant in Southeast Asia**

*Pathogens and Global Health* (2013)

**Abstract.** Zoophilic fungal infections are a prevalent disease in tropical countries and clinicians must consider them in the differential diagnosis of pruritic skin lesions. We report a clinical case of *Trichophyton erinacei* skin infection after recreational exposure to an Asian Elephant. As far as we were able to search the literature, it is the first case described after contact with elephants.

### S. Bracco, A. Brajkovic, A. Comotti & V. Rolandi **Characterization of elephant and mammoth ivory by solid state NMR**

*Periodico di Mineralogia* 82 (2013) 239-250

**Abstract.** Ivory has always been considered one of the most attractive and valuable biological gem materials. It is tooth dentin, or the yellowish white, calcified, extremely elastic tissue that forms the tusks of several mammalian species. Microscopic examination of the surface in all possible directions is needed to a successful identification of cut and polished samples of ivory, but sometimes it is not enough. Supplemental techniques should be used for assisting discrimination of elephant (both *Loxodonta africana* and *Elephas maximus*) ivory and wholly mammoth (*Mammuthus primigenius*) ivory, because from a textural standpoint they can be remarkably similar. To provide the key identifying features of these two types of ivory is

nowadays of special significance, due to the fact that elephant ivory trade and import and export are illegal, whereas wholly mammoth tusks may be legally exported and manufactured. Both materials are formed primarily by nanocrystals of biological calcium orthophosphate that are embedded in a type I collagen matrix. By exploiting  $^1\text{H}$ ,  $^{13}\text{C}$  and  $^{31}\text{P}$  magic angle spinning (MAS) NMR we investigated the composition of several elephant and mammoth ivory specimens.  $^{13}\text{C}$  MAS NMR spectra confirmed the presence of the  $\text{CO}_3^{2-}$  group associated to the carbonated hydroxyapatite in both ivory types. In the collagen structure no differences have been highlighted. Quantitative  $\text{P}^{31}$  MAS NMR spectra revealed important features about the inorganic matrix. The high resolution allowed us to achieve the simultaneous detection of the signal assigned to the bulk  $\text{PO}_4^{3-}$  groups of the hydroxyapatite phase and of minor side peaks ascribed to unprotonated surface sites  $\text{PO}_x$  ( $\text{PO}$ ,  $\text{PO}_2^-$  and  $\text{PO}_3^{2-}$ ) and to protonated sites  $\text{PO}_x\text{H}$  on the surface of the nano-sized crystals of the hydroxyapatite.

E. Cappellini, A. Gentry, E. Palkopoulou, Y. Ishida, D. Cram, A.-M. Roos, M. Watson, U.S. Johansson, B. Fernholm, P. Agnelli, F. Barbagli, D.T.J. Littlewood, C.D. Kelstrup, J.V. Olsen, A.M. Lister, A.L. Roca, L. Dalén & M.T.P. Gilbert

### **Resolution of the type material of the Asian elephant, *Elephas maximus* Linnaeus, 1758 (Proboscidea, Elephantidae)**

*Zoological Journal of the Linnean Society* 170 (2014) 222-232

**Abstract.** The understanding of earth's biodiversity depends critically on the accurate identification and nomenclature of species. Many species were described centuries ago, and in a surprising number of cases their nomenclature

or type material remain unclear or inconsistent. A prime example is provided by *Elephas maximus*, one of the most iconic and well-known mammalian species, described and named by Linnaeus (1758) and today designating the Asian elephant. We used morphological, ancient DNA (aDNA), and high-throughput ancient proteomic analyses to demonstrate that a widely discussed syntype specimen of *E. maximus*, a complete foetus preserved in ethanol, is actually an African elephant, genus *Loxodonta*. We further discovered that an additional *E. maximus* syntype, mentioned in a description by John Ray (1693) cited by Linnaeus, has been preserved as an almost complete skeleton at the Natural History Museum of the University of Florence. Having confirmed its identity as an Asian elephant through both morphological and ancient DNA analyses, we designate this specimen as the lectotype of *E. maximus*. The mass spectrometry proteomics data have been deposited in the ProteomeXchange Consortium with the data set identifier PXD000423. © 2013 The Linnean Society of London.

S. Chen, Z.-F. Yi, A. Campos-Arceiz, M.-Y. Chen & E.L. Webb

**Developing a spatially-explicit, sustainable and risk-based insurance scheme to mitigate human–wildlife conflict**

*Biological Conservation* 168 (2013) 31–39

**Abstract.** Insurance may encourage coexistence between farmers and wildlife by reimbursing farmers' losses. China introduced an insurance scheme to mitigate human–elephant conflict in Xishuangbanna Dai autonomous prefecture in Yunnan Province, where elephants cause damage to rubber plantations. However, recent experience has suggested that the present insurance system exhibits poor performance related to funding shortfalls, undervaluing of plantations and insufficient payouts, and by limiting community involvement. To address these shortcomings we conducted attitude surveys with farmers, and developed an actuarial (risk-based) insurance model for rubber loss that incorporated spatially-explicit risk of depredation and net present value of rubber at damage, in order to calculate fair payouts at village and town levels for the year 2011. Farmers were largely dissatisfied with

the current insurance system, and their level of satisfaction was associated with the compensation ratio (percentage of lost rubber reimbursed by insurance). The illustrative results based on 2011 rubber loss data revealed high variability in risk and therefore payouts (and further, premiums) and that fair insurance payouts would be approximately five times the current levels. To improve compensation and support long-term program sustainability, we considered an insurance cost-sharing mechanism that incorporated shared payments from government, rubber farmers, and Chinese tourists. We found that multiple stakeholders were willing to pay for elephant conservation, which could make significant contributions to insurance premiums over the long term. Importantly, this proposed insurance model could be broadly applicable to livestock and long-lived cash crop compensation systems. © 2013 Reprinted with permission from Elsevier.

K. Fanson, T. Keeley, & B. Fanson

**Cyclic changes in cortisol across the estrous cycle in parous and nulliparous Asian elephants**

*Endocrine Connections* 3 (2014) 57–61

**Abstract.** In the context of reproduction, glucocorticoids (GCs) are generally considered to have negative effects. However, in well-studied model species, GCs fluctuate predictably across the estrous cycles, and short-term increases promote healthy ovarian function. Reproductive challenges have plagued captive elephant populations, which are not currently self-sustaining. Efforts to understand reproductive dysfunction in elephants have focused on the suppressive effects of cortisol, but the potential permissive or stimulatory effects of cortisol are unknown. Here, we provide a detailed examination of cortisol patterns across the estrous cycle in Asian elephants (*Elephas maximus*). Time series analysis was used to analyze cortisol and progesterone data for a total of 73 cycles from 8 females. We also compared cortisol profiles between females that successfully conceived and females that failed to conceive despite repeated mating attempts. Our results revealed that cortisol fluctuates predictably across the estrous cycle, with a peak during the second half

of the follicular phase followed by low levels throughout the luteal phase. Furthermore, this pattern was significantly altered in nulliparous females; cortisol concentrations did not decline during the luteal phase to the same extent as in parous females. This study highlights the complexity of cortisol signaling, and suggests future directions for understanding the role of cortisol in reproductive dysfunction. © 2014 The Authors.

