**Allomothering Among Captive African elephants**  
Laura Beer, Heather R. Bates and Robert H. I. Dale  
Butler University

According to P.C. Lee (1987), interactions between African elephant calves and other elephants are frequent, consisting of friendly, relaxed interactions or of adults providing assistance to calves. When a female elephant other than its mother provides comfort, care or protection a calf, it is called allomothering. Using video recordings of African elephants at the Indianapolis Zoo, we compared the interactions between several calves and Sophi (the “matriarch”/dominant female) and Tombi (a relatively subordinate adult in the group). Note that allomothering may occur either after an adult approaches a calf or after a calf approaches an adult. We examined the nature of the interactions between the calves and the adults.

**Rhinoceros Horns and Imitations in the Trade**  
Vanessa Blount, B.C. Yates, and E.O. Espinoza  
National Fish and Wildlife Forensics Laboratory

The illegal trade in rhino horn is a leading contributing factor to the extinction of rhinoceros. Former evidentiary material can be used to further our knowledge base on how the horns are removed, processed, shipped, and modified for sale as whole horns or artifacts. Mechanisms of fakery can be detected using variable light source and low magnification to show how horse hooves and cattle horns are made into rhino horn imitations. Additionally, illegal fakes have been found made from carved elephant toenail. The implications of selling fake rhino horn include continued promulgation of the desire for rhino products and wasted time agencies/organizations spend in monitoring alleged contraband.

**Elephants for Africa: Conservation through Research and Education**  
**Preliminary Findings on Male Elephant Sociality in the Makgadikgadi National Park, Botswana**  
Kate Evans, Mphoeng Ofithile, and Miguel Cases  
Elephants for Africa

Elephants for Africa’s work focuses on male elephants, a little understood aspect of elephant ecology. Studying the elephants that are utilising the Makgadikgadi National Park (MNP), historically a peripheral elephant range, will educate us on the conservation of elephant landscapes in order to increase range and connectivity between populations; a conservation priority of the World Wildlife Fund for Nature (WWF). The MNP as part of the Northern Conservation Area, is home to the largest remaining population of elephant in the world and is part of the Kavango-Zambezi Transfrontier Conservation Area (KAZA), which has been highlighted a priority area for the conservation of the African elephant by the WWF.

In recent years there has been an influx of male elephants into this area with the current population being made up predominantly of bulls with sightings of male groups more than 100 strong socialising...
together (Bradley, pers comms). Male groups as large as these have not been sighted in Africa in recent history, giving us a unique opportunity to further understand the social ecology of male elephants.

Understanding the population dynamics of the elephants utilising the area and potential fluctuations in the population alongside habitat changes; contributing to both the national (Department of Environmental Affairs 2008), regional (Department of Environmental Affairs and Centre for Applied Research 2010) and the African Elephant Specialist Group (AfESG) research priorities. The Okavango Delta is extremely dynamic, relying on a flood pulsing system, which shifts the wet and dry seasons, since 2008 the flood levels have increased dramatically, through necessity, the elephants are periodically forced into new and old ranges. This along with a recent increase and then stabilization of the elephant population in Northern Botswana (Chase 2010) may have caused the recent influx of male elephants into the MNP and surrounding areas (Department of Environmental Affairs and Centre for Applied Research 2010).

Initial findings show that groups as large as 52 male elephants are meeting at the Boteti River not only to drink and mudbath but to socialize. Leading us to wonder what role these large social groupings have in male elephant sociality and the implications for their conservation and welfare both in-situ and ex-situ. Comparing data from our 10-yaer database in the Okavango Delta we will present preliminary findings on the differences in male social ecology between these two predominantly male elephant areas in Botswana.

