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Journal of the Asian Elephant Specialist Group



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The journal is intended as a medium of communication on issues that concern the management and conservation of Asian elephants (*Elephas maximus*) both in the wild and in captivity. It is a means by which members of the AsESG and others can communicate their experiences, ideas and perceptions freely, so that the conservation of Asian elephants can benefit. All articles published in *Gajah* reflect the individual views of the authors and not necessarily that of the editorial board or the AsESG.

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Editorial Note

Gajah now comes to you in a slightly modified format. We encourage you to write in with comments or opinions regarding articles published in *Gajah*, These comments and opinions will hereafter be published in a separate section as 'Correspondence'.

Gajah will be published as both a hard copy and an on-line version accessible from the AsESG web site. If you would like to be informed when a new issue comes out, please provide your e-mail address. If you would like to have a hard copy, please send a request with your name and postal address by e-mail to <romalijj@eureka.lk> or to:

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Cover: Wild elephants crossing a highway in China
Photo by IFAW

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Editorial

Jayantha Jayewardene

The Asian Elephant Specialist Group stands out as an icon of the commitment of scientists, governments and civil-society entities to saving the Asian elephant throughout its range states. It is also committed to the conservation of Asian elephants in zoos and with private owners. Yet there is an overwhelming public perception that elephants are fast disappearing, and that the advice of scientists is not being heeded. Is our commitment actually working towards conserving these elephants?

As the focal point for advocacy on Asian elephant conservation plans and actions, there is no gainsaying that the AsESG has been less than effective, given the enormous task it has at hand. In the last six years or so the group has met only once or twice. Communication to members by way of newsletters, e-mails etc also have been minimal. The AsESG has amongst its members conservationists, researchers, scientists, managers, policy makers and amateur enthusiasts who are all interested in making an effort to conserve the Asian elephant. It is essential that the group gives leadership and support to the activities of these people and also makes information available to others.

The AsESG needs to have a programme of work, and such a programme needs to be developed through consultation with the membership, especially with those directly concerned with elephant conservation in each of the range states. There should be an annual plan and strategy, which should also address the issue of finances necessary for implementation. These plans should be prioritized so that funds, if not available in full, could be utilized for the more important actions. It would be interesting to know what the IUCN's budget for the AsESG is. If there are no funds coming in to the AsESG from the IUCN, it risks transforming the Group into little more than a talk shop: some clarity is needed on the role of the AsESG and its relevance within the IUCN family.

When assessed, the actual accomplishment of the AsESG in the last five or six years has been minimal. The group met last in 2000. Each country was supposed to formulate an elephant conservation plan but this has not happened. In Sri Lanka, for example, neither the AsESG nor its members, in that capacity, have been influential in the debate on, for example, the efficacy of electric fences, the definition of range areas, the usefulness of elephant drives, the conservation utility of privately-owned elephants and the *ex situ* population. The public has a right to ask whether the AsESG exists purely to enable its members to wear a colourful badge that awards them a degree of self-importance in the international conservation bureaucracy.

The recent effort to merge *Gajah* with *Pachyderm*, the Journal of the African Elephant Specialist Group, clearly showed the insensitivity of some to real elephant conservation. It showed that though they thought they are in a position to try and dictate terms, they did not really understand the role *Gajah* plays and could play in the future. It also seemed that they did not understand the Asian way of thinking. It took a protracted and sometimes heated e-mail debate to concur to *Gajah* retaining its identity.

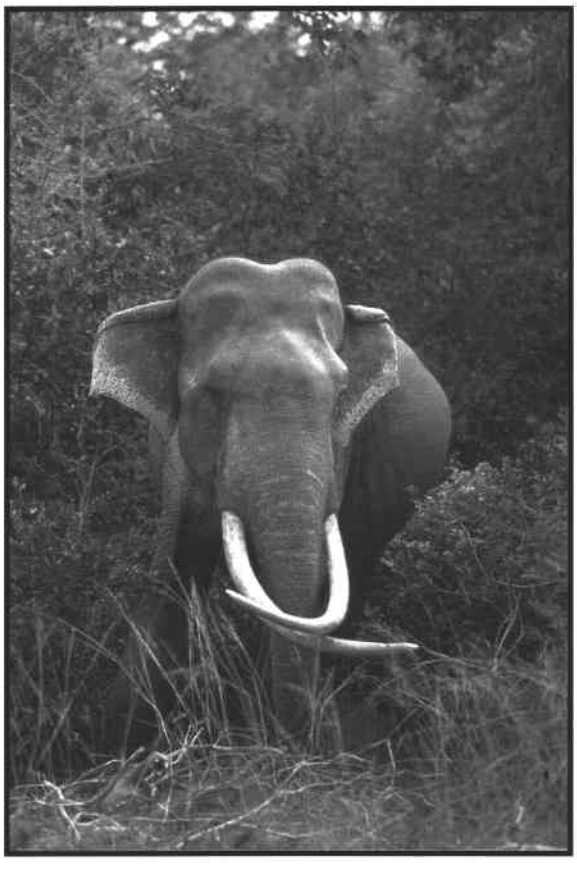
The debate that ensued in the e-mail network on the merits and demerits of continuing with *Gajah* also showed that little seems to have been transferred, in terms of capacity, to local conservationists in most of the range states by those who are carrying out various projects there, especially by some of those who continue to live there. Some wanted *Gajah* to be a peer reviewed journal so that their publications would have scientific credibility. While the quality of publication is undoubtedly important, others wondered how this would

help elephant conservation or strengthen the efforts of conservationists.

Many symposia, workshops, seminars and the like are held regularly, but what have they really achieved in terms of improving the prospects for survival of Asian elephants in each of the range states? Books are written, published and sold, but what effects have these on elephant conservation? Most of these books, in terms of costs, are out of reach of the conservationists working in the field. Of course, books by persons like Raman Sukumar, Richard Lair, Mike Schmidt, Susan Mikota *et al.*, have helped inform elephant conservationists, but much of the literature is purely academic and has little relevance to on-ground actions.

The members of the AsESG itself are not privy to the plans or annual budget of the AsESG, if there indeed is such a plan and budget. It is difficult to escape the conclusion that there is a lack of transparency. In fact, the editor had to solicit funds for the publication of *Gajah*.

My intention is to help make *Gajah* a journal that would encourage those who wish to contribute their knowledge and experience to help the prospects of survival of the Asian elephant, rather than using it as a vehicle for personal academic advancement or for notching up 'publications'. There are, at the moment, many journals, which can accommodate scientific papers on elephant conservation. *Gajah* need not be merely another one of these. Instead, *Gajah* should be a means by which the members of the AsESG and others can communicate their experiences, ideas and perceptions freely, so that the others who are interested in and are committed to the conservation of the Asian elephant, can benefit, bearing in mind that the ultimate beneficiary must not be any one of us, but the Asian elephant.



Cross-tusker of Kumana, Sri Lanka, killed by a homeguard in January 2007
Photo by Palitha Antony

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Tsunami and Elephant "Sixth Sense" in Sri Lanka

Prithiviraj Fernando

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Introduction

Soon after the Asian tsunami on the 26th of December 2004, there were many reports in the local and international press of how people had observed animals reacting in strange ways, in Sri Lanka and other locations thousands of km away from the epicenter, weeks to hours before the tsunami struck:

- http://www.sciencenewsforkids.org/articles/20050413/Feature1.asp
- http://news.nationalgeographic.com/news/2005/01/0104_050104_tsunami_animals.html
- http://news.bbc.co.uk/2/hi/south_asia/4136485.stm
- http://www.reuters.com/newsArticle.jhtml?type=scienceNews&storyID=7207207
- http://www.dawn.com/2005/01/10/int8.htm
- Sheldrake (2005)

These reports suggested the possession of a 'sixth sense' by animals both domestic and wild, which warned them of the impending tsunami and allowed them to take appropriate action to escape it. Elephants featured prominently in these claims with stories of elephants in Sri Lanka and Thailand having saved tourists (Sheldrake 2005). The ability of elephants to detect seismic vibrations and low frequency sounds was thought to provide support for such responses. A person in Yala National Park related how he observed herds of elephants running away in terror from the coastal area half an hour before the tsunami struck. A game guard in Yala related the story of how house sparrows in Okanda on the Eastern coast, had suddenly abandoned their nests two weeks before the tsunami, and that the house were the nests was destroyed by the tsunami. A party of visitors to Yala who were at the Buttuwa bungalow on the coast claimed that on the morning of the tsunami, a herd of spotted deer had climbed up the sand dune behind the bungalow and were gazing out at the sea around an hour before the tsunami struck. They were so transfixed that they did not even take any notice of the humans around. Another stated, that a person took his dogs for walks on the beach every morning, but on the fateful day, the dogs flatly refused to go out, thus saving his life. An observation that no dead animals were found in the Yala National Park soon after the tsunami similarly added credence to the 'sixth sense' story, suggesting that such pre-warning enabled them to save their lives. However, these stories when checked out proved to be either fabrications or the drawing of unjustified association between cursory observations and the tsunami.

The radio collared elephants

An unbiased observation of animal movement before and during the tsunami was that of two radio collared elephants we were tracking in the Yala National Park, South-east Sri Lanka (Wikramanayake *et al.* 2006). The two animals were fitted with GPS-satellite collars that remotely collected a GPS position every 4 hours. The recorded positions were transmitted to an overpass satellite that relayed the data back to us. Elephants have a sexually dimorphic social organization with females and young in herds and adult males being solitary. Both the collared animals we were tracking were herd animals, one a juvenile male 'Kavan' and the other an adult female 'Biso-Menike', hence their move-ments represented that of the whole herd. Both the herds numbered around 30 animals each, although the number of animals that were closely associated together at any given time varied from about four individuals, up to the full herd. As a response to an event such as a tsunami would be uniform at least across all members of a herd, the movements of the two tracked animals can be taken to represent the two herds at the least.

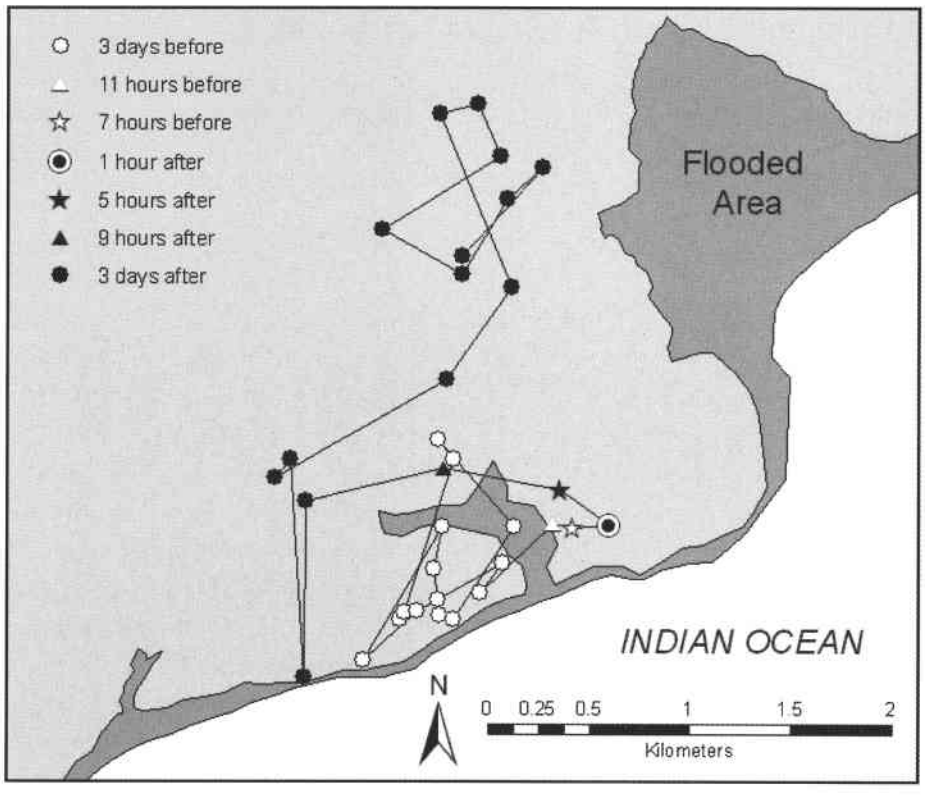


Figure 1. Map showing Biso-Menike's locations in the week of the tsunami (23rd - 29th Dec. 2004).