Y. Furuse, A. Dastjerdi, K. Seilern-Moy, F. Steinbach & B.R. Cullen

**Analysis of viral microRNA expression by elephant endotheliotropic herpesvirus 1**  
*Virology* 454-455 (2014) 102-108

**Abstract.** Elephant endotheliotropic herpesvirus 1 (EEHV1), a member of the *Betaherpesvirinae* subfamily, has recently emerged as an important viral pathogen of Asian elephants that can cause a severe, often fatal, hemorrhagic disease. EEHV1 does not replicate in culture and little is currently known about the molecular biology of this emerging pathogen, with the notable exception of its genomic DNA sequence. Here, we have used small RNA deep sequencing to determine whether EEHV1, like other human and murine betaherpesviruses, expresses viral microRNAs in infected tissues in vivo. Our data provide evidence supporting the existence of at least three novel viral microRNAs encoded by EEHV1 and one of these, miR-E3-5p, is shown to repress target mRNA expression. Moreover, miR-E3-5p expression was readily detectable in tissue samples derived from two infected



Kaudulla National Park (Sri Lanka)

elephants, including in whole blood. These data shed new light on the biology of EEHV1 and identify small RNAs that have the potential to be useful in the diagnosis of sub-clinical infections in captive Asian and African elephants. © 2014 Reprinted with permission from Elsevier.

Ž. Grabarević, A.G. Kurilj, M. Hohšteter, B. Artuković, A. Hinke-Bruckmann, P. Džaja, Z. Hutinec, S. Seiwert & I. Bata

**Eccrine carcinoma in the foot of an Asian elephant (*Elephas maximus*)**

*Journal of Zoo and Wildlife Medicine* 44 (2013) 1049-1054

**Abstract.** A case of eccrine carcinoma of the interdigital foot glands in a 39-yr-old female Asian elephant (*Elephas maximus*) from Zagreb Zoo is described. The tumor between the toenails of the right forefoot was surgically removed 3 yr before postmortem examination (2003), and the histopathologic diagnosis was compound eccrine carcinoma characterized with glandular tubular and papillary proliferations, mild cellular pleomorphism, proliferation of the myoepithelial cells with mucoid secretions, and necrosis. Immunohistochemistry revealed strong immunoreactivity to S-100 protein, estrogen, and high-molecular weight cytokeratin. This elephant also had chronic renal fibrosis with uremia. © 2014 American Association of Zoo Veterinarians.

S. Gubbi, M.H. Swaminath, H.C. Poornesha, R. Bhat & R. Raghunath

**An elephantine challenge: human–elephant conflict distribution in the largest Asian elephant population, southern India**

*Biodiversity & Conservation* 23 (2014) 633-647

**Abstract.** Wildlife conservation is a complex issue especially when it involves large carnivores or mega-herbivores that are conflict-prone. Karnataka state in southern India is known to harbor high density of wild elephants. This conservation success story also has opportunity costs for communities living in close proximity to elephants. Despite the fact that human–elephant conflict is a serious conservation and social issue, there is little quantitative understanding of conflict especially over large areas. Here we conduct the first analysis of human–elephant

conflict distribution, severity and explanatory factors over the entire state of Karnataka. We use data from the state forest department records on villages that experience conflict, compensation payments made by the government, elephant densities, forest cover and perimeter, and presence of physical barriers to mitigate elephant conflict. In total, 60,939 incidences of crop loss were reported and US\$ 2.99 m paid in compensation during April 2008–March 2011. A total of 91 people were killed by elephants and 101 elephants died in retaliatory killings during the study period. A total of 9.4 % of the state's geographic area covering 25 of the 42 forest administrative divisions were affected. There was no significant difference in conflict incidences or compensation given between protected areas and non-protected areas. There was no correlation between conflict incidences/unit area and elephant density, forest cover, forest perimeter of protected areas and presence of physical barriers. The results depict the importance of efficient management of physical barriers, conserving key habitat linkages, and acts as baseline data for future work. © 2014 With kind permission from Springer Science+Business Media.

G. Gürelli & A. Ito

**Intestinal ciliated protozoa of the Asian elephant *Elephas maximus* Linnaeus, 1758 with the description of *Triplumaria izmirae* n. sp.**

*European J. of Protistology* 50 (2014) 25-32

**Abstract.** Species composition and distribution of intestinal ciliates excreted in the feces of three Asian elephants living in Sasa National Park, Izmir, Turkey, were investigated. Seven ciliate genera consisting of 36 species were identified. This is the first report on intestinal ciliates in elephants living in Turkey; one new species, *T. izmirae* n. sp., was described. This new species has a special macronucleus shape, skeletal rod plates with two wings and posterior contractile vacuole lying beneath the dorsal left base of the tail flap. The buccal infraciliary bands of *T. izmirae* are similar to those of *T. selenica* and *T. suwako* known from elephants. *Triplumaria ovina* and *Raabena bella* occurred in highest percentages in two elephants, whereas *Latteuria polyfaria* was highest in the third one. Ciliate densities in the three fecal samples were 3.5,

1.5 and  $5.0 \times 10^4$ /ml. © 2014 Reprinted with permission from Elsevier.

V. Gurusamy, A. Tribe & C.J.C. Phillips

**Identification of major welfare issues for captive elephant husbandry by stakeholders**

*Animal Welfare* 23 (2014) 11-24

**Abstract.** Accurate identification of key welfare issues for captive elephants could improve standards and help in the development of a welfare index. In the absence of adequate scientific information on the relative importance of key issues, the views of a range of stakeholders were sought using adaptive conjoint analysis. Fifteen key welfare issues were identified by experts, and three to six Levels of each, representing common husbandry practices. In order of declining importance, 224 stakeholders rated the issues as enclosure substrate > group size > healthcare > enrichment > chaining > enclosure type > exercise provision > enclosure size > interaction with keeper > enclosure environment > keeper knowledge/experience > diet > contact method with keeper > display duration > enclosure security. Enclosure size was considered more important by scientists and keepers than zoo directors/managers and animal welfare organisation representatives. Animal welfare organisation representatives rated enclosure security higher than scientists. Keeper husbandry methods and ability of elephants to be active were two principal components in responses. Three principal groups of respondents were identified: scientists/veterinarians focusing more on conditions for the elephants and less on interaction with the public; keepers, focusing on keeper contact method, feeding and knowledge of elephants; and a group with mainly animal welfare organisation representatives/zoo directors focusing on enclosure security. It is concluded that there are some differences between stakeholders in their recognition of the most important welfare issues for elephants in zoos. However, recognising that a diversity of informed opinion is necessary to adequately devise welfare standards, an index of elephant welfare in zoos is proposed, based on the relative merits of different husbandry practices and the importance of the different issues. © 2014 Universities Federation for Animal Welfare.