Differentiation of Mycobacterium Species from Elephant Respiratory Samples in Nepal, Using Polymerase Chain Reaction-Restriction Fragment Length Polymorphism (PCR-RFLP) Analysis

Corissa Miller¹, Kristin Warren², Carly Holyoake², Ian Robertson², Gretchen Kaufman³, Tierra Evans⁴, Dibesh Karmacharya⁵, Sulochana Manandhar⁵, Kshitiz Shrestha⁵ and Maheshwar Dhakal⁶

¹Ecotone Wildlife Veterinary Services, Australia; ²School of Veterinary and Biomedical Sciences, Murdoch University, Australia; ³Paul G. Allen School for Global Animal Health, Washington State University, USA; ⁴Center for Conservation Medicine, Tufts Cummings School of Veterinary Medicine, Tufts University, USA; ⁵Center for Molecular Dynamics Nepal (CMDN), Nepal; ⁶Department of National Parks and Wildlife Conservation, Government of Nepal

Tuberculosis caused by Mycobacterium tuberculosis complex (MTBC) species poses a significant threat to the health and welfare of Asian elephants, and to the conservation of the species as a whole (Greenwald et al. 2009). Both Mycobacterium tuberculosis (M. tb) and Mycobacterium bovis (M. bovis) are endemic to Nepal, yet it is unknown which species are responsible for pulmonary mycobacteriosis in Nepal’s elephant population (NETCMAP 2011). Captive elephants interact closely with humans, wildlife and domestic species, increasing the risk for bidirectional transmission of Mycobacterium species and raising important public health, economic and conservation concerns (Murphree et al. 2011; Oh et al. 2002). It is widely accepted that, while early detection and management are essential for successful disease control in elephants, key inadequacies exist in current tuberculosis diagnostics (Angkawanish et al. 2010; Montali et al. 1998). Diagnosis relies on trunk wash (TW) culture and serology (Mikota and Maslow 2011). However, TW culture is impractical in many countries and lacks sensitivity (Mikota et al. 2006). Serology, while sensitive, does not differentiate the various Mycobacterium species, nor is it useful for monitoring elephants post-treatment (Kay et al 2010). The objective outcome of this research was to minimise the impact of tuberculosis on Asian
elephant populations, through development of a novel molecular diagnostic technique, using Nepal’s captive elephant population as a model.

A gyrB-based PCR-RFLP assay for the detection of MTBC species was developed, building on preliminary work by Wilson and others (2008) at the Center of Molecular Dynamics Nepal (CMDN). The technique was found to be capable of detecting and differentiating Mycobacterium tuberculosis and Mycobacterium bovis DNA from elephant trunk wash and nasal drip samples. Preliminary genetic sequencing confirmed potential for future application for identification of drug resistance. Despite multiple limitations in relation to study protocol, field sampling and in-country laboratory and technical capabilities, it was demonstrated that the PCR-RFLP technique is practical, accessible and relevant to developing Asian elephant range countries such as Nepal, and provides a potentially valuable addition to the current array of diagnostic options. The findings and limitations of this research were collated to provide recommendations for future research and improved management strategies, to minimise the impact of tuberculosis on the wild and captive populations of this endangered species.

References


Preliminary Recordings of Wild Asian Elephant (Elephas Maximus) Vocalizations in Preparation for Playback Experiments

Michael A. Pardo1*, Shermin de Silva, PhD2,3
1Department of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853 USA, map385@cornell.edu
2Department of Fish, Wildlife, & Conservation Biology, Colorado State University, Fort Collins, CO 80523 USA
3Trunks and Leaves, Inc., 157 Summer Street, No. 10F, Somerville, MA 02143 USA