Analysis of the two tracked elephants' ranging patterns showed there were no abnormal movements that indicated any response to the tsunami prior to its occurrence. On the days prior to the tsunami, Biso-Menike and her herd were ranging in the coastal area close to Buttuwa and Uraniya (Fig. 1). Biso-Menike was only about 200 m from the sea at the time of the tsunami impact and even continued to range in the same area afterwards (Fig. 1). Her position at the time of the tsunami impact was close to the Uraniya lagoon, through which the tsunami incurred onto the land. The tsunami wave would have passed only a few meters away from where she and the rest of her herd were at the time. Kavan and his herd were ranging about 5-6 km inland from the coast and also did not show any response (Fig. 2). While Kavan's group was beyond the area inundated by the tsunami, a distance of 6 km from the coast would be insignificant if animals perceived, and were responding to the tsunami's genesis occurring over 1500 km away, or its approach through the ocean at hundreds of km per hour. Hence both animals and the associated herds could be expected to show the same response if indeed they were pre-warned of the tsunami.

Thus the only unbiased animal data disproves prior detection and response of animals to the tsunami. For more details see Wikramanayake *et al.* 2006.

It is interesting to analyze the possible mechanisms of a response by animals to an impending tsunami, through a scientific point of view. If animals did responded to the tsunami any time prior to its impact, they had to either perceive its genesis or approach and then respond to it in a meaningful way, i.e. flee inland from the coastal area. This could happen if either the detected event was a disturbance of sufficient magnitude to elicit a general non-specific response or if the animal identified it as a particular cue and conscious-ly or instinctively associated it with the coming of a tsunami.

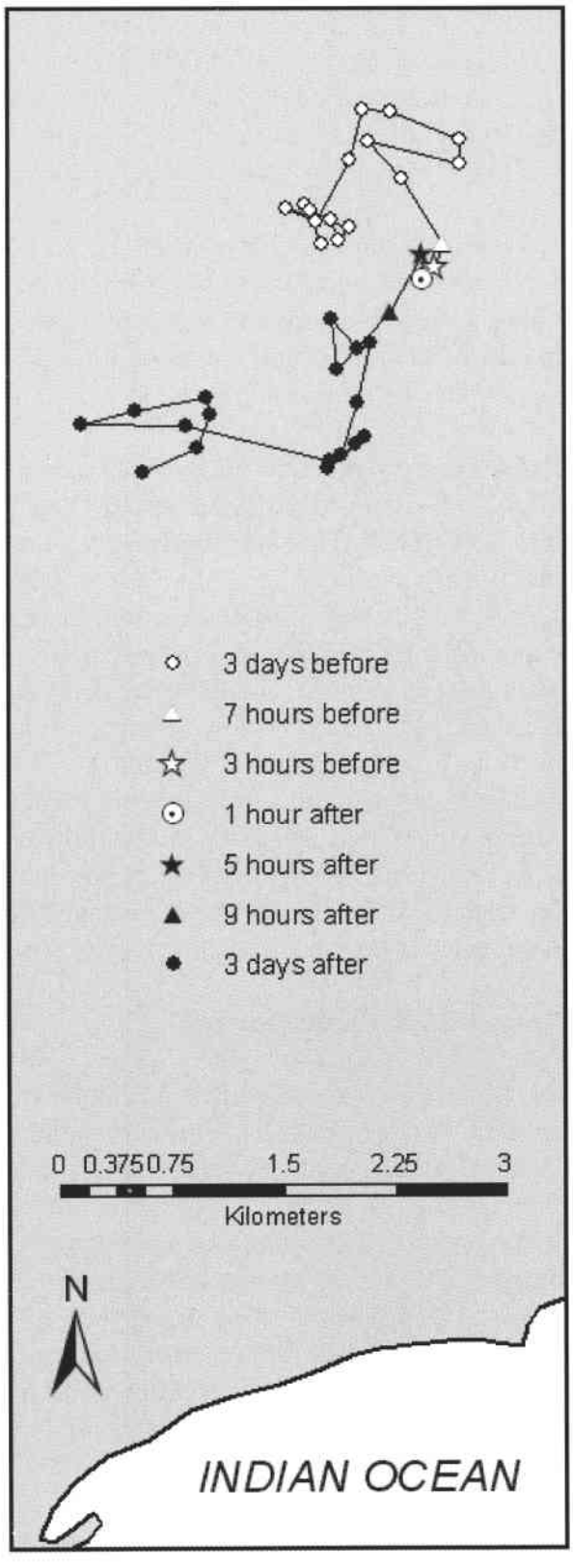


Figure 2. Map showing Kavan's locations in the week of the tsunami (23. to 29. Dec. 2004).

A general response to disturbance

The 2004 Asian tsunami was generated by a massive sub oceanic earthquake. Therefore it is possible that animals in Sri Lanka perceived a seismic signal at its genesis. However, if they responded to the seismic signal of the earthquake, every time an earthquake occurs, irrespective of whether it was sub-oceanic and would generate a tsunami or inland and not generate a tsunami, animals should flee in the opposite direction. Since Sri Lanka is an island, a strong nonspecific general response to disturbance would predict that animals on the western side should run to the coast, as the disturbance would be from the east. However, since the epicenter of the earthquake that gave rise to the tsunami was over 1500 km away from Sri Lanka, any seismic signal perceived would have been of very small magnitude. Even if detected, the disturbance would be very minor. Animals would not respond to such a minor signal with a non-specific fleeing response, as one of equal or greater magnitude would be generated by a very much smaller tremor that occurred at a lesser distance, or any number of other events such as something impacting the ground, an explosion, or even a thunder clap.

The approaching tsunami while it was travelling through the deep ocean would not provide a sufficient disturbance to elicit a non-specific response as the tsunami is just another wave, only a meter or so in height in mid ocean. Therefore, it is unlikely that animals could have perceived the earthquake or the tsunami any significant time before its impact, or if they did, would have responded to it as a non-specific general response to disturbance, other than maybe to prick up their ears.

A specific response

Recognition of the disturbance as an event that portends a tsunami suggests that animals associated the detected disturbance, however minor, with the subsequent arrival of a tsunami. Such association would have to be through personal experience or through 'instinct'.

Response based on previous personal experience by individual animals is not possible in Sri Lanka, as when compared to the lifetime of animals, tsunamis occur extremely rarely in this part of the world. Consequently, no animal living in Sri Lanka at the time of the tsunami could have previously experienced such an event. In fact the enormous human death toll bears stark evidence to the rarity of tsunamis. Tsunamis did not feature in the collective human consciousness in this part of the world, even though we have a collective 'memory' that goes back thousands of years through our written records. A possible reference to a tsunami in ancient Sri Lankan literature is that of the story of the 'sea coming ashore', in Kelaniya (western coast) during the reign of king Kelanitissa many centuries ago. The only other recorded tsunami event in recent history was the one generated by the cataclysmic explosion of Krakatoa in 1883, which took the life of a single person in Hambantota on the south-eastern coast (Winchester 2003). Thus, for any animal to have responded to the tsunami of 2004 through personal experience, it had to be well over 121 years old.

Could the reaction to the perceived cue be instinctive, or genetically inherited? Many behaviors have genetic components. However, for any behavior to have a genetic component or be 'inherited', it needs to be selected for. Such selection could occur if it impacted an entire population or a fragment of the population frequently. Now when a tsunami occurs, if the animals that ran away by detecting the tsunami were the only ones of the species that survived the tsunami, then the tsunami would exert a strong selective pressure on the ability of animals to detect it and run away in time. If so, even if a tsunami happened every few thousand years or generations, only the ones that would run away would survive from the whole species every time. Therefore a tsunami would exert a strong selective force and would select for animals that have such a 'tsunami sense'. On the other hand, if the tsunami impacted only a fragment of the species or population, the animals that ran away would survive, but so would a large number of individuals that did not run away but were beyond the reach of the tsunami. In re-colonizing the area impacted by the tsunami, the ones that ran away would have to compete with the ones that did not show that behavior but survived because they were out of reach of the tsunami. If tsunamis occurred very frequently, each time it would select the ones that ran away. Hence depending on the area and frequency of impact, over a period of time tsunamis could again select for that behavior.

However, if tsunamis impacted only a small fragment of the population *and* occurred very rarely, which is the case in relation to Sri Lanka, the selective force would be so small that it would have no effect.

Extensive surveys conducted by us (Fernando *et al.* 2006) showed that the tsunami impact was very localized and patchy. The extent of the tsunami impact on land, in relation to the species distribution of most terrestrial fauna, especially in relation to groups such as mammals, was minute. Therefore, tsunamis do not have an impact on most animals, of an intensity, extent, or frequency, required to exert a selective pressure. In essence, tsunami impact on terrestrial fauna is that of a low magnitude rare event, hence of little evolutionary potential for selection of a behavioral response such as running away in response to its pre-detection.

Animal deaths in the tsunami

Our surveys also showed that a number of animals that did perish from the tsunami included buffalo, wild boar, hare, a python etc. (Fernando *et al.* 2006). While the numbers were very small when compared to the massive human toll, it can be explained without invoking sixth senses or instincts. Firstly, the number of animals and especially large mammals, in the coastal area at any point in time is insignificant compared to the number of humans in similar areas, a comparison of just a few animals to millions of people. The highest threat from the tsunami was to those that were on the beach at tsunami impact. However, unlike humans, one very rarely finds any large animals on the beach itself, especially during daytime. For example, seeing an elephant on the beach is an exceedingly rare sight. Therefore, the possibility of a large

animal getting caught in a tsunami is very remote.

The tsunami impact was very patchy and incursion of the tsunami occurred mainly through breaks in the coastal sand dunes such as lagoon and river outlets and low-lying areas. Therefore, even animals that were in the coastal zone but just outside the area of incursion were perfectly safe, as was the case with Biso-Menike. In contrast to its approach through the ocean, the tsunami wave impacting the shore and advancing through the lagoons and fringe forests would create an enormous disturbance and every animal would instantly react to it and try to get out of the way. As most animals depend on their speed and reactions to escape from hunters or to hunt themselves, practically any wild animal would respond to such an event far better than any human could. Therefore, even if everything else was equal, fewer animals would be caught in a tsunami than humans.