S. Hambrecht & S. Reichler

**Group Dynamics of Young Asian Elephant Bulls (*Elephas maximus* Linnaeus, 1758) in Heidelberg Zoo – Integration of a Newcomer in an Established Herd**

*Der Zoologische Garten* 82 (2013) 267-292

**Abstract.** The social organisation of elephants is based on female philopatry and male natal dispersal. The separation of males from their family group is a behavioural strategy of inbreeding avoidance. In the course of this gradual process young bulls increasingly have contact to males belonging to other herds, mainly same-aged, in form of sparring with spending more and more time away from their own family. After leaving the natal herd they join other males and form loose all-male groups. This natural process during the development of male elephants, however, raises a problem for the elephant keeping in zoological gardens because of the increasing intolerance by the herd in combination with the lack of adequate keeping facilities for bulls. As the keeping of young bulls without or limited contact to conspecifics is an unnatural way of handling them, as described above, efforts are made for establishing an appropriate husbandry. Zoo Heidelberg is the first German facility, which keeps a group of young elephant bulls. Moreover it is the first zoo which undertakes the experiment to integrate another young bull in an established group. The aim of this study was to assess the group dynamics, particularly the individual personalities and social bonds, in a group of young bulls in captivity during the integration of a new bull. By means of the focal animal sampling the social behaviour of the four young bulls during the first four months of integration of the new bull was continuously recorded. It was quantified by the frequencies of defined social events and the individual duration of social isolation and association with another elephant. The durations and the frequencies were standardised as the percentage of the individual observation period and the number of occurrences per hour, respectively, in order to allow the comparison of the individuals. The four young bulls showed distinct personalities, which affected the strength and kind of social bonds between them. In general the members of the initial group interacted more

frequently among themselves than they did with the new one. Particularly the initial three elephants exhibited physical contact and friendly behaviours to a greater extent than the new bull did. But the frequency and the motivation of the associations depended on the social partner both in the case of the initial group members and the new one. Furthermore the behaviour of the new elephant indicated social isolation and an elevated stress level. Beside a high frequency of social interactions, the existence of a dominance hierarchy and the progressive integration of the new bull suggest a stable social structure and therefore support the concept of keeping young bulls in same-sex groups. © 2013 Reprinted with permission from Elsevier.

A.D. Hayward, K.U. Mar, M. Lahdenperä & V. Lummaa

**Early reproductive investment, senescence and lifetime reproductive success in female Asian elephants**

*J. of Evolutionary Biology* 27 (2014) 772-783

**Abstract.** The evolutionary theory of senescence posits that as the probability of extrinsic mortality increases with age, selection should favour early-life over late-life reproduction. Studies on natural vertebrate populations show early reproduction may impair later-life performance, but the consequences for lifetime fitness have rarely been determined, and little is known of whether similar patterns apply to mammals which typically live for several decades. We used a longitudinal dataset on Asian elephants (*Elephas maximus*) to investigate associations between early-life reproduction and female age-specific survival, fecundity and offspring survival to independence, as well as lifetime breeding success (lifetime number of calves produced). Females showed low fecundity following sexual maturity, followed by a rapid increase to a peak at age 19 and a subsequent decline. High early life reproductive output (before the peak of performance) was positively associated with subsequent age-specific fecundity and offspring survival, but significantly impaired a female's own later-life survival. Despite the negative effects of early reproduction on late-life survival, early reproduction is under positive selection through a positive association with lifetime

breeding success. Our results suggest a trade-off between early reproduction and later survival which is maintained by strong selection for high early fecundity, and thus support the prediction from life history theory that high investment in reproductive success in early life is favoured by selection through lifetime fitness despite costs to later-life survival. That maternal survival in elephants depends on previous reproductive investment also has implications for the success of (semi-) captive breeding programmes of this endangered species. © 2014 The Authors. Published by John Wiley & Sons Ltd on behalf of European Society for Evolutionary Biology.

L. Highfill, O. Fad, R. Makecha & S. Kuczaj  
**Asian elephants (*Elephas maximus*) may demonstrate stable personalities**

*International Journal of Comparative Psychology* 26 (2013)

**Abstract.** Pioneering studies of animal personality appeared in the 1970s (e.g., Adamec, 1975; Buirski, Plutchik, & Kellerman, 1978; Stevenson-Hinde & Zunz, 1978). These studies proposed personality differences and examined behavioral tendencies that would be predicative of those personality traits. These studies began a surge of interest in consistent individual characteristics among individuals of various species, and during the past few years, research has begun to focus on animal personality more seriously. This line of research has resulted in a number of studies revealing individual differences in personality traits in such diverse species as primates, marine mammals, insects, fish, invertebrates, and birds (Gosling, 2001). Animal personality is defined as an individual animal's unique and stable patterns of behavior (Gosling, 2001). Based on this definition, there are often two main goals of animal personality research: 1) determine if individuals within a species exhibit distinctive patterns of behavior and 2) determine if these patterns are consistent and stable over time and in a variety of contexts. © 2013 by the International Society for Comparative Psychology.

P. Imrat, S. Mahasawangkul, C. Thitaram, P. Suthanmapinanth, K. Kornkaewrat, P. Sombutputorn, S. Jansittiwate, N. Thongtip, A.

Pinyopummin, B. Colenbrander, W.V. Holt & T.A.E. Stout

**Effect of alternate day collection on semen quality of Asian elephants (*Elephas maximus*) with poor initial fresh semen quality**

*Animal Reprod. Science* 147 (2014) 154-160

**Abstract.** In captivity, male Asian elephants often yield poor quality semen after transrectal manually assisted semen collection; however, the reasons for the disappointing semen quality are not clear. Here we test the hypothesis that accumulation of senescent spermatozoa is a contributory factor, and that semen quality can therefore be improved by more frequent ejaculation. To this end we investigated the effect of collecting semen five times on alternate days, after a long period of sexual rest, on semen quality in Asian elephants known to deliver poor semen during infrequent single collections. All eight bulls initially displayed a high incidence of detached sperm heads and low percentages of motile (close to 0%) spermatozoa. After semen collection on alternate days, the percentages of detached sperm heads, and head and mid-piece abnormalities, were reduced significantly ( $p < 0.05$ ). In particular, one bull showed markedly improved sperm motility (increased from 0% to 60%) and membrane integrity (increased from 5% to 75%). In addition, advancing age significantly ( $p < 0.01$ ) correlated with lower percentages of sperm with intact membranes and a higher frequency of detached sperm heads. In contrast to sperm accumulation problems in other species, a small ampullary diameter correlated significantly ( $p < 0.05$ ) with reduced semen quality. © 2014 Reprinted with permission from Elsevier.