Communication complexity is thought to increase with social complexity. Asian elephants live in a fission-fusion society and form multiple long-term social relationships, suggesting that their communication system may be particularly complex. They produce at least fourteen distinct call types1, but the meanings of these calls have never been experimentally determined. Growls (a type of low-frequency harmonic call) are individually distinct, but also highly variable within a given individual1. However, it is not known whether there are different structural or functional categories of growls. Combination calls are composed of a broadband segment immediately followed by a low-frequency harmonic segment1. Anecdotal reports suggest that elephants may respond more to combination calls than to low-frequency calls alone. The broadband segment may help call attention to the information contained in the low-frequency segment. Alternatively, the low-frequency segment may allow individual identity to be assigned to a broadband call. In December 2012 and January 2013, we recorded fifty-three calls from wild Asian elephants in Uda Walawe National Park, Sri Lanka, and categorized the vocalizations into basic call types according to de Silva1 by visual inspection of the spectrograms. Thirty-one calls were low-frequency signals with clear harmonics (growls and rumbles), eleven were broadband signals with no clear harmonics (barks, roars, and longroars), and five were combination calls (bark-ropbles). The remainder of the calls consisted of higher frequency sounds (trumpets and squeaks). We will record additional calls and pool our recordings with a pre-existing call library recorded by the Uda Walawe Elephant Research Project. We will then use cluster and discriminant function analysis to determine if growls can be subdivided into discreet structural categories. If structural categories exist, we will use playback experiments to test whether they correspond to functional categories. We will also use playback experiments to test multiple hypotheses for the function of combination calls.
ACKNOWLEDGMENTS
We are deeply grateful to the staff of the Uda Walawe Elephant Research Project, without whom this research would not be possible. We also thank the Sri Lankan Department of Wildlife Conservation for permission to work in Uda Walawe National Park. This project was funded by grants from the Cornell University Graduate School and the Athena Fund of the Cornell Lab of Ornithology.

LITERATURE CITED

Confirmation of the First Case of Endotheliotrophic Elephant Herpes Virus (EEHV) Infection in Nepal Using a Real-Time Quantitative PCR Assay and DNA Sequence Analysis
Suraj Subedi¹, Corissa Miller², Dibesh Karmacharya³ and Sulochana Manandhar³
¹National Trust for Nature Conservation (NTNC), Sauraha, Nepal; ²Ecotone Wildlife Veterinary Services, Australia; ³ Center for Molecular Dynamics Nepal (CMDN), Kathmandu, Nepal

Elephant endotheliotropic herpes virus (EEHV) presents a growing threat to the health and conservation of both captive and wild endangered Asian elephant populations worldwide (Cracknell 2008). In the acute form the disease is characterized by a sudden onset of lethargy, oedema of the head, proboscis and limbs, oral ulcers, and diffuse internal haemorrhaging (Garner et al 2009; Miller and Fowler 2012). In acute cases, death often results within one week following the onset of symptoms, and few cases have survived with intensive treatment (Hayward 2012). There is currently limited knowledge of the prevalence of EEHV in Nepal, a country with both captive and wild Asian elephant populations. However, since 2008, four elephant calves have succumbed to unconfirmed but presumed herpes virus infections (Gairhe 2012). Findings from a study of the Chitwan National Park (CNP) elephant breeding center in mid-2012 suggest the presence of latent EEHV infections in a number of adults within the breeding herd, although PCR and sequencing results were inconclusive (Kaufman et al, unpublished). In December 2012 a juvenile female elephant from the CNP breeding herd presented with ante-mortem and post-mortem changes characteristic of acute EEHV. Conjunctival swabs and heart, liver, kidney and blood samples were collected by the National Trust for Nature Conservation (NTNC) and analysed at the Center for Molecular Dynamics Nepal (CMDN). Samples were analysed using a validated real-time quantitative PCR assay (Hardman et al 2010; Latimer et al 2011), and all samples confirmed to be positive for EEHV. Using DNA sequencing and viral gene sub-typing analysis (Stanton et al 2010; Stanton et al 2012, in review) all samples were subsequently identified as subtype EEHV1A. These results mark the first PCR-confirmed case of EEHV infection in Nepal, and demonstrate the presence of EEHV in the CNP captive elephant population. Such findings support the hypothesis that latently infected individuals reside within the CNP breeding herd, and highlight the urgent need for adaptive management to minimise morbidity and mortality. Further research into EEHV prevalence, epidemiology and dynamics in Nepal are recommended in order to mitigate the impact of this disease on both captive and wild Asian elephant populations.