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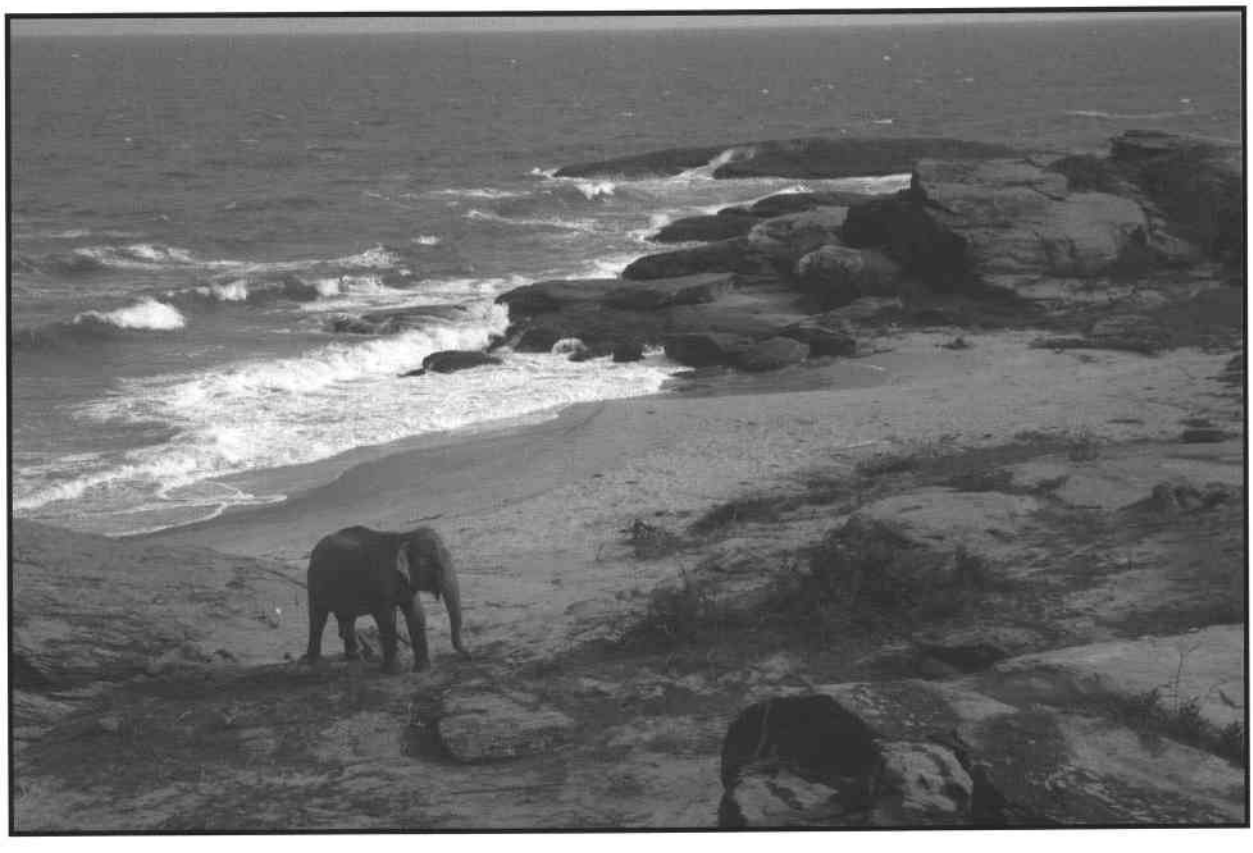
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A rare sight - elephant on the beach in Yala National Park, Sri Lanka
Photo by Jennifer Pastorini

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Some Practical Guidelines for Users of the ARGOS Satellite-Telemetry System

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Abstract

The Argos location and data collection system has been used widely in wildlife research though many workers have identified problems with it, particularly its lack of precision. The Indochina Elephant Programme (Fauna & Flora International) and the Cambodian Forestry Administration undertook a satellite telemetry project in Cambodia, which ended prematurely due to an apparent failure in the system. The transmitter was recovered and several methods used to determine when the system failed as well as to calculate error estimates for the PTT-derived data. It was discovered that the collar had become static only five months into the study and that LC 3 provided the most reliable locations, followed by LCs A & 2. Users of the Argos system are strongly advised to make their own error estimates and although these tests use ad hoc data, modification to suit pre-deployment tests would be straight-forward.

Introduction

The study of animal movements through satellite telemetry has played an increasingly important role in conservation biology over the past couple of decades. One of the most widely used, the Argos location and data collection system, is operated and managed by Collecte, Localisation, Satellites (CLS). This system utilizes dedicated receivers placed on-board several polar-orbiting satellites, which collect and analyse signals (up-links) from Platform Terminal Transmitters (PTTs). This data is then relayed to processing centers, in France and America, where the PTT's location during the initial up-link, is calculated. This final calculation is based on the change in frequency of the original signal as the satellite passed overhead; the Doppler shift effect. The result is sent to the system user in the form of a lat/long location in decimal degrees. Each location is classified into one of seven Location Classes (LC) four of which (LCs 0-3) give an estimation of the locations accuracy (Table 1).

Table 1. CLS error estimates.

Location Class	Accuracy
3	< 150m
2	150 m accuracy < 350 m
1	350 m accuracy < 1000 m
0	> 1000m
A	No estimate of accuracy
B	No estimate of accuracy
Z	Invalid location

The performance of the system depends on several factors that affect both the transmitter (e.g. altitude, latitude, topography and oscill-ator stability) and the on-board receiver (e.g. geometrics, number of messages and their dis-tribution in time). Any combination of these factors acting upon the system means that its overall performance can vary both within and between studies (Keating *et al.* 1991).

Operational since the 1970's the system has been used widely in wildlife research and has been increasingly applied to the study of both African (Lindeque & Lindeque 1991; Tchamba *et al.* 1995; Verlinden & Gavor 1998; DeBoer *et al.* 2000) and Asian elephants (Stuwe *et al.* 1998; Goldthorpe & Heffernan in press). Although the use of the system has resulted in a plethora of information, many workers have identified problems with it including locational inaccuracy (Hillman-

Smith *et al.* 1995; Stuwe *et al.* 1998; Verlinden & Gavor 1998; Hays *et al.* 2001; Minton *et al.* 2003), sporadic signal reception (Stuwe *et al.* 1998), failing batteries (Tchamba *et al.* 1995; Dietz *et al.* 2003) and unexplained PTT failure (Stuwe *et al.* 1998; Verlinden & Gavor 1998). Despite this the system continues to be used and improve-ments made (Gillespie 2001; Mech & Barber 2002).

The issue of locational accuracy has provided perhaps the most attention from workers possibly because it is not caused by a function in the equipment but is rather a conglomerate of several technical and environmental considerations that cannot, themselves, be corrected. As a result, users are advised to calculate their own error estimates (Hays *et al.* 2001) several examples of which exist in the literature (Fancy *et al.* 1989; Keating *et al.* 1991; Keating 1994; Minton *et al.* 2003).

Fauna & Flora International (FFI), in collaboration with the Cambodian Forestry Administration, undertook a satellite telemetry project in the Cambodian province of Mondulkiri to map the home range and habitat features of resident Asian elephants. A male adult elephant was successfully collared and tracked for 113 days using a KiwiSat 101 PTT programmed with a 3/9 hour Duty Cycle (Goldthorpe & Heffernan in prep.). Around seven months into the study it became apparent that the transmitter was static, and the study was ended prematurely. As the PTT was still transmitting it was recovered and attempts made to determine, as closely as possible, the point of failure so that a usable data-set could be extracted for analysis. The opportunity to calculate independent accuracy, or error, estimates from the data received was also taken.

During the study period it was also discovered that the calculations made by CLS result in a location that is rounded to the nearest three decimal points (Fabienne Vigier pers. com.). When viewed in the ArcView Geographic Information System (GIS) this coarse resolution results in the ordering of points into a grid which can severely bias calculations made in some of the GIS home range analysis functions (Phillip Hooge pers. com.). Despite this, the problem of rounding has not, to the author's knowledge, been dealt with in the literature elsewhere; an oversight made even more mystifying when considering the ease with which it can be accounted for.

This paper details methods, used to overcome these problems so that future users of the PTT system can easily identify and deal with them as they occur.

Methods

Identifying time of collar failure

The time at which the transmitter became detached from the elephant was not immediately apparent. Unlike radio-telemetry, where a static transmitter is relatively easily identified by a series of near-identical signals (Kenward 2001) satellite-derived locations can still appear spread over a relatively large area due to their inherent inaccuracy (Dan Kelly, pers. comm. & personal observation). To increase the likelihood of identifying the correct time of detachment, several methods were applied with a focus on high-quality locations. All analysis was carried out on LC data-sets separately.

Method 1: Calculating distances between the point of recovery and each received location

With the position of the static transmitter known, it was possible to calculate the distance between each PTT-derived location and the point of transmitter recovery in excel using the formula:

$$\sqrt{\left((X_{Known} - X_{Received})^2\right) + \left((Y_{Known} - Y_{Received})^2\right)}$$

Average distances for each calendar month were then calculated and a visual comparison made by way of a standard bar chart. It was assumed that the time of detachment would be shown as a clear and consistent reduction in the distances between the point of recovery and the PTT-derived locations.

Method 2: Calculating distances between cumulative locations

Distances between successive PTT-derived locations were calculated, using the ArcView extension "Path, with Distances and Bearings" (Jenness 2003) and averaged for each month. Again, results were displayed in the form of a standard bar chart for visual inspection and the point of detachment associated with a clear and consistent reduction in successive distances.

Method 3: Overlaying ArcView accuracy buffers

Each LC data-set was further categorized by month and plotted in ArcView along with the known location. Around the latter, buffers based on the error estimates given by CLS (Table 1) were created using the "Create Buffers" function. Through the systematic removal of each month's data it was possible to see at what point the majority of remaining locations occurred within the relevant buffers. This would represent the point at which the transmitter became static.

Calculating error estimates

All data collected from the active PTT between the time identified as the point of detachment and the day the PTT was recovered was considered as originating from the same geographical point. This point had been recorded on a hand-held Garmin GPS unit giving a reliable (± 10 m) UTM (WGS 84) for the PTTs' true location.

These data were transferred into an excel workbook and grouped according to their LC. The distance (meters) between each received location and the transmitters true location was then calculated using the formula:

$$\sqrt{\left((X_{PTT} - X_{GPS})^2\right) + \left((Y_{PTT} - Y_{GPS})^2\right)}$$

Standard deviation (n-1) and 95% Confidence Intervals were also calculated to provide a statistical measure of reliability (Dytham 1999). The presence of large intervals in some of the data-sets indicated the presence of outliers and box-plots were constructed, using the SPSS "Explorative Statistics" function, to identify these values. The PTT-receiver tele-metry system is affected by external factors such as the relative movements of the satellite and the PTT or even the level of cloud or canopy cover between the two. These, in turn, can influence the data-processing carried out by the on-board receiver which itself relies on the quality of up-links. Transmissions calculated on the boundary of the systems acceptance parameters can, then, result in erroneous locations (Keating 1994) the presence of which will skew results when averages are involved (Dytham 1999).

Rounding of decimal degree locations

Finally, in order to overcome problems that can be experienced by some ArcView functions through overlapping points (Philip Hooge pers. com.) the ArcView extension "Random Point Generator" (Jenness 2004) was used. This extension enables the user to generate a set of random points by moving an original point in a random direction for a random distance within a user-defined para-meter. In this case, movement distances were set according to the error estimates calculated for each LC as detailed above.

Results

Identifying time of collar failure

The results gained from each method applied to the data-set showed a severe reduction in the spread of locations occurring sometime in early August (Figs. 1-4). It was decided therefore, that all pre-August data represented actual elephant movements and could be used in subsequent home range analysis whilst that collected in and after August would be re-jected (Goldthorpe & Heffernan in prep.).

Calculating error estimates

A summary of the post-detachment data is given in Table 2. There are notable variations in the number of locations received within each LC with the total number received for LCs 0 & 1 being extremely low (these were excluded from subsequent analysis). To ensure that accuracy estimates were not affected by sample size all data-sets were equalized (Kevin Lay

pers. com.). The range shown by some of the data sets provides an initial indication of the precision of each. Even with outliers removed, the range displayed by LC B data is huge (99 – 9567 m) whilst that of LC 3 is far smaller (17 – 228 m). The range displayed by LC A is also interesting in that it was dramatically reduced, with a difference of 2400m between the two upper ranges, prior and subsequent to outlier removal. This indicates that, although LC A locations tend to be accurate they must be treated with caution due to an increased likelihood of erroneous locations when compared with both LCs 3 & 2.