M. Isaka, S. Palasarn, S. Komwijit, S. Somrithipol & S. Sommai

**Pleospurin A, an antimalarial cyclodepsipeptide from an elephant dung fungus (BCC 7069)**

*Tetrahedron Letters* 55 (2014) 469-471

**Abstract.** Cyclodepsipeptides SCH 217048 (1), SCH 218157 (2), and a new analog, pleospurin A (3), were isolated from cultures of an unidentified elephant dung fungus of the family Pleosporaceae. The structure of 3 was elucidated on the basis of detailed spectroscopic interpretation. The absolute configurations of 1–3 were determined by chiral column HPLC analysis and Marfey's

method. Cyclodepsipeptides 1–3 exhibited antimalarial activity against *Plasmodium falciparum* K1 with respective IC50 values of 1.6, 6.4, and 1.6 µg/mL, while they did not show cytotoxicity against KB, MCF-7 and NCI-H187 cell-lines or non-cancerous Vero cells at 50 µg/mL. © 2014 Reprinted with permission from Elsevier.

A. Ito, M. Ishihara, & S. Imai

***Bozasella gracilis* n. sp. (Ciliophora, Entodiniomorphida) from Asian elephant and phylogenetic analysis of entodiniomorphids and vestibuliferids**

*European J. of Protistology* 50 (2014) 134-152

**Abstract.** *Bozasella gracilis* n. sp. in the order Entodiniomorphida was found in fecal samples of an Asian elephant kept in a zoo. The ciliate has general and infraciliary similarities to the families Ophryoscolecidae and Cycloposthiidae. Phylogenetic trees were inferred from 18S rRNA gene sequences of *B. gracilis*, 45 entodiniomorphids, 10 vestibuliferids, 5 macropodiniids, and an outgroup, using maximum likelihood, Bayesian inference, and neighbor joining analyses. Of them, there were 32 new sequences; 26 entodiniomorphid species in the genera, *Bozasella*, *Triplumaria*, *Gassovskiella*, *Ditoxum*, *Spirodinium*, *Triadinium*, *Tetratoxum*, *Pseudoentodinium*, *Ochoterenaiia*, *Circodinium*, *Blepharocorys*, *Sulcoarcus*, *Didesmis*, *Alloiozona*, *Blepharoconus*, *Hemiprorodon*, and *Prorodonopsis*, and 6 vestibuliferid species in the genera, *Buxtonella*, *Balantidium*, *Helicozoster*, *Latteuria*, and *Paraisotricha*. Thirty additional



Tusker checking on the females (Minneriya)

sequences were retrieved from the GenBank database. Phylogenetic trees revealed non-monophylies of the orders Entodiniomorphida and Vestibuliferida, the suborders Entodiniomorphina and Blepharocorythina, and the families Cycloposthiidae and Paraisotrichidae. *Bozasella gracilis* was sister to *Triplumaria*. In addition, to avoid homonymy, we propose *Gilchristinidae* nom. nov., *Gilchristina* nom. nov. and *Gilchristina artemis* (Ito, Van Hoven, Miyazaki & Imai, 2006) comb. nov.

J. Kajaysri & W. Nokkaew

**Assessment of pregnancy status of Asian elephants (*Elephas maximus*) by measurement of progesterone and glucocorticoid and their metabolite concentrations in serum and feces, using enzyme immunoassay (EIA)**

*J. of Vet. Medical Science* 76 (2014) 363-368

**Abstract.** The study was to find patterns of progesterone (progesterone and its metabolite) and glucocorticoid and their metabolite concentrations in serum and feces of pregnant Asian elephants (*Elephas maximus*). The five female Asian domestic elephants were naturally mated until pregnancy. After that, blood and feces samples were collected monthly during pregnancy for progesterone, glucocorticoid and their metabolites analysis by enzyme immunoassay (EIA). The results showed the serum progesterone concentration during gestation was  $2.11 \pm 0.60$  to  $18.44 \pm 2.28$  ng/ml. Overall, serum progesterone concentration rose from the 1st month to reach peak in the 11th month, after which it declined to its lowest level in the 22nd month of pregnancy. Fecal progesterone concentration varied from  $1.18 \pm 0.54$  to  $3.35 \pm 0.45$  µg/g during pregnancy. In general, fecal progesterone concentration increased from the 1st month to its highest level in the 12th month. After this, it declined reaching its lowest point in the 22nd month of pregnancy. Glucocorticoid hormones and their metabolite concentrations both in serum and feces fluctuated from low to medium throughout almost the entire pregnancy period and then rapidly increased around the last week before calving. Our study suggests that this profile of progesterone and glucocorticoid hormones and their metabolite concentration levels in serum and feces can be used to assess

the pregnancy status of Asian elephants. If serum and fecal progesterone concentrations were found in very low levels and glucocorticoid and their metabolite concentrations were found in very high levels, it was indicated that the cow elephant would calve within 7 days. © 2014 The Japanese Society of Veterinary Science.

A. Kanagavel, R. Raghavan & D. Veríssimo

**Beyond the “general public”: Implications of audience characteristics for promoting species conservation in the Western Ghats hotspot, India**

*AMBIO* 43 (2014) 138-148

**Abstract.** Understanding how different audience groups perceive wildlife is crucial for the promotion of biodiversity conservation, especially given the key role of flagship species in conservation campaigns. Although the heterogeneity in preferences reinforces the need for campaigns tailored to specific target audiences, many conservation education and awareness campaigns still claim to target the “general public”. Audiences can be segmented according to social, economic, and cultural criteria across which species perceptions are known to vary. Different studies have investigated the preferences of different groups towards certain wildlife species, but these are largely confined to a single conservation stakeholder group, such as tourists, local communities, or potential donors in western countries. In this study, we seek to determine from a multi-stakeholder perspective, audience characteristics that influence perceptions towards wildlife at Valparai, a fragmented plateau in the Western Ghats region of the Western Ghats - Sri Lanka Hotspot. We found that stakeholder group membership was the most important characteristic followed by gender. While some characteristics had a wide-scale effect others were restricted to a few species. Our results emphasize the need to design conservation campaigns with specific audiences in mind, instead of the very often referred to “general public”. © 2013 Royal Swedish Academy of Sciences. With kind permission from Springer Science+Business Media.