References


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Baby Steps
Kathy Suthard and Diane Hagey
*Pittsburgh Zoo & PPG Aquarium*

The Rhino Keepers Association
Jane Kennedy
*San Diego Global*

Education Outreach Materials from USFWS and Asian Elephant Conservation Fund
Mini Nagendran
Asian Elephant Conservation Fund and U.S. Fish and wildlife Service
Allomothering among Captive African Elephants
Laura Beer, Heather R. Bates, Robert H. I. Dale
Butler University, Indianapolis, IN, USA

Abstract
We observed four elephants in a large outdoor exhibit at the Indianapolis Zoo (see diagram) over three sessions for a total of minutes. During each session, a female calf, Nyah (3 months), her mother, Ivory (30 years), her sister, Zahara (6 years) and the group’s “matriarch”, Sophi (44 years – the oldest, largest elephant), were present. We counted the number of times that Nyah was within one adult body length of another elephant (about 3m), which elephant initiated the interaction, and the duration of each interaction. Of course, it was possible for Nyah to be near more than one elephant at the same time.

Introduction
It is clear that allomothering (Lee, 1987) is common among African elephants. It is less clear which elephant initiates or terminates contact in an allomothering interaction, or how allomothering is distributed within a group of captive elephants. This study addresses these two questions.

Results
We observed a 3-month-old African elephant calf in the main exhibit at the Indianapolis Zoo. The exhibit was over one acre (0.5 hectares) in size. Nyah was always together with her mother, Ivory, her sister, Zahara and the group’s “matriarch” (oldest, largest elephant), Sophi. We analyzed digital videotape of three sessions frame by frame in order to determine Nyah’s location relative to those of each of the other three animals. We defined proximity as Nyah being within one adult body length of another animal (about 3m). Statistics analyses used the Chi-square statistic.

Nyah: Interaction Times (s)

<table>
<thead>
<tr>
<th>Status</th>
<th>Duration(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not visible</td>
<td>84</td>
</tr>
<tr>
<td>Alone</td>
<td>1372</td>
</tr>
<tr>
<td>I</td>
<td>538</td>
</tr>
<tr>
<td>S</td>
<td>952</td>
</tr>
<tr>
<td>Z</td>
<td>805</td>
</tr>
<tr>
<td>IS</td>
<td>464</td>
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<td>ISZ</td>
<td>260</td>
</tr>
<tr>
<td>Total</td>
<td>5752</td>
</tr>
</tbody>
</table>

Nyah: Time with each elephant

<table>
<thead>
<tr>
<th>Nyah Status</th>
<th>Time(s)</th>
<th>P(Visible time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>1372</td>
<td>0.24</td>
</tr>
<tr>
<td>With Ivory</td>
<td>1549</td>
<td>0.27</td>
</tr>
<tr>
<td>With Sophi</td>
<td>2666</td>
<td>0.47</td>
</tr>
<tr>
<td>With Zahara</td>
<td>2343</td>
<td>0.41</td>
</tr>
<tr>
<td>Visible</td>
<td>5668</td>
<td></td>
</tr>
</tbody>
</table>

Nyah spent about one quarter of her time either alone or with her mother, and nearly half of her time near her sister or the matriarch of the group. She spent a majority of her time near two or more of the other elephant. This is what we had expected to happen based on previous data from other locations.

Each elephant initiated contacts with Nyah at about the same frequency with which it terminated contacts with her. However, Nyah interacted differently with each of the other elephants. She had more separate contacts with Zahara than with either of the other elephants, reflecting the higher activity levels of the two calves, $\chi^2 (1) = 7.1, p < 0.01$ [Zahara vs. the other two elephants combined].

Nyah was more likely to initiate contacts with Ivory and Sophi than vice versa, $p < 0.01$ in each case. Sophi, in particular, rarely initiated contacts with Nyah. On the other hand, Zahara was more likely to initiate contacts with Nyah, than vice versa, $p < 0.001$.

It appears that Nyah sought out Ivory and, especially, Sophi, whereas Zahara was more likely to seek out Nyah.

References
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