The average (mean) distance between each LC's calculated location and the true location of the PTT were deemed to be the true measure of location accuracy and are given as the radius of a circle (Table 3). When imported into ArcView it is possible to translate these error estimates into buffer-zones around the known location of the PTT (Fig. 4). These were used to calculate, for each LC data-set, the percentage of points that occur within their associated zone of error by clipping each LC point theme with the relevant buffer polygon. The attribute table that ArcView produces contains only those points within the buffer and can be compared with the original table to provide a percentage of the total (Table 3) and

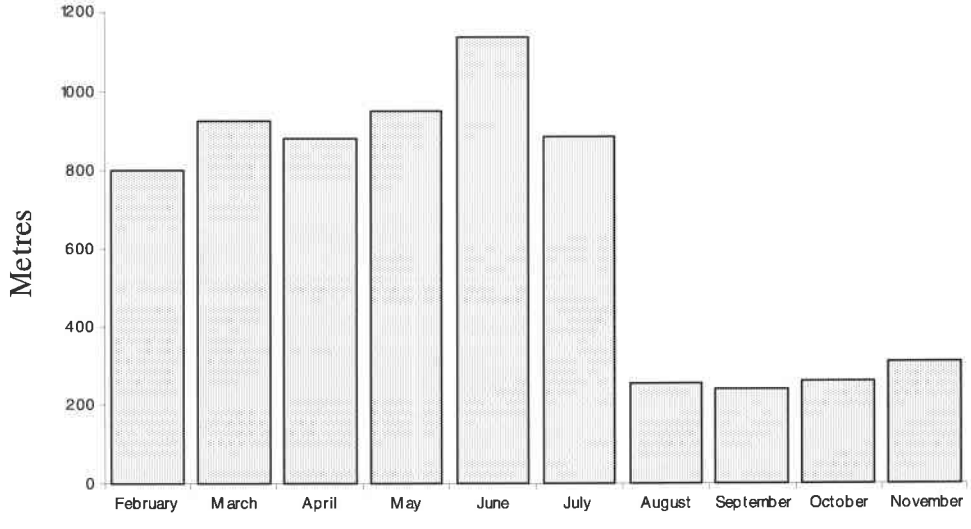


Figure 1: Average monthly distances between PTT-derived locations and recovery point

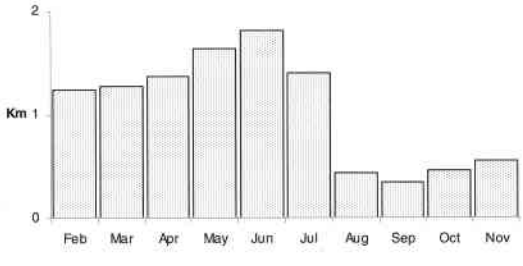


Figure 2: Average per month

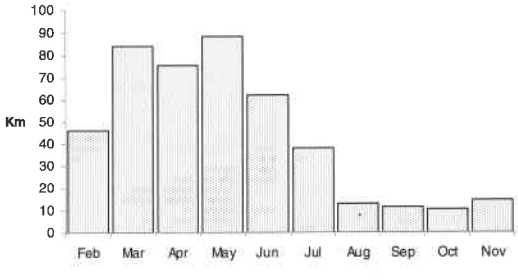


Figure 3: Distances between locations

Table 2. Summary of data received from PTT between 01/08/04 and 31/11/04.

LC	Total Received (equalized n = 8)	Minimum (m)	Maximum (m) With Outliers	Maximum (m) Without Outliers	Outliers
A	87	17	3107	707	4
B	146	99	21,933	9567	6
0	1	1976	1976	1976	0
1	2	121	581	N/A	0
2	8	121	563	N/A	0
3	18	17	228	228	1

provide an idea of the precision of each associated error estimate.

Table 3. Estimates of location class accuracies

LC	Mean (n = 8)	SD (n-1)	95% CI	Points within Buffer (%)
A	154	72	±50	72
B	1860	883	±612	64
2	269	139	±96	71
3	103	44	±30	63

Discussion

Determining time of collar failure

All analysis carried out on satellite-derived data between February and November 2004 indicate that the collar became detached in early August. All subsequent analysis carried out on the PTT-derived data included only data received between February and the 30th of July, 2004, representing around five months of telemetry data.

The large variations in sample size and range between the LCs are, most likely, a result of the way in which the satellite receives and translates the up-links from the PTT. The LC code to which each location is assigned depends, primarily, upon the number of messages received during an overpass by the satellite as well as the distribution of those messages over the time of contact (Argos 1996). For example, an LC 3 code requires at least four equally spaced messages received over a period of no less than seven minutes whilst an LC 0 requires only two messages with no time restrictions (Keating 1994). When considering the role that environmental factors, such as cloud and forest cover, will play in this process, as well as technical considerations such as the path and trajectory of the satellite in relation to the PTT, it is not surprising that "low quality" locations out-number "high-quality" locations. This, alone, is a clear enough indication that those using this system are well advised to calculate their own error estimates before deciding upon the parameters of their final analysis.

Location error estimates

Locations categorized by CLS as belonging to LC 3 proved to be the most accurate and precise of the PTT-derived locations in the current field tests, followed, in order of accuracy, by LC A and LC 2. At the opposite end of the scale, with an estimated error of nearly 2 km, LC B proved far too unreliable for inclusion in subsequent analysis. Although the precision of LC 3 data is in concordance with estimates given by CLS (Table 1) it is interesting to note that here, LC A has proven to be consistently more accurate than LC 2. Disparity between error estimates calculated by the service provider and those determined by the user has, however, been seen before (Minton *et al.* 2003) and, it is assumed, is an example of the case-specificity of the system.

According to CLS, LC A & B data are derived from too few messages (less than four) to allow for error estimates to be calculated (Argos 1996). This can lead the user to assume that they are, inherently, less accurate than those LCs (0-3) that do include an error estimate. As a result, they are often excluded from analysis in favour of LCs 3, 2 & 1 (Tchamba *et al.*

1995; Hays 2001). The results of the current study, however, show that this decision could be misguided and result in the unnecessary reduction of overall sample size possibly at the expense of reliable home range estimates (Harris *et al.* 1990). Indeed, the inclusion of LC A data in the current project led to a doubling of the sample size with home range analysis incorporating only those locations assigned, by CLS, to the Location Classes 3, 2 & A (Goldthorpe & Heffernan in prep.).

Although this test used post-detachment data, which may not always be available to workers, it would be simple to carry out similar tests using PTTs before they are deployed. However, caution should be taken in choosing a suitable area in which to activate and test the transmitter. The performance of the transmitter is affected by many factors ranging from the obvious considerations of, in forest studies, canopy cover and topography to the less obvious factors such as the height of the transmitter from the ground and the speed with which it moves during transmission periods (Sean Walls pers. com.; Colin Hunter pers. com.). For these reasons, the optimal test site would be the study site itself or, at the very least, an area where the environmental and physical conditions most closely match those of the planned study site.

Though it is important to note that the subject animal in the current study had an uncharacteristically small home range (Goldthorpe & Heffernan in prep.), there is no doubt that the ARGOS satellite telemetry system is best suited to studies of wide-ranging animals in relatively open studies. Indeed, the PTTs used by the system are most commonly associated with studying the movements of marine turtles (Kevin Lay pers. com.). For researchers wishing to work with less mobile animals living in an environment where signals may be restricted, however, it may be that a different choice of equipment is required. A good potential alternative uses the already established technology behind the Global Positioning System (GPS) as this has a capacity for a much increased precision and accuracy, over the ARGOS system. There are, of course, still issues presented by, for example, habitat type whereby an extremely dense forest will make communication between the transmitter

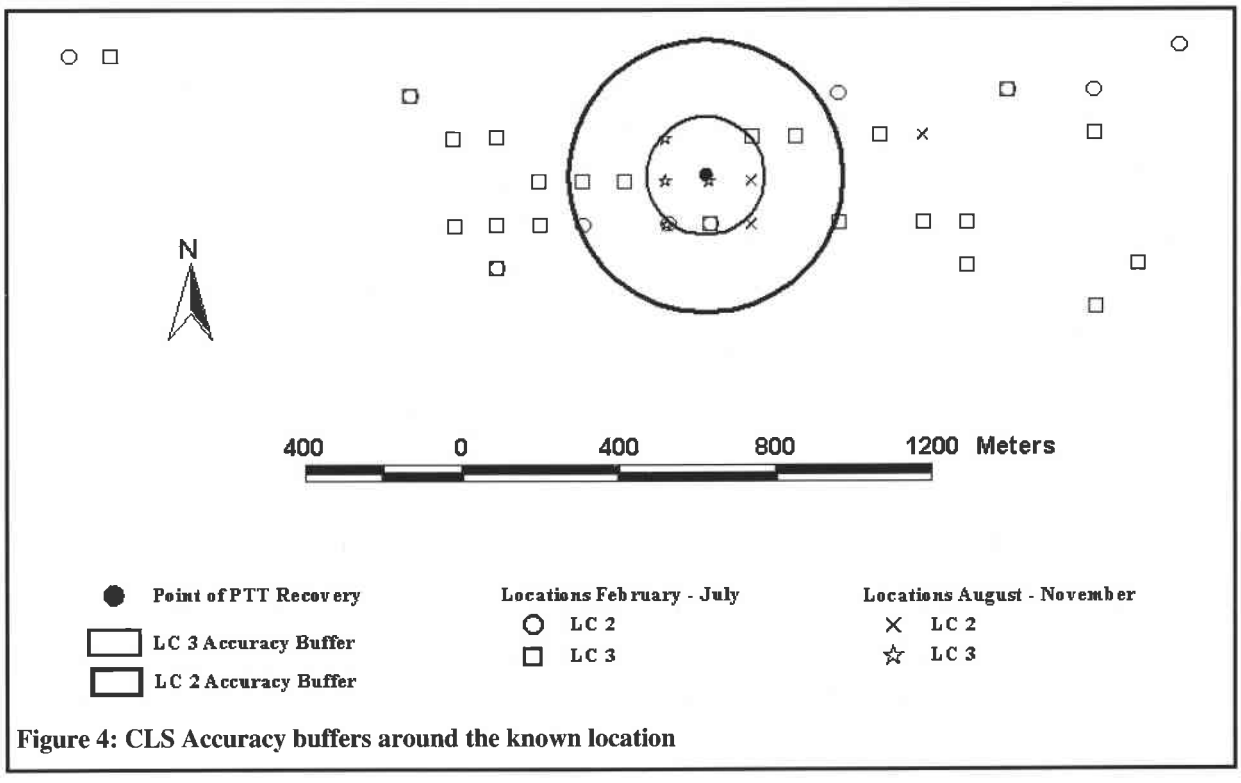


Figure 4: CLS Accuracy buffers around the known location

and receiver difficult but these are issues that are constantly being upgraded and improved.

Acknowledgements

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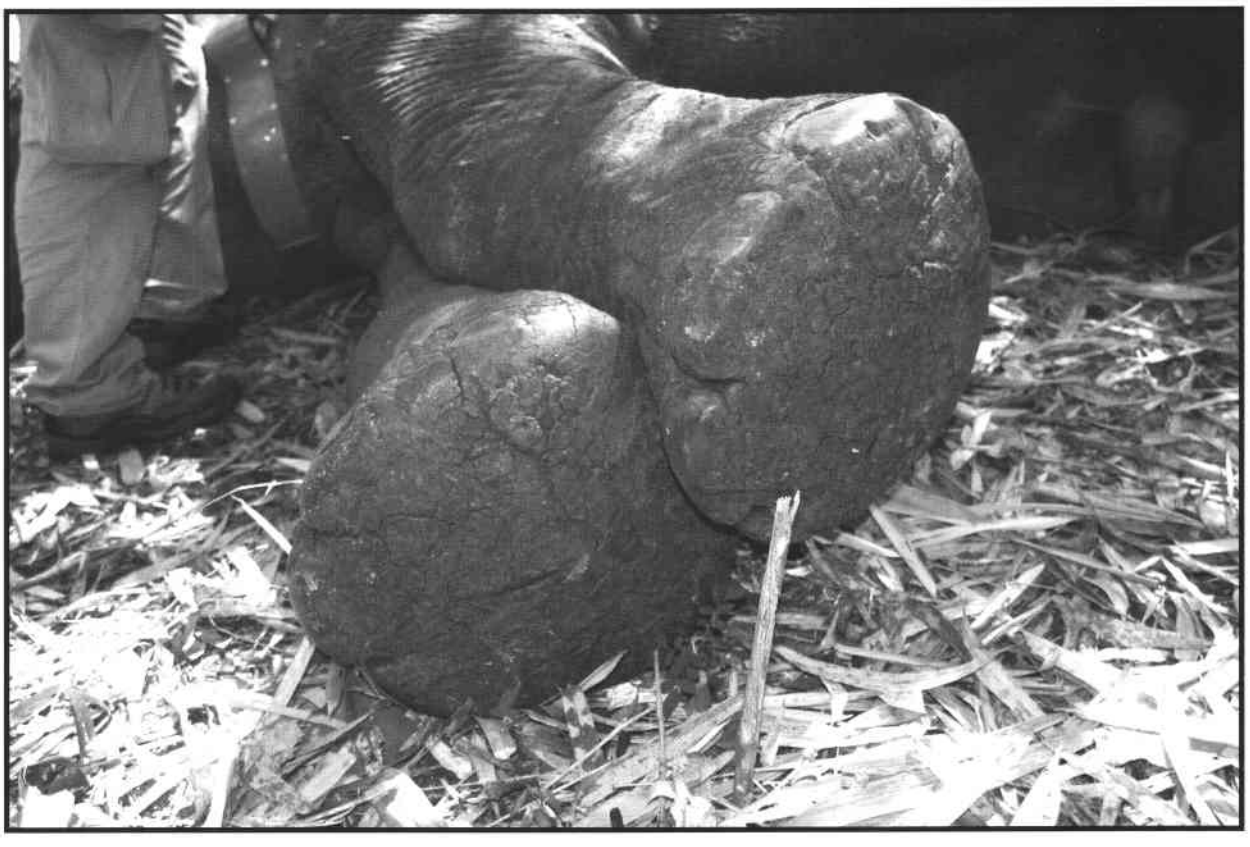
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Elephant down for collaring
Photo by Gareth Goldthorpe

Gajah 26 (2007) 16-17

Elephant Protocol in Kerala Tradition

P. M. Narayanan

India

▶ Observe the elephant, especially the face as well as the eyes and the other body languages to ensure that mood and temperament of the animal is normal and calm.