V. Kumar, V. Reddy, A. Kokkiligadda, S. Shivaji & G. Umaphathy

**Non-invasive assessment of reproductive status and stress in captive Asian elephants in three south Indian zoos**

*General and Comparative Endocrinology* 201 (2014) 37-44

**Abstract.** Asian elephants in captivity need immediate attention to be bred so as to meet the increasing demand for captive elephants and to overcome the dependence on supplementing the captive stock with wild animals. Unfortunately, captive breeding programs across the globe have met with limited success and therefore more effort is needed to improve breeding in captivity. Endocrine profiling of reproductive hormones (progesterone and androgens) and the stress hormone (glucocorticoids) could facilitate better management and breeding strategies. In the present study, we investigated reproductive and stress physiology of 12 captive Asian elephants for 10–27 months using a non-invasive method based on steroid analysis of 1700 elephant dung samples. Most of the elephants were cycling regularly. Males during musth showed increased fecal androgen metabolite concentrations and exhibited a slight increase in fecal glucocorticoid metabolite levels. Elephants used in public festivals and processions showed significantly increased in faecal glucocorticoid metabolite levels. The results indicate that captive elephants require periodic health care, better husbandry practices and scientific management for sustainable captive population. © 2014 Reprinted with permission from Elsevier.

E. Martin, C. Martin & L. Vigne

**The decline in carving African and Asian elephant tusks in Nepal and the decrease in ivory items for retail sale in Kathmandu**

*Pachyderm* 54 (2013) 52-58

**Abstract.** The Nepal ivory industry has collapsed since early 2001, when the last survey was conducted. The few remaining craftsmen have stopped carving ivory. The number of shops selling ivory items has fallen from 57 in February 2001 to 19 in December 2012. During this period ivory items on display for sale in Kathmandu dropped from 1546 to 208. Smuggled raw ivory from Africa and Asia used to come into Nepal via India, but both the India and the Nepal governments have improved their border

controls. Wildlife law enforcement in Nepal has strengthened considerably since 2010 with the establishment of government committees and bureaus dealing with wildlife crime all over the country. All ivory is illegal to sell or to display in shops, and vendors are now reluctant to sell new ivory items and are trying to offload their last remaining ivory objects. Turnover is slow as customer demand has fallen, partly as Nepalese now prefer to buy gold items and also because foreign tourists (the main buyers) show little interest in buying ivory as the selection is poor and there is a greater risk entailed in smuggling worked ivory out of the country. Thus Nepal is not a threat to Africa's or Asia's elephants.

M. Miller & F. Olea-Popelka

**One Health in the shrinking world: Experiences with tuberculosis at the human–livestock–wildlife interface**

*Comparative Immunology, Microbiology and Infectious Diseases* 36 (2013) 263-268

**Abstract.** Tuberculosis (TB) is a global anthro-pozoonotic infection that has raised awareness of the impact of disease at the human–livestock–wildlife interface. There are examples of transmission from livestock resulting in establishment of reservoirs in wildlife populations, and exposures from interactions between humans and wildlife that have resulted in disease outbreaks. A One Health approach is crucial to managing and protecting the health of humans, livestock, wildlife and the environment. Although still in its infancy in many areas of the world, the use of transdisciplinary teams to address wildlife–human–livestock boundary diseases will broaden the scope of options for solutions. This paper reviews some less commonly known examples of threats and outcomes using lessons learned from tuberculosis. © 2013 Reprinted with permission from Elsevier.

S.Y. Moon-van der Staay, G.W.M. van der Staay, T. Michalowski, J.-P. Jouany, P. Pristas, P. Javorský, S. Kišidayová, Z. Varadyova, N.R. McEwan, C.J. Newbold, T. van Alen, R. de Graaf, M. Schmid, M.A. Huynen & J.H.P. Hackstein

**The symbiotic intestinal ciliates and the evolution of their hosts**

*European J. of Protistology* 50 (2014) 166-173

**Abstract.** The evolution of sophisticated differentiations of the gastro-intestinal tract enabled herbivorous mammals to digest dietary cellulose and hemicellulose with the aid of a complex anaerobic microbiota. Distinctive symbiotic ciliates, which are unique to this habitat, are the largest representatives of this microbial community. Analyses of a total of 484 different 18S rRNA genes show that extremely complex, but related ciliate communities can occur in the rumen of cattle, sheep, goats and red deer (301 sequences). The communities in the hindgut of equids (*Equus caballus*, *Equus quagga*), and elephants (*Elephas maximus*, *Loxodonta africanus*; 162 sequences), which are clearly distinct from the ruminant ciliate biota, exhibit a much higher diversity than anticipated on the basis of their morphology. All these ciliates from the gastro-intestinal tract constitute a monophyletic group, which consists of two major taxa, i.e. Vestibuliferida and Entodiniomorpha. The ciliates from the evolutionarily older hindgut fermenters exhibit a clustering that is specific for higher taxa of their hosts, as extant species of horse and zebra on the one hand, and Africa and Indian elephant on the other hand, share related ciliates. The evolutionary younger ruminants altogether share the various entodiniomorphs and the vestibuliferids from ruminants. © 2014 Reprinted with permission from Elsevier.

C. Mumby, T. Bouts, L. Sambrook, S. Danika, E. Rees, A. Parry, M. Rendle, N. Masters & R. Weller

**Validation of a new radiographic protocol for Asian elephant feet and description of their radiographic anatomy**

*Veterinary Record* 173 (2013) 318

**Abstract.** Foot problems are extremely common in elephants and radiography is the only imaging method available but the radiographic anatomy has not been described in detail. The aims of this study were to develop a radiographic protocol for elephant feet using digital radiography, and to describe the normal radiographic anatomy of the Asian elephant front and hind foot. A total of fifteen cadaver foot specimens from captive Asian elephants were radiographed using a range of projections and exposures to determine the best radiographic technique. This was subsequently

tested in live elephants in a free-contact setting. The normal radiographic anatomy of the Asian elephant front and hind foot was described with the use of three-dimensional models based on CT reconstructions. The projection angles that were found to be most useful were 65–70° for the front limb and 55–60° in the hind limb. The beam was centred 10–15 cm proximal to the cuticle in the front and 10–15 cm dorsal to the plantar edge of the sole in the hind foot depending on the size of the foot. The protocol developed can be used for larger-scale diagnostic investigations of captive elephant foot disorders, while the normal radiographic anatomy described can improve the diagnostic reliability of elephant feet radiography. © 2013 BMJ Publishing Group Limited.

S. Nummela, H. Pihlström, K. Puolamäki, M. Fortelius, S. Hemilä & T. Reuter

**Exploring the mammalian sensory space: co-operations and trade-offs among senses**

*J. of Compar. Physiology A* 199 (2013) 1077-92

**Abstract.** The evolution of a particular sensory organ is often discussed with no consideration of the roles played by other senses. Here, we treat mammalian vision, olfaction and hearing as an interconnected whole, a three-dimensional sensory space, evolving in response to ecological challenges. Until now, there has been no quantitative method for estimating how much a particular animal invests in its different senses. We propose an anatomical measure based on sensory organ sizes. Dimensions of functional importance are defined and measured, and normalized in relation to animal mass. For 119 taxonomically and ecologically diverse species, we can define the position of the species in a three-dimensional sensory space. Thus, we can ask questions related to possible trade-off vs. co-operation among senses. More generally, our method allows morphologists to identify sensory organ combinations that are characteristic of particular ecological niches. After normalization for animal size, we note that arboreal mammals tend to have larger eyes and smaller noses than terrestrial mammals. On the other hand, we observe a strong correlation between eyes and ears, indicating that co-operation between vision and hearing is a general mammalian feature. For some groups of mammals we note a correlation,

and possible co-operation between olfaction and whiskers. © 2013 With kind permission from Springer Science+Business Media.