▶ Never approach the animal under the influence of alcohol or any other psychedelic drugs.

▶ Do not approach the animal until and unless the animal shows welcome response signs, which is expressed by making the grunting sound as well as by repeatedly tapping the trunk on the ground.

▶ Approach the animal only if it is in a mood of obedience showing calm temperament. This is an indication that the mahout can go close and dust the animal and start further daily routine like cleaning the tethering site etc.

▶ When oral commands are given never use percussion commands simultaneously. In other words oral commands are the preferred choice of command. The advantage of using oral commands is that mahout can make the animal obey the commands from a safe distance, and avoid the risk of approaching the animal in the morning before making sure of the mood of the animal.

▶ Avoid frequent and unnecessary use of tools (stick, hook, pole etc.). When tools are used frequently, animal gets habituated and often ignores such commands, which are critical.

▶ Commands are to be clear, audible and the voice, properly modulated and with clear syllables. Use only standard protocols of commands and restraining methods. Training contrary to that is likely to cause stress to the animal.

▶ Elephant may be approached with tools (stick & hook) or without them. This is the option of the mahout. But once an animal gets used to one protocol, the animal will become restive if mahout changes this protocol.

▶ All tools of restraint, like different types of chain must be available at all times (body chain, hobbles & cross chain). Body chain is a must when taken out of the tethering site for a walk or transport.

▶ Mahout's attitude towards the elephant should be like a parent. Elephants do accept scolding and other punishment to some extent. But if mahout is cruel with elephant he can expect the same in return.

▶ Unnecessary and cruel punishment like deprivation of food and water will make elephant aggressive towards the mahout.

▶ Good command words, with proper modulation of voice are an asset to mahout. Calling out to the animal in a loud modulated voice at the critical times can save lives.

▶ Superstitions like auspicious and inauspicious time should never be applied in a mahout's job. Every moment is important and at times very critical even.

▶ Knowledge of sensitive points is a basic requirement for every mahout. He should have basic knowledge on elephant behaviour and signs of illness.

▶ Controlling the elephant while riding it is an expert job and requires special skills. The elephant can become violent even at the slightest provocation and more so if frightened from behind.

▶ Develop observational skills. Observe the animal, standing at a distance. Note its mood, behaviour responses in different situations. Mahout should be able to read an elephant's moods and react accordingly.

▶ At the first sign of musth the elephant should be tethered. Elephant in musth should not be made to work nor subjected to punishment by depriving it of food and water.

▶ In the event of an elephant running amok the mahout should not leave the animal but handle the situation with tact and common sense.

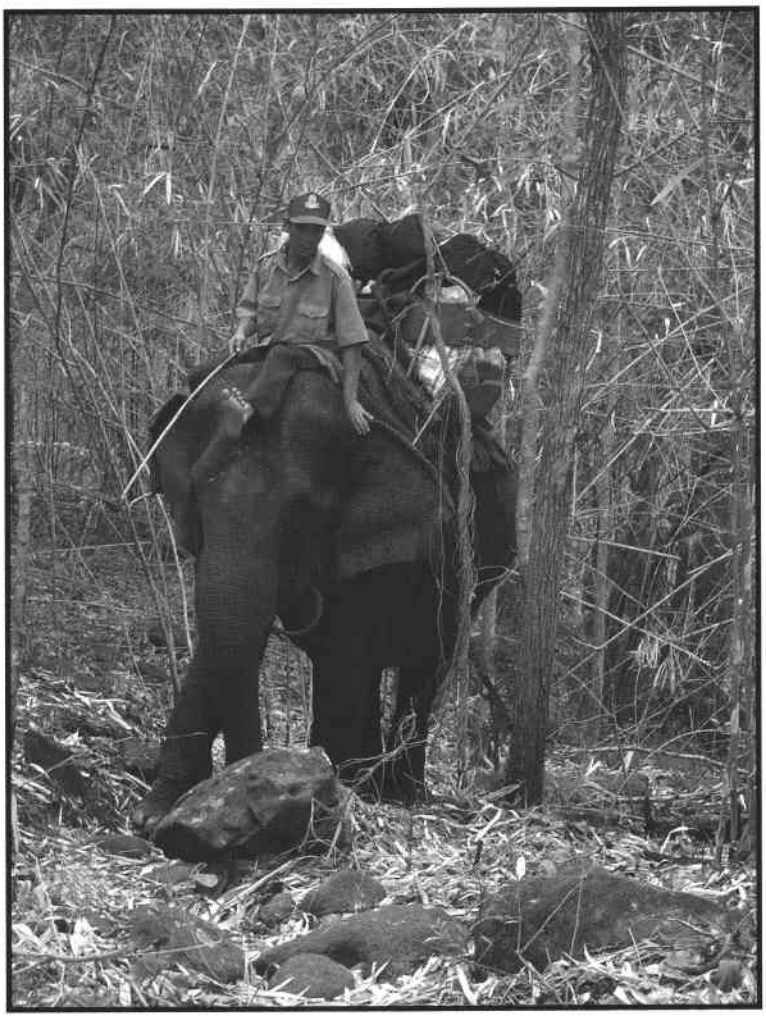
▶ You cannot change the elephant's temperament, but you can and have to change yourself for the good and lasting results.

▶ Elephant is highly adaptable and hence can be trained for different situations. But such training should be done humanely.

▶ Logging elephants and festival elephants are different and require different methods to control them. Riding ensures better control of logging elephants. For festival elephants it is better for the mahout to remain on the ground.

▶ Reinforcement of obedience protocols should be done every day. The elephant should be subjected to these protocols daily.
Exercise the elephant regularly. The best form of exercise is to walk.

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Pack elephant on the trail (Cambodia)
Photo by Gareth Goldthorpe

Gajah 26 (2007) 18-20

Human-Elephant Conflict (HEC) Pilot Study in Southern Lao PDR

Khamkhoun Khounboline

Lao PDR

Introduction

Lao People's Democratic Republic (PDR) is considered to have the most important national elephant population in Indochina with viable numbers remaining in many areas (Duckworth & Hedges 1998). However, as a result of overlapping elephant habitat and human settlements, resource use issues such as the human- elephant conflict (HEC) have emerged over the past few years and there is a strong need to improve our understanding of wild populations, habitats, and threats, and to improve the capacity of the national resource officials to manage existing elephant populations. Pressure from human activities has been found to be quite high, e.g. poaching and logging activities, which cause elephants to change their use of habitats which increases the HEC. This again results in wild elephants coming to eat and destroy villagers' crops, huts, and rice stocks and engaging in attacks.

Elephants are one of the big wildlife species, whose survival is one of the holy grails of conservation. Unfortunately, because of their size and migratory behaviour, elephants often come into conflict with people. This is especially so in areas where there is agricultural development as in Lao.

A new study from southern Lao looked at elephant problems and mitigation techniques. It found that, although the natural resource conservation awareness activities, guarding team/firecracker/noise alarm do help to mitigate conflicts between elephants and humans, they do not completely eliminate the problem and do not offer a stand alone solution.. This implies the need for an integrated approach to solve the problem of human-elephant conflict. The study was undertaken by species conservation specialist from WWF and staffs from DAFO, PAFO of Xekong Province. We also undertook training to improve villagers' understanding of government policies relevant to forestry and wildlife management, in which 595 people from 12 villages took part.

The elephant problem

The study was conducted to assess the conflict between farmers and wild elephants in four provinces of Lao. The HEC in this area has been increasing over the last eight years and is now a major social and economic issue. Since early 1975, the elephant population has been drastically reduced to the present level. This was primarily due to depletion of natural forests, which have been reduced by 50% in the last 30 years, and to the increase of the human population.

Today, the remaining elephants are confined to national Protected Areas and some forest pockets in the southern parts of Lao. However, given the elephants' food and water requirements, it is inevitable that free-ranging elephants still encroach on crop fields outside the Protected Areas. As small farmers and wild elephants compete for steadily dwindling land and water, so the conflict between them has gotten worse. Roaming elephants raid crops, damage houses and in some instances, injure or kill people. In frustration, many farmers have been killing elephants to protect themselves and their livelihoods.

Most villagers responded that habitat disturbance was the main cause of conflict rather than other activities in Phu Theung, Xekong Province. In 17 villages surveyed, 36% of people indicated that hunting and logging were large problems and caused HEC, 26% believed elephants liked to eat crops which caused HEC, while 14% believed a lack of water resources led to HEC.

Other reasons cited were the location of crop fields within the migration paths of elephants, and the occurrence of fire and other human disturbances such as logging, hunting, shooting and the collection of forest products. An unusual reason cited was that recent bamboo forests around a village had increased green cover in the area and encouraged elephants to linger there instead of quickly moving through, thus increasing crop damage and conflict.

Crop protection methods

Guarding teams have been organized to keep elephants away from farmland because traditional ways of keeping elephants out - such as shouting, lighting fires, and making loud noises are no longer effective. The techniques used were field guarding by a team using firecrackers, making noise and use of alarms, and conducting elephant population conservation awareness activities in several villages of the area. Use of alarms involved using an electric alarm system, which runs off a 12 volt battery. This method was conduced on the edge of the field, where elephants were known to visit. Elephants were expected to trigger the alarm via a trip line.

In the next few years, the project plans to extend the activity to new areas in the north where HEC is most intense.

Crop damage mitigation experiment

The effectiveness of conflict mitigation was evaluated in the Ban Chakham, Ngothong pilot area. Different field protection methods used, including guarding and use of firecrackers were studied.

For each of the methods selected for the study, information was collected both from villages that were protected and not protected by guarding teams. In addition general information from households, agricultural, and land ownership information was also gathered. Data was also collected about the damage elephants caused and how the impact had been mitigated by the guarding team. People were asked for their ideas on compensation. Details were also gathered on their opinions about their responsibility for HEC mitigation.