A. Parameswaran

**Zooësis and ‘becoming with’ in India: The ‘figure’ of elephant in Sahyande Makan: The elephant project**

*Theatre Research International* 39 (2014) 5-19

**Abstract.** I analyse Sahyande Makan: The Elephant Project (2008), a cross-cultural theatrical production in Malayalam and Japanese by the Kerala-based group Theatre Roots and Wings, as an instance of ‘zooësis’. The performance presents the state of an elephant in the space of a Kerala temple festival ritual, pooram. The elephant moves into a fantasy of the wild as it is under the physiological condition of musth. Approaching the question of the performing animal as intersectional, this performance challenges anthropocentrism and its assumed binary of human/animal, and draws a possible relation between domestic and wild, or the world of norms and freedom, both for elephants and for humans. I argue that by taking embodiment as the site of exploring discipline as well as imagining a freeing, and by positing an alternate way of ‘being worldly’ through affect and senses, the performance articulates what Donna Haraway has posited as the process of ‘becoming with’. © 2014 Internat. Federation for Theatre Research.

S. Paudel, S.K. Mikota, C. Nakajima, K.P. Gairhe, B. Maharjan, J. Thapa, A. Poudel, M. Shimozuru, Y. Suzuki & T. Tsubot

**Molecular characterization of *Mycobacterium tuberculosis* isolates from elephants of Nepal**

*Tuberculosis* 94 (2014) 287-292

**Abstract.** *Mycobacterium tuberculosis* was cultured from the lung tissues of 3 captive elephants in Nepal that died with extensive lung lesions. Spoligotyping, TbD1 detection and multi-locus variable number of tandem repeat analysis (MLVA) results suggested 3 isolates belonged to a specific lineage of Indo-Oceanic clade, EA15 SIT 138. One of the elephant isolates had a new synonymous single nucleotide polymorphism (SNP) T231C in the *gyrA* sequence, and the same SNP was also found in human isolates in Nepal. MLVA results and transfer history of the elephants

suggested that 2 of them might be infected with *M. tuberculosis* from the same source. These findings indicated the source of *M. tuberculosis* infection of those elephants were local residents, presumably their handlers. Further investigation including detailed genotyping of elephant and human isolates is needed to clarify the infection route and eventually prevent the transmission of tuberculosis to susceptible hosts. © 2014 Reprinted with permission from Elsevier.

J. Payne & G. Davies

### **Conservation of rain forest mammals in Sabah: long term perspectives**

*Raffles Bulletin of Zoology* 529 (2013) 187-201

**Abstract.** The two authors of this paper commenced their careers under the guidance of the Earl of Cranbrook, in Sabah in 1979, when the timber boom was under way, and when knowledge of the mammal fauna was rudimentary. A faunal survey of Sabah conducted in 1979–1982 provided a baseline and recommendations on forest conservation relevant especially to the large mammal species reckoned to be threatened by logging and forest loss at that time. This paper traces some of the major changes in forestry in Sabah, the establishment of the forest estate, and the replacement of a long-cycle selective logging system by over-logging and conversion of forest to plantations. The visionary Sabah Forestry Department has tried to maximise the extent of forest retained and its value to species conservation in the face of inevitable political, social, and economic pressures, and has largely succeeded. The situation regarding Sumatran rhinoceros, Bornean elephant and Bornean orang-utan in Sabah is described, along with the surprising changes in our perception of the conservation needs of these iconic species since 1982. © 2013 National University of Singapore.

J.M. Plotnik, R.C. Shaw, D.L. Brubaker, L.N. Tiller & N.S. Clayton

### **Thinking with their trunks: elephants use smell but not sound to locate food and exclude nonrewarding alternatives**

*Animal Behaviour* 88 (2014) 91-98

**Abstract.** The two-way object choice paradigm has been used extensively in studies of animal cognition. The paradigm involves presenting two

options, one rewarding and one nonrewarding, to a subject and allowing it to make a choice between the two, potentially by exploiting specific cues provided by the experimenter. Using the paradigm, we tested first whether Asian elephants, *Elephas maximus*, could use auditory and/or olfactory cues to find food. While elephants were unable to locate hidden food by following an auditory cue, they were capable of finding food when the cue was olfactory. The second part of the study involved providing the subjects with only olfactory information about one option before presenting them with a choice between two. In trials in which subjects were allowed to investigate only the nonrewarding option, they made choices by exclusion, either inferring the location of the rewarding option or simply avoiding the nonrewarding one. Elephants thus relied on olfaction to locate food and to exclude nonrewarding food locations, but failed to use auditory information (when it was the only cue presented) to do the same. This study represents important evidence of elephants using their sense of smell in a cognitive task. © 2013 The Association for the Study of Animal Behaviour. Reprinted with permission from Elsevier.

S. Qasim, A.N. Khan & M. Qasim

### **A comparative study of conservation strategies of two selected national parks from Pakistan & Thailand: Lessons learned from each other**

*Journal of Managerial Sciences* 8 (2014) 61-75

**Abstract.** The conservation strategies of two national parks i.e., Chiltan Hazarganji of Pakistan and Kaeng Krachan of Thailand were compared in this study. It was found that that Kaeng Krachan national park has much better “Zoning schemes” conservation strategies than Chiltan Hazarganji national park. However, the “trophy hunting” and community involvement of Chiltan Hazarganji were also important for conservation of Chiltan Markhor. The best conservation strategies of Kaeng Krachan national park may be attributed not only to awareness of the Thai people about biodiversity conservation but also the strong political will of Thailand’s government to promote tourism industry of the country. The study therefore recommends the exchange of information on natural resources conservation between the two countries.

S. Romain, T. Angkawanish, P. Bampenpol, P. Pongsopawijit, P. Sombatphuthorn, R. Nomsiri & A. Silva-Fletcher

**Diet composition, food intake, apparent digestibility, and body condition score of the captive Asian elephant (*Elephas maximus*): A pilot study in two collections in Thailand**

*J. of Zoo and Wildlife Medicine* 45 (2014) 1-14

**Abstract.** Limited data are available regarding the nutrition and feeding of captive Asian elephants in range countries. In this study, feeding regimens of two collections in northern Thailand and their actual diets shaped by availability of forage and mahout preferences were assessed for nutritional quality. The composition of dietary intake, fecal output, and the dietary regimen were individually recorded for 5 days in 10 elephants. The proportion of forage in the diet represented 41 to 62% of the dry matter intake (DMI) in one collection whereas in the other collections it varied between 68 and 72%. Between 8.5 and 24% of the diet consisted of commercial pellets, and hulled rice represented up to 25% of the DMI in one collection. Sugar cane, corn cobs, and fruits such as bananas were eaten in smaller amounts. Body condition scores and weights were measured, which revealed that nine animals were in good condition. Representative samples of each food as well as fecal samples were analyzed for dry matter, crude protein, fat, crude fiber, gross energy, ash, calcium, and phosphorus. Diet adequacy was assessed by calculating the digestible nutrients in the rations and by comparing them to the recommendations from literature. The digestible energy (DE) intake varied between 0.6 and 1.4 megajoules (MJ) per kg 0.75 per day; therefore, higher than the estimated recommendations of 0.65 MJ per kg 0.75 per day for nine of the elephants. In all elephants the crude protein intake was less than the maintenance recommendations and ranged between 6.01 and 7.56% of the DMI. Calcium intake was low in one collection and there was an inverse calcium:phosphorus ratio, which was inadequate. The present study adds to the knowledge of captive elephant diets in Asia and is a starting point for further research, which is necessary to design optimum diet plans for captive Asian elephants in Thailand. © 2014 American Association of Zoo Veterinarians.

A.H.M.R. Sarker & E. Røskaft

**Perceptions of farmers in Bangladesh to Asian elephants (*Elephas maximus*)**

*Environment and Natural Resources Research* 4 (2014) 23-38

**Abstract.** We explored the degree to which Bangladeshi farmers perceive Asian elephants (*Elephas maximus*) as agricultural pests, as related to the type of farming and other demographic profile of the farmers. We analysed the size and cropping patterns of farms raided by wild elephants, the extent and nature of crop loss, the months and crop-raiding time; and the size of elephants' herds that caused crop-raiding incidents. The average loss of entire crops increased with distance from the park up to 300 m and then decreased with greater the distance. The greatest loss due to crop raiding was associated with specific crops. Farmers incurred the greatest mean losses in terms of cost from like rice, vegetables, banana, and teak. The highest proportion of small losses occurred during the early evening, while the greatest financial losses occurred during late evening. Wild elephants raided crops throughout most of the year, but the greatest loss and cost were incurred during the monsoon season. The proportion of crops lost varied with the herd size of elephant responsible for crop-raiding and the duration of crop-raiding. Differences were found in the views of farmers regarding the perceptions towards elephant as pest. Considering crop-raiding elephant herd as pest has been given different views by the farmers based on their financial/comfortable status. © 2014 Canadian Center of Science and Education.



Male enjoying a drink (Sri Lanka)

S.K. Shil, M.A. Quasem, M.L. Rahman, A.S.M.G. Kibria, M. Uddin & A.S.M.L. Ahasan  
**Macroanatomy of the bones of pelvis and hind limb of an Asian elephant (*Elephas maximus*)**  
*International Journal of Morphology* 31 (2013) 1473-1478

**Abstract.** Recent excavated skeleton of an adult female Asian elephant (*Elephas maximus*), died in dystokia in Bangladesh was used for macro anatomical study. Some unique morphological features of bones of hind limb were observed. Pelvic canal was more oval and the wings of ilium were wider. Rump slope was about 36°. Angle between femur and tibia was close to 180°. In Femur, the major trochanter was located at the lower level of head. Minor trochanter, fovea capitis and trochanteric ridge were absent. Supracondyloid fossa was shallow but the intercondyloid fossa was deep. Posterior surface of patella possessed a blunt vertical ridge. The articular surfaces of both tibial condyles were clearly concave. The tibia and the fibula were articulated proximally and distally with keeping a wide interosseous space. Instead of tibial tuberosity, there was an elongated triangular depression in proximal part. There were six tarsal bones arranged in three rows. The comparative size of the distal tarsal bones were III+IV > I > II. The comparative lengths of the metatarsal bones were III > II > IV > V > I. Digits I and V were the most vertical and digit III was the most horizontal. The proximal phalanx was the biggest of all.

J.J. Stanton, S.A. Nofs, A. Zachariah, N. Kalaivannan & P.D. Ling

**Detection of endotheliotropic herpesvirus infection among healthy Asian elephants (*Elephas maximus*) in South India**

*Journal of Wildlife Diseases* 50 (2014) 279-287

**Abstract.** Elephant endotheliotropic herpesviruses (EEHVs) can cause fatal hemorrhagic disease in Asian (*Elephas maximus*) and African (*Loxodonta africana*) elephants. Of the seven known EEHV species, EEHV1 is recognized as the most common cause of hemorrhagic disease among Asian elephants in human care worldwide. Recent data collected from ex situ Asian elephants located in multiple North American and European institutions suggest

that subclinical EEHV1 infection is common in this population of elephants. Although fatal EEHV1-associated hemorrhagic disease has been reported in range countries, data are lacking regarding the prevalence of subclinical EEHV infections among in situ Asian elephants. We used previously validated EEHV-specific quantitative real-time PCR assays to detect subclinical EEHV infection in three regionally distinct Asian elephant cohorts, totaling 46 in situ elephants in South India, during October and November 2011. Using DNA prepared from trunk washes, we detected EEHV1, EEHV3/4, and EEHV5 at frequencies of 7, 9, and 20% respectively. None of the trunk washes was positive for EEHV2 or 6. At least one EEHV species was detectable in 35% (16/46) of the samples that were screened. These data suggest that subclinical EEHV infection among in situ Asian elephants occurs and that Asian elephants may be natural hosts for EEHV1, EEHV3 or 4, and EEHV5, but not EEHV2 and EEHV6. The methodology described in this study provides a foundation for further studies to determine prevalences of EEHV infection in Asian elephants throughout the world. © 2014 Wildlife Disease Association.

S.J. Sugumar & R. Jayaparvathy

**An improved real time image detection system for elephant intrusion along the forest border areas**

*Scientific World Journal* 2014 (2014) 393958

**Abstract.** Human-elephant conflict is a major problem leading to crop damage, human death and injuries caused by elephants, and elephants being killed by humans. In this paper, we propose an automated unsupervised elephant image detection system (EIDS) as a solution to human-elephant conflict in the context of elephant conservation. The elephant's image is captured in the forest border areas and is sent to a base station via an RF network. The received image is decomposed using Haar wavelet to obtain multilevel wavelet coefficients, with which we perform image feature extraction and similarity match between the elephant query image and the database image using image vision algorithms. A GSM message is sent to the forest officials indicating that an elephant has been detected in the forest border and is approaching human

habitat. We propose an optimized distance metric to improve the image retrieval time from the database. We compare the optimized distance metric with the popular Euclidean and Manhattan distance methods. The proposed optimized distance metric retrieves more images with lesser retrieval time than the other distance metrics which makes the optimized distance method more efficient and reliable. © 2014 The Authors.