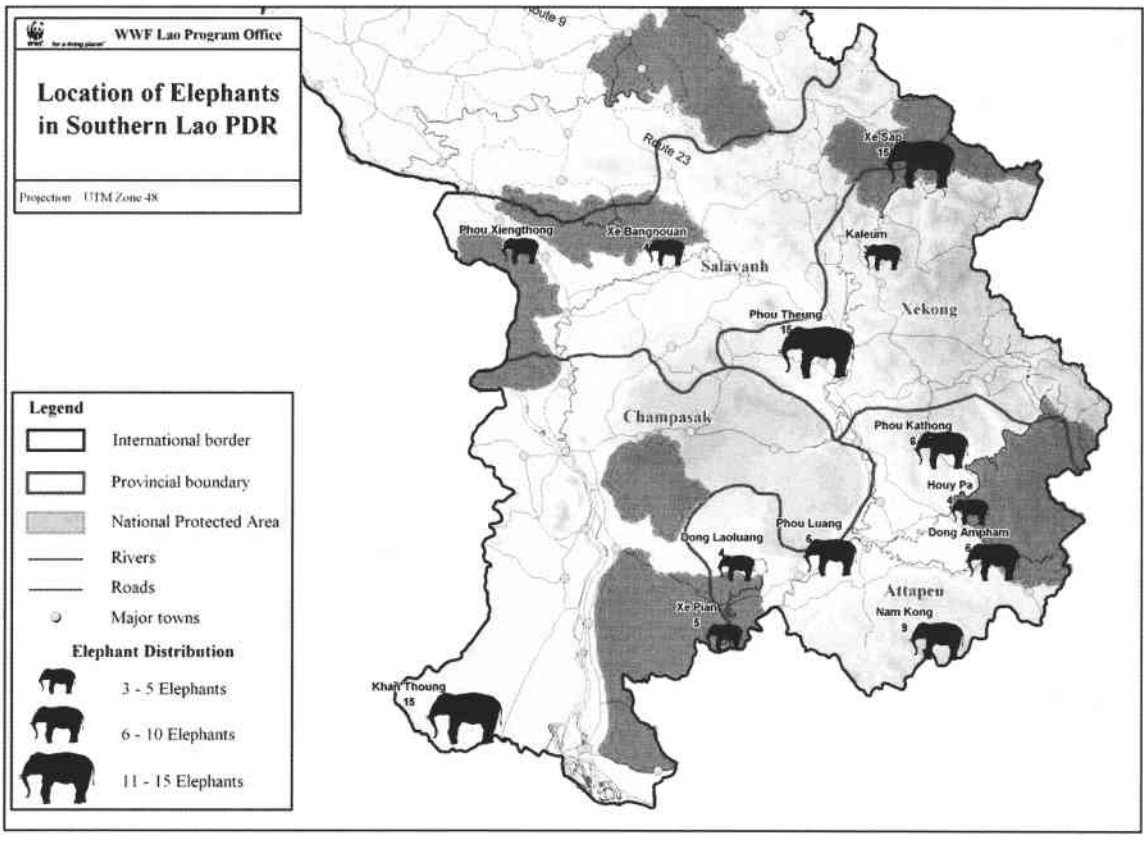
Do the methods work

Overall, it was found that, although the methods employed do help mitigate HEC, they are not capable of completely eliminating conflict. While some problems have been solved by these methods, the responsibility of farmers and local staff has been inadequate. The guarding team failures were mainly due to lack of responsibility and problems with supporting official staff. Other problems resulted from failure to take into account elephant behavior and distribution patterns.

Compensation schemes are required to be established. Important ways in which communities can help is by support to enforce laws against illegal hunters, traders and wood collectors. Another important observation was that officials sometimes were seen as part of the problem, which meant that no one was interested in solving the problem.

Making the methods more effective

According to local people, guarding teams will be more effective if combined with other mitigation measures. Among the suggestions made by them were establishing corridors between forest areas and planting fodder trees in the forest. One problem is the illegal timber fellers and hunting activities in elephant habitat.



What should be done

The findings of the study show that respon-sible local officials are needed to support activities for implementing of the HEC work. Local people should be involved in planning and implementing HEC mitigation methods and they should be supported, so that they can play a role in solving problems.

Appraisals should pay attention to present land use patterns. A successful activity plan to deal with the elephant problem must be far-reaching. And land use planning exercises need to be conducted where there is elephant habitat.

HEC mitigation experiments should continue in pilot study sites to look for other useful methods, which can be conducted in the field, which villagers can then implement.

Pressure from human activities has been found to be quite high on initial investigation. There appears to be a heavy presence of hunting due to evidence of poachers' camps. Poacher's guns disturb the elephants and cause the herds to change their habitat, which increases the chance of HEC. We also found there were extensive logging activities in the elephant habitat which is causing considerable disturbance to elephant populations.

Preliminary information that has been sourced through villagers' estimates suggests that the population size of the majority of elephant herds in southern Lao PDR is not viable for the long-term. Most elephant herds are small and dispersed, which makes conservation activities challenging. Eleven locations estimated 100 individuals, of which the two largest known elephant herds of 15 individuals each should be targeted for conservation. It should be noted that elephant data obtained to date has been collected by interviewing villagers and the Champasak Conservation Unit. This information should now be verified through direct observation in the field.

HEC is restricted to one site in Xekong Province only, and this project has effectively mitigated HEC in southern Lao PDR as part of this project.

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Gajah 26 (2007) 21-26

Project to Microchip and Register Captive Elephants in Assam, India

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Introduction

The population number of captive elephants in India was based only on estimations, as prior to the year 2002 no formal scientific census had been taken. However the population was estimated to be 3400–3600 (Bist 2003), of which Assam is thought to have about 1500 elephants distributed throughout the state. Therefore in 2002 Project Elephant (Government of India) decided to undertake a project of microchip implantation in all captive elephants of India for identification and proper maintenance of a database. As part of this project the Department of Environment and Forest (Government of Assam) started the implantation project and decided to conduct a mass implantation programme during the "Kaziranga Elephant Festival". Details of planning, preparation and mass scale implantation, is discussed hereunder.

Kaziranga National Park is regarded as the heart of wildlife conservation in Northeast India. The "Kaziranga Elephant Festival" was conceptualized and organized by the Department of Tourism and the Department of Environment and Forest (Government of Assam) and held on January 11-13, 2003. The aim of the festival is to promote tourism in the state, creating public awareness about the plight of the Asian elephant in the state, and promote the concept of "elephant-human coexistence" in today's world of mosaic habitat types.

The event was the best opportunity to implant microchips in captive elephants in Assam as the Department of Environment and Forest invited all private elephant owners of the neighbouring districts to participate with their animals. Looking at the possibility of one of the largest ever congregations of captive elephants in the state, most of which are privately owned and reside in remote areas, it was decided to implant microchips in all the participating captive elephants during the three day festival. It was put forward by the authors to the concerned Department to invite the owners with their elephants at least two days before the festival so that the exercise could be started well ahead of the hustle and bustle of the tourism festival. The Wildlife Trust of India, a non-government organization, with support from the International Fund for Animal Welfare (IFAW) supported a free health check-up for all participating elephants in the event. It is worth mentioning that in terms of quality veterinary care for captive elephants it is estimated that about 15% of captive elephants get good veterinary care, 25% get average care, while 55% of captive elephants get poor care. This is one of the most serious problems faced by these animals (Bist 2003). After the December 1996 ban on logging operations in Northeast India by the Honourable Supreme Court of India, most of the captive elephants of the region suddenly became jobless, and gradually became "beasts of burden" for the private owners, except some 10% of family owners who kept their elephants as a symbol of pride.

Materials and methods

Microchip tagging

The microchip technology was developed in USA during the early 1980s for identification of animals. The microchips are a tag in the form of "Read Only Transponder". Each tag comprises some read only memory, a power rectifying circuit, an onboard oscillator, and a variable antenna, loading circuit and driving logic. The memory is permanent and the tags do not need power to retain their identity and function without any battery.

The microchip is small, barely larger than a grain of rice, and is approximately 12 mm x 2 mm in size. Newly designed microchips consist of a glass capsule made of bio-compatible glass, which is readily accepted by the body tissue. Within the glass capsule there is a silicon chip carrying the unique individual code, along with a ferried rod and copper coil that receives and sends the information to the reader.

The FDX–B microchips conforming to ISO 11784 and 11785 are preloaded in a sterilized hypodermic syringe. The code on the microchip is unique and can be read by passing the reader over the microchip. A built in rechargeable battery powers the hand-held lightweight reader. Readings are received by the reader and displayed on its LCD screen, while the presence of a microchip is also confirmed by a beep signal. The Tracer ISOMAX 111 reader, which was used in the festival, is a second-generation reader and is fitted with a data port that allows transfer of stored data into a computer system.

Method and site of implant

The recommended method of implantation is by hypodermal injection. Each microchip is contained in a separate hypodermic sterile pack. Before injecting the implant, the chip may be read to confirm that it is reading properly and the number can be noted accordingly.

The recommended implant site in elephants is subcutaneous, in the neck behind the left ear (Fig. 1). The site is chosen for easy access and to allow consistency within large groups. It is effective for easier reading on a national scale.

The needle is inserted upward at an angle of 45–50° at the site (Fig. 2). After implantation the site should be checked for any bleeding or tearing of tissues, and should be disinfected. Then the chip is read by the hand-held reader to ensure its location and function (Fig. 3).

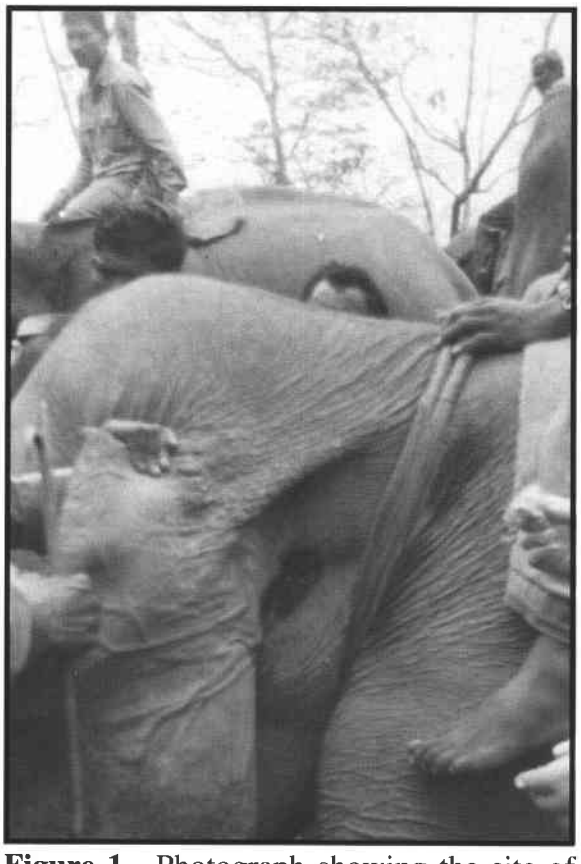


Figure 1. Photograph showing the site of implantation.



Figure 2. Photograph showing the process of implantation

Season and weather considerations

January is peak winter in Northeast India and peak tourist season as well; hence the festival was planned during this month. This is favourable for the mahouts and captive elephants, as they can transport their animal from far away places through the shortest route to Kaziranga, crossing rivers and rivulets, which in the monsoon season would not be possible. Almost 90% of the elephants were transported on foot by their owners who cannot

afford the luxury of transporting them by vehicles.

Camp sites for elephants

Based on the data available to the Forest Department and other sources, it was estimated that at least 150 captive elephants would participate from five adjoining districts of Kaziranga National Park: Golaghat, Nagaon, Jorhat, Sonitpur and Kamrup. Planning for temporary housing of the participating captive elephants was done according to their basic management and husbandry requirements. Two sites close to the southern boundary of Kaziranga National Park were selected based on availability of space, a large water source, distance from human habitation, accessibility by vehicles, availability of shade, availability of fodder, and safety considerations for the animals and humans from wild elephants. For ease of record keeping and logistic supply the two sites were strategically located so that elephants coming from districts in any direction could camp on either side, hence the distance travelled would be less. Special attention was paid to the disposal of dung and residual fodder of the captive elephants that would accumulate during the period of the event. Huge pits of 15 m. x 15 m. x 10 m. in size were dug at both sites for disposal of dung and residual fodder, and instructions were given to the mahouts to dispose of litter on a daily basis and burn it every alternate day.

Captive elephants

The captive elephants were divided into four different groups: adult males, adult females, sub-adults, and adult females with suckling calves. The winter, specifically from October to April, is the peak period for healthy adult male elephants to come into musth (Dutta & Pathak 1997), hence a solitary camp was selected for these animals. After registration and examination for initial signs of musth (i.e. swelling over the perineal region or temporal region accompanied by behavioral change with aggression) such animals were kept isolated. It was also taken into consideration that in cases of more than one individual coming into musth or showing signs of premusth, the tethering distance between them would be at least 50 meters apart, and prior arrangements were made accordingly. The adult females, the sub-adults and docile male elephants were kept at both camp sites. Adult females with suckling calves were allowed to stay with the camp elephants of Kaziranga NP for two reasons: safety of the calves from chances of a predator attack, and minimal stress of transport and of disturbance by crowds at this site. The site has electricity and armed guards patrol the area.

Registration of elephants

Each captive elephant was registered on arrival at the camp and an identification number was given to it. The identification number was written on a cotton cloth with permanent marker pen and handed over to the mahout or the owner who was asked to tie it on the gaddi (saddle) of the elephant on all occasions. The support staff of the Forest Department kept a record of the elephants separately, to be distributed to the veterinary officers in charge of the health camp and implantation programme. During the registration basic information was recorded for all captive elephants. This information included name and address of the owner, name of the elephant, sex and approximate age, temperament and physical parameters like height at shoulder, chest girth, circumference of left foreleg.

The veterinary team and support staff

A total of six veterinary surgeons, experienced in working with elephants, participated in the event. The team of veterinary surgeons was divided into two groups to address the elephants at two different sites at the same time. Among the groups, two veterinary surgeons were given the responsibility of performing a thorough health check-up and collection of data as well as rendering necessary treatment, while the other two veterinarians implanted microchips. The remaining two members supported each team where needed.



Figure 3. Photograph showing the method of reading the microchip.

Data collectors, four forest guards and two skilled mahouts supported each team of veterinary surgeons.

Protocol for mahouts and elephants

For the microchip implantation and health check-up of the elephants a no-man zone was created close to the area where the elephants were tethered at both campsites. The two teams placed themselves in the no-man zone at least 50 meters away from each other. A forest guard was put on duty with the elephants and given a whistle and a red flag, while another staff member was assigned to the implantation team with a whistle and a green flag. The forest guard with the implantation team waved the green flag to the forest guard with the elephants signalling that one elephant with its mahout could come for implantation. The forest guard waved the red flag signalling he had seen the instruction. The elephants' registration number was displayed to the team and was noted. After completing implantation, the same elephant was taken to the team of veterinarians conducting the health check-up and treatment. Once the elephant left the implantation team, the forest guard waved the green flag signalling that the next elephant could come and the cycle moved on. After completing the health check-up and any necessary treatments, the elephant returned to the tethering area by another route, to ensure that the teams attended to all elephants and that the mahouts were not confused during the exercise. During the implantation and examination only essential personnel was allowed in the area, the media was placed in a strategic point away from both teams.

Veterinary surgeon protocol during implantation

The veterinary staff followed a protocol during the entire exercise. This included instructions given beforehand to the owners and to the mahouts about what was going to be done and what was expected of them. The protocol included that the elephant would have hobbles on its forelegs and the owner or mahout would tie the forelegs with the hobbles. After securing the elephant with the hobbles the mahout gave the command of "Sam beit" (kneel down) and

the owner then pulled the left ear of the animal towards the eyes of the animal. After this the animal was approached from behind by one of the veterinarians and the area on the elephant's neck was sterilized for implantation. The second veterinary surgeon immediately followed and implanted the chip sub-cutaneously. Standard sterilization protocols were followed by the veterinary surgeons while implanting the microchips.

Results and discussions

The underestimation in the number of attending elephants provided some last minute crises in terms of logistic supply and fodder. A total of 210 captive elephants attended the event instead of an estimated 150, but luckily there was enough space for the surplus 60 animals in both the main camps and the camp for musth elephants where some female elephants and sub-adults were accommodated. Among the 210 registered elephants there were 17 (8.0%) adult tuskers, 45 (20.9%) adult makhnas, 106 (50.4%) adult females, 19 (8.5%) sub-adults and 23 (10.9%) suckling calves.

A total of 199 captive elephants were implanted with microchips among the 210 registered elephants that attended the camp. The other 11 elephants could not be implanted because they were 3 months to 4 years of age, and being suckling calves accompanied by their mothers they did not cooperate with the physical restraining process required for the implantation. Chemical restraint was ruled out under these circumstances. Only 0.5% of the adult elephants required chemical immobilization because of non-cooperation with the procedure or getting too nervous. Almost 60% of the total number of animals (n=210) had their first exposure to a veterinary surgeon and for obvious reasons were curious or nervous, but with their skill the mahouts were capable of giving them the required security and comfort during the implantation.

There were at least three instances where the protocol for implantation could not be followed due to unavoidable circumstances. It was documented that most owners had 1-2 captive elephants up to a maximum of 4. Owners of 3-4 captive elephants brought their elephants together for implantation and health check, and convinced the authors that due to the strong social bond among them, no single elephant was eager to move alone leaving the other members behind!

Unlike other states in India where a sizeable captive elephant population exists (such as in Kerala) the management and husbandry of captive elephants in Northeast India is quite different. The majority of the captive elephants in the Northeast enjoy near wild or natural conditions as a result of their location in the vicinity of forests, either because of being employed in the timber industry or because they are owned or managed by tribal communities residing in close proximity to the forests. These elephants have access to natural forage and abundant sources of fresh water; hence they appear well hydrated and content like their wild brethren. During lay off from work, they are hobbled and let loose for grazing the entire day. If the elephant is engaged in work in the daytime, it is released to graze at night, allowing the elephant to choose forage and giving it a better chance for balanced nourishment (Sarma 2003). Striking differences noticed between the captive elephants managed by the protected areas and by private owners is that the body condition index is far better among elephants with private owners than elephants in protected areas. But interestingly, regarding the foot condition among 151 captive elephants that were given a detailed health examination, a total of 33.7% had nail cracks and 10.5% had fissures on the footpad (Ashraf *et al.* 2003). The nail cracks may be attributed to poor foot care or occupational hazard. A total of 2 adult female elephants had fractured hind legs, a result of a heavy log hitting directly over the affected leg during logging operations.

Despite minimal contact with human beings and inexperience with exposure to crowds, ochlophobia was noticed in only 1 adult female elephant during the festival. She was immediately moved away from the crowd.

A total of 4 (6.45%, n=62) male elephants came into musth and needed to be sedated

thereafter for better restraint and management. These elephants were implanted with microchips after sedative administration.

Because of the heavy demand of tuskers outside the state, many adult tuskers have been sold out of state, which resulted in a captive sex ratio of about 1 male to 5-6 females, which is similar to a natural undisturbed herd. Therefore, there is no dearth of breeding males to breed receptive captive females and they are procreating unlike captive females elsewhere (Sarma 2003). Among the 106 adult female elephants that attended the event, a total of 23 (21.6%) had suckling calves from 4 months to 5 years of age. Upon interrogation it was found that 100% of the breeding female elephants have mated with wild adult males to produce the offspring. This is quite a natural phenomenon for captive elephants in Northeast India and can be attributed to the husbandry and management system followed in the state. The weaning age of captive born calves is approximately 5 years as per the information gathered from the owners.

The transportation of almost 90% of the captive elephants was done on foot, even females with suckling calves. These elephants started their journey well in advance, with frequent breaks in villages and towns to finally reach the event. This resulted in some stress to the suckling calf and their lactating mothers, although per the information gathered from the mahouts, many female elephants could not come because of suckling calves below 1 year of age.

Almost 90% (n=240) of the mahouts were illiterate and needed more effort in making them understand the protocol, but with the help of the support staff this was not too difficult.

Conclusion

The FDX–B (Tracer) microchips conforming to ISO 11784 and 11785 were implanted successfully in 199 captive elephants during the "Kaziranga Elephant Festival". Following the same methodology, a few more mass scale implantation programmes have been successfully completed. So far in Assam a total of approximately 850 elephants are microchipped, and the method is very simple, safe, and without any post-implantation complications.

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Gajah 26 (2007) 27-30

Impact of Border Fence along India-Bangladesh Border on Elephant Movement

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Abstract

The barbed wire fence that has been erected along the India-Bangladesh border has become a barrier to the movement of wild elephants at a number of locations in Assam, Meghalaya, Mizoram and Tripura. While the animals continue to move across by breaking the fence at places, there is possibility of injury besides creating problems in their normal movement. Such disturbance could increase human-elephant conflict, which has already taken a serious turn. This article discusses the issue, the problems arising out of the same and also recommends potential solutions.

Introduction

The north-eastern (NE) India is an important habitat of the Asian elephants *Elephas maximus* in its entire range (Bist 2005; Choudhury 1999; Choudhury & Menon 2005). The region comprises the states of Arunachal Pradesh, Assam, Manipur, Meg-halaya, Mizoram, Nagaland, Tripura, Sikkim and the northern West Bengal (21°58'-29°27'N, 88°00'-97°24'E) covering about 274,680 km² of geographical area (Fig. 1). The NE India is part of a global biodiversity hotspot (Myers *et al.* 2000). The elephant habitat in the region is contiguous with Bhutan, Bangladesh, Myanmar and to some extent Nepal. The animals move between these countries at different times (Choudhury 1999). To prevent influx of illegal human population and also to check movement of various insurgent groups, the Government of India has started construction of fencing with barbed wire all along the India-Bangladesh border. It has been observed that this fence has already posed serious problem for some elephant population while for some others it is going to be a problem in the near future. The total length of the border is 4894 km, of which more than two-third already fenced.

This short paper discusses the problems area by area and also suggests potential solutions.

Methods

The data was obtained during general field study in different parts of north-east India to determine the distribution and status of different species of wildlife including the elephant since 1985. Since the fencing is a recent phenomenon, the areas likely to be affected were also visited for first hand observation of the problem. The field study, besides ascertaining the presence or absence of elephants, interviewed border villagers, forest staff and the security staff posted was taken.

Results

Patharia Hill (24°33'-47'N, 92°15'-16'E) (marked 'A' on map in Fig. 1). This north-south running low hills falls partly in India and partly in Bangladesh. The approximate area on Bangladesh side is >100 km² while on Indian side, the area of the reserved forest is 75 km². It is located in Karimganj district of Assam and Moulvi Bazar district of Bangladesh. A small isolated population of eight elephants survives in this small habitat. The number was 18 in mid 1980s including Longai-Tilbhum forests (Choudhury 1991), which came down to eight in 1993 (Choudhury 1999). In this sector, the boundary fencing was completed a few years back but the elephants regularly damage it to cross over and vice versa. The movement of elephants between the forests of two countries is not seasonal but a regular one as the fence is right across the heart of the habitat. This is the last herd of elephants in the Barak valley region of southern Assam. The Cachar population was extirpated in 1988 (Choudhury 2001a) while in Hailakandi, only three survived.

The link with the nearest population (Hailakandi) ceased in the mid 1970s (Choudhury 1991), due mainly to deforestation, encroachment, and large-scale cultivation of sugarcane, and jhum cultivation by the Reangs tribe, coupled with poaching by the Mizo tribe. Similar disturbance prevented it from dispersing towards the south (Mizoram). The gap between Tilbhum and Patharia Hill Reserved Forests is widening but the elephants occasionally use the clearings and tea plantations for movement. The total area of the habitat is about 140 km^2 (Assam 80 km^2, Tripura 20 km^2 and Bangladesh 40 km^2).

Southern Garo Hills (25°12'N, 90°12'E / 25°05'N, 90°42'E) (marked 'B' in Fig. 1). This is part of a large population that lives in Garo Hills- Khasi Hills of Meghalaya and adjacent areas of Kamrup-Goalpara of Assam. Every year 40 to 50, very rarely up to 70-80 elephants move down to the plains of Durgapur in Netrakona district (earlier a part of Mymensingh district) of Bangladesh. The elephants move down from Balpakram National Park – Baghmara Reserved Forest through the stretch between Baghmara and Maheshkhola. They mainly go down at the advent of winter just before harvesting of paddy and are back once the harvest is over.

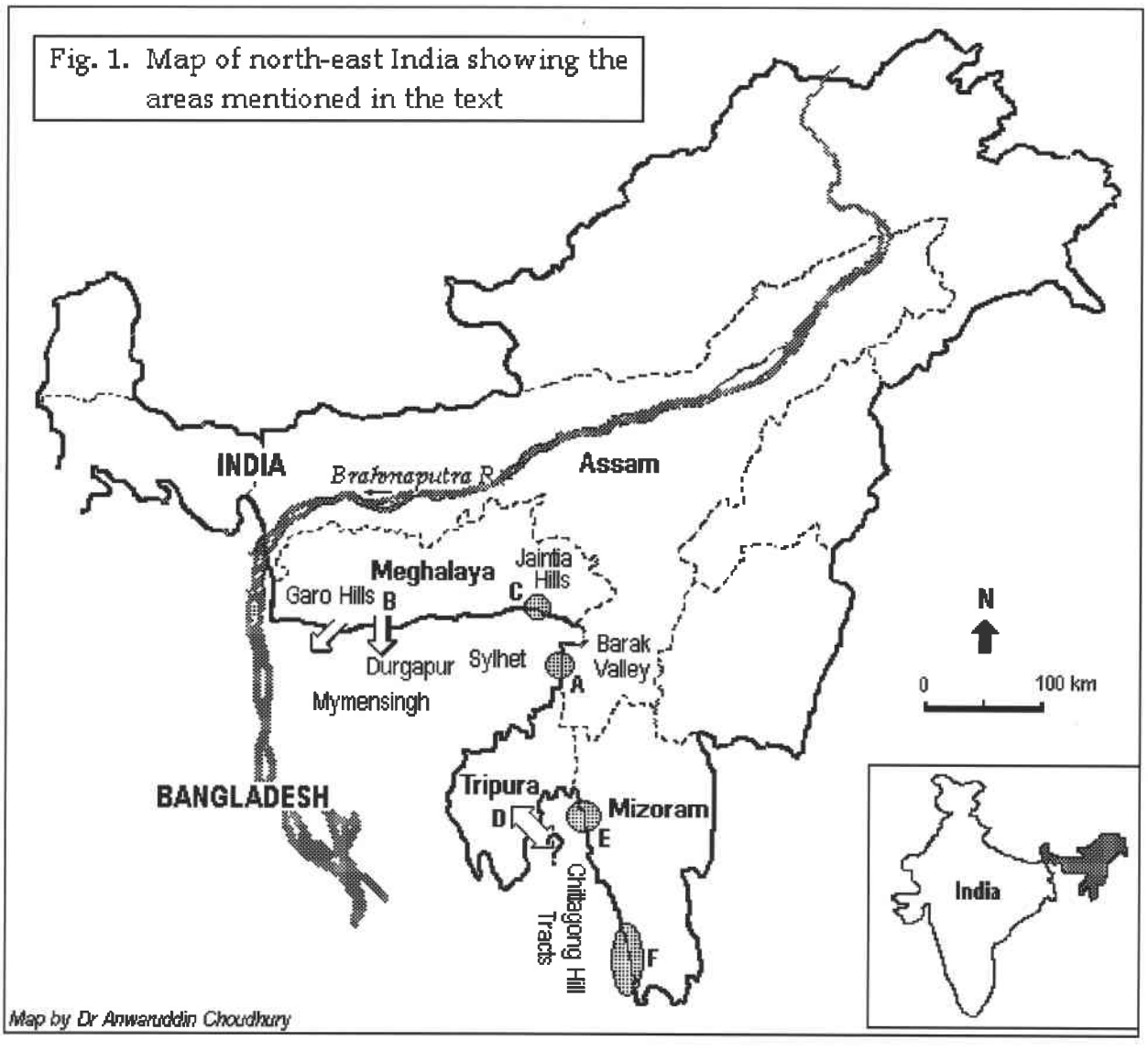


Fig. 1. Map of north-east India showing the areas mentioned in the text

A news report came up with a figure of about 100 elephants in Gozni area of the northern district of Sherpur, about 125 miles from the capital, Dhaka (Anon 2004). The animals reportedly killed 13 people and injured around a hundred during a period of two years. These elephants moved across through a different route from or west of Angratoli Reserved

Forest. Islam (2005); however the report did not mention this movement although there is mention of the Durgapur area.

Jaintia Hills (25°07'N, 92°12'E) (marked 'C' in Fig. 1). A small population of elephants is found in the southern areas of Jaintia Hills district of Meghalaya. This was the Barail-Jaintia Hills population of Choudhury (1999); however, with the complete disappearance of elephants from Barail foothills in Cachar, the only survivors of that population is now confined to Meghalaya only, mainly moving in Narpuh Block I Reserved Forest and adjacent forests of Lakadong. Lone males have been found to follow the Prang River (known as Hari River in Bangladesh) up to the plains where it spreads out from the hills. Thus they occasionally cross the international boundary. The Bangladesh part is in Sylhet district.

Tripura (approx. 23°30'-40'N, 92°00'E) (marked 'D' in Fig. 1). The number of elephants in Tripura is fast declining due to insurgent activities. Nobody knows exactly the number of present animals and they wander about a large forested / degraded area, bulk of which is unguarded by Forest staff due to presence of heavily armed underground guerillas. Occasional movement between Tripura's Dhalai, North and South districts and Chittagong Hill Tracts (Khagrachari and Ran-gamati districts) could still be there as there is habitat contiguity. From an estimated 184 ele-phants in 1995 (Choudhury 1999), the current numbers could be as low or less than 30.

Dampa Tiger Reserve (23°30'-40'N, 92°18'E) (marked 'E' in Fig. 1). The largest protected area in Mizoram with 500 km^2 of area has a very small elephant population numbering four in 1999-2001; down from five in 1997-98 and >10 in 1980s (Choudhury 2001b). This reserve is right on the India-Bangladesh border and the elephants are known to move across occasionally to Rangamati district in Chittagong Hill Tracts, Bangladesh.

South Mizoram (22°00'-40'N, 92°33'-36'E) (marked 'F' in Fig.1). Unlike other populations or herds, which mostly go from the Indian side, in this case, some elephants (up to 20-25) from Chittagong Hill Tracts (Rangamati district) in Chittagong Hill Tracts of Bangladesh occasionally enter Mizoram, affecting the forests and paddy fields of Lawngtlai and Lunglei districts (Choudhury 2001b).

Discussion

The border fence that has been erected and is being erected is quite strong with several strings or iron wire. Although the Patharia experience suggests, that in the Garo Hills and Mizoram sectors as well the pachyderms will damage the fence for crossing over and this remains a matter of concern. The fence certainly is a disturbing agent for the elephants and they break after repeated attempts. Secondly, there is a chance of injury to the elephants.

In Garo Hills – Bangladesh sector, there is no habitat across the border and the animals go for the crops. Although the fence in this sector will help stop crop loss but it being a tradition, which these elephants are following since time immemorial it may be difficult to prevent breaking of fence in places. In Bangladesh, the reaction was against the animals (Anon 2004). An NGO once demanded absurdly that the Indian government "takes back about 100 elephants". They even urged for elimination of the elephants for "attack on people, destruction of trees, roads and houses." There were reports of at least 13 human deaths and 100 were injured in two years (2000-2002) in Sherpur area. Elephants killed 162 people and injured 157 in Bangladesh, mostly in the Chittagong Hill Tracts, in the five years to 2002, says the World Conservation Union.

Suggested actions

In the known corridors in all these sites, there should be provision for gates or openings so that the elephants can migrate without any problem. In Garo Hills sector, such openings may not be possible as there is no suitable habitat across the border in Bangladesh. However, in Patharia and the Mizoram sector, both sides of the border is forested and forms an elephant habitat. Wide openings should be provided at suitable locations, especially along the elephant tracks. In case of Patharia and Dampa, the main fence could be realigned

along the reserved forest and sanctuary boundary so that even if any human infiltrator crosses the border through the gates, he could be detected. In the process, the reserves would get protection from encroachment and tree felling. Patharia Hill should be declared a transborder wildlife sanctuary as has been done in many parts of Africa. Patharia has many other rare species of wildlife such as pig-tailed macaque *Macaca nemestrina*, Phayre's leaf monkey *Trachypithecus phayrei*, hoolock gibbon *Hoolock hoolock* and clouded leopard *Neofelis nebulosa*.

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Gajah 26 (2007) 31-33

Current Investigations of Asian Elephant Semen in North America

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Introduction

Reproductive technologies such as artificial insemination (AI) and sperm cryopreservation (i.e. freezing) have become high priorities for increasing reproductive success in captive elephants throughout the world. The current populations of Asian and African elephants in North America (managed by the Elephant Species Survival Plan, SSP) are not currently self-sustaining, and are estimated to become nonviable within a few decades unless reproductive rates increase dramatically. Unfortunately, there are only a limited number of breeding bulls and even fewer elephant breeding centres. This has created an urgent need to develop semen cryopreservation techniques and bank samples from all available bulls within the SSP. To reverse these trends and create sustainable populations of healthy elephants, more research is needed to increase our understanding of their basic reproductive biology and optimize breeding management strategies, including the use of assisted reproductive technologies.

Semen collection for artificial insemination

Currently, fresh-extended semen is typically utilized for AI due to the limited success in elephant sperm cryopreservation. Semen samples are collected, extended, cooled and transported within 12 hours to the AI facility for several consecutive days coordinated to the female's estimated time of ovulation. Due to the uncertainty of obtaining semen samples with acceptable quality for AI, utilizing fresh-extended semen requires the recruitment of multiple bull holding facilities to collect semen. However, even the safeguard of recruiting multiple bulls for collection is highly unpredictable, at times leaving AI institutions with either no or suboptimal semen quality after shipment. As a result, investigations to improve sperm storage and develop cryopreservation techniques in elephants have become major areas of focus.

Semen extender and short-term storage

Investigations to improve storage conditions for fresh-extended semen for both Asian and African elephants are necessary to enhance AI efficiency and to advance techniques for cryopreservation. Currently, studies are being performed to formulate the optimal extender (i.e. diluent) and storage temperature that will protect and extend the viability and longevity of Asian elephant spermatozoa during storage. Improvements in semen preservation have far reaching potential. In addition to directly enhancing AI efficacy and providing fundamental information towards improving cryopreservation methods, improved semen preservation also allows additional studies to be performed that were previously unachievable due to reduced sperm survival after short-term transport (i.e. < 24-48 h).

Sperm sex sorting

Studies to develop successful sperm sex sorting techniques in both Asian and African elephants are currently being investigated. Spermatozoa sorted for the female X-chromosome may be utilized for AI to increase the probability of adding younger females to the captive population. The goal is to establish an exponentially growing captive elephant population by creating a gender-skewed captive elephant demographic with a higher

ratio of younger and reproductively viable females to males. Sperm sex sorting requires fresh and viable semen samples to be shipped to a geographically central location due to the specialized equipment required for this procedure. Although the differentiation between X- and Y-chromosome bearing sperm has been successful in both Asian and African elephant spermatozoa, the consistency and availability of obtaining high quality samples (i.e. high motility and viability) after transport has been a major setback, reducing the potential of sperm sex sorting. For this reason, studies to optimize spermatozoa longevity and viability of fresh-extended semen after short-term transport are a priority to further advance elephant reproductive technologies.

Sperm cryopreservation

The advantages of improved sperm cryopreservation are numerous: i) ensure the consistent availability of good quality semen for AI; ii) reduce the cost and logistics associated with using cooled fresh-extended semen; iii) encourage species conservation and preservation by facilitating the development of a genome resource bank; iv) optimize genetic diversity and captive population management; and v) help maintain a healthy elephant meta-population.

Cryopreservation of Asian elephant sperm has posed many challenges, with many samples exhibiting low sperm survival and viability after thawing. By contrast, cryopreserved African elephant sperm has had a relatively higher post-thaw sperm survival compared to Asian elephants, and has resulted in at least one successful pregnancy following AI. Although the exact cause of this discrepancy remains unknown, one possible explanation has been attributed to the species-specific differences in sperm membrane composition. The acrosome, an enzyme-filled sac located at the anterior portion of the sperm head, also appears to be more sensitive in Asian elephants. Since the acrosome plays a key role in sperm-oocyte binding and oocyte penetration during fertilization, a prematurely reacted or damaged acrosome can potentially compromise the fertilizing capability of spermatozoa (Figs. 1 & 2). As a result, species-specific differences in membrane composition and/or structure may influence the physical properties of a membrane, determining how well a sperm cell survives through temperature induced membrane transitions during cryopreservation.

Seminal plasma analysis