S.J. Sugumar & R. Jayaparvathy

### **Design of a quadruped robot for human–elephant conflict mitigation**

*Artificial Life and Robotics 18 (2013) 204-211*

**Abstract.** Human–elephant conflict is a major problem leading to crop damage, human death by elephants and elephants being killed by people. The surveillance and tracking of elephant herds are difficult due to their size and nature of movement. **Materials:** In this article, we propose a four-wheeled quadruped robot to mitigate human–elephant conflict. The robot can detect movement of wild pachyderms in certain pockets along the forest borders through which the elephants enter into the human living areas from the forest. The robot is so designed that it can navigate with wheels on flat terrains and with legs on unfriendly rugged terrains with the help of mounted cameras. **Methods:** The images of the wild elephant are captured and transmitted to the base stations and an SMS is sent to the forest officials indicating an elephant is found. We obtain a suitable kinematic model for both legs and wheels with control algorithm for the quadruped robot to move along a predetermined path. **Conclusion:** The quadruped robot proposed is a solution to detect elephant movement without affecting the ecological conditions to overcome human–elephant conflict. The unpredictability of time and location of elephant arrival into the villages are considered the major issues that are resolved in this work. The results of our work contribute to elephant conservation issues and are suitable for the detection of elephants in forest border areas. © 2013 ISAROB.

I.C. Suter, G.P. Maurer & G. Baxter

### **Population viability of captive Asian elephants in the Lao PDR**

*Endangered Species Research 24 (2014) 1-7*

**Abstract.** Asian elephants *Elephas maximus* have been captured and trained by Lao mahouts for centuries. While captive elephants are losing their traditional relevance, they still play a significant role in the Lao logging and tourism industries. However, with only an estimated 480 captive elephants remaining nationally and only ~60 cows under 35 yr of age, the future viability of this population is uncertain. We assessed >80% of the captive elephant population and used VORTEX software to create 7 population viability analysis scenarios. Our results demonstrate that without changes to conservation management the current population is likely to be extinct in 112 yr ( $r = -0.099$ ). Reduced mortality rates, increased reproductive rates and population supplementation will give the population an additional 108 yr of longevity, but will not, of themselves, prevent extinction. Management programs should direct efforts towards in situ breeding programs, a cessation in calf exportation, improved veterinary care and population supplementation. Since captive populations are also small and declining in other range nations, there is also a case for managing all Asian elephants as a single management unit. © 2014 Inter-Research.

A.A.E. van der Geer, G.A. Lyras, L.W. van den Hoek Ostende, J.de Vos & H. Drinia

### **A dwarf elephant and a rock mouse on Naxos (Cyclades, Greece) with a revision of the palaeozoogeography of the Cycladic Islands (Greece) during the Pleistocene**

*Palaeogeography, Palaeoclimatology, Palaeoecology 404 (2014) 133-144*

**Abstract.** During the Late Pleistocene, Naxos and adjacent areas, including Delos and Paros, constituted a mega-island, here referred to as palaeo-Cyclades. The extensive low-lying plains with lakes and rivers provided a suitable habitat for elephants. Due to long-term isolation from the mainland and mainland populations, these elephants evolved miniature size. The species found on Naxos had a body size of about ten percent of that of the mainland ancestor, *Palaeoloxodon antiquus*. During the glacial periods of the Late Pleistocene, *P. antiquus* may have migrated eastwards and southwards in search of better conditions and reached the islands. The dwarf

species of the various Southern Aegean islands (e.g. Crete, Tilos, Rhodos, palaeo-Cyclades) are each the result of independent colonisation events. The very small size of the Naxos species relative to the dwarf elephants from Crete is explained as due to the lack of competitors. The only other elements of the contemporaneous fauna were a rock mouse (*Apodemus cf. mystacinus*) and a shrew (*Crocidura sp.*). Submergence of the area, climate change, volcanism, hunting by humans or a combination of these factors during the terminal Pleistocene may have caused the extinction of this endemic fauna. © 2014 Reprinted with permission from Elsevier.

T.N.C. Vidya

### **Novel behaviour shown by an Asian elephant in the context of allomothering**

*Acta Ethologica 17 (2014) 123-127*

**Abstract.** In the absence of large sample sizes, logistic difficulties, and, more importantly, knowledge about appropriate hypotheses to test cognition in elephants, reliable anecdotal observations from field studies are increasingly being realized as valuable in this context. I report here a novel behaviour shown by a subadult female in the context of allomothering. The observation was made as part of a long-term study of social organization and behaviour in free-ranging Asian elephants in southern India. A subadult, nulliparous female, Genette, while allomothering a calf, was confronted by the calf persistently trying to suck at Genette's mammary glands. This was presumably uncomfortable for Genette, as evidenced by her reactions of avoiding, kicking, and nudging the calf away. She, however, started offering her trunk tip to the calf to suck, and this behaviour was seen repeatedly, with the calf actively sucking on it as if drinking milk. I discuss how this trunk-sucking behaviour differs from related behaviours previously seen in elephants and how this might be a case of problem solving. © 2013 Springer-Verlag Berlin Heidelberg and ISPA.

G. Wilson, M.A.M. Gruber & P.J. Lester

### **Foraging relationships between elephants and *Lantana camara* invasion in Mudumalai Tiger Reserve, India**

*Biotropica 46 (2014) 194-201*

**Abstract.** *Lantana camara* is a widespread exotic invasive species in India, capable of dominating and displacing native forage species. We investigated whether *L. camara* was associated with variation in elephant foraging behavior in Mudumalai Tiger Reserve, India. The behavioral responses of elephants to *L. camara* were assessed from feeding and stepping rates. Elephants were never observed to feed on *L. camara*, but rather fed on grass and browse present within and around *L. camara* patches. A multiple regression analysis showed that feeding rates were negatively associated with *L. camara* invasion ( $F_{1,55} = 4.26, R^2 = 0.07$ ), but not stepping rates. Instead, grass cover and browse density were associated with stepping rates ( $F_{2,55} = 11.16, R^2 = 0.30$ ). Path analysis indicated that the total effect of *L. camara* on feeding rates was 11% ( $\beta = -0.24$ ) less than the direct negative association ( $\beta = -0.27$ ) owing to a positive indirect association of *L. camara* with feeding rates through grass cover and browse density ( $\beta = 0.03$ ), while stepping rates were negatively associated with grass cover ( $\beta = -0.39$ ) and positively associated with browse density ( $\beta = 0.38$ ). Our results indicate that *L. camara* appears capable of modifying feeding rates of elephants, likely through a loss of grass areas due to *L. camara* invasion. Experimental work is needed to test for causal relationships among the variables we measured, to enhance our understanding of how invasive weeds modify elephant behavior. © 2014 The Association for Tropical Biology and Conservation.



“Najaah” at Metigattha Wewa (Sri Lanka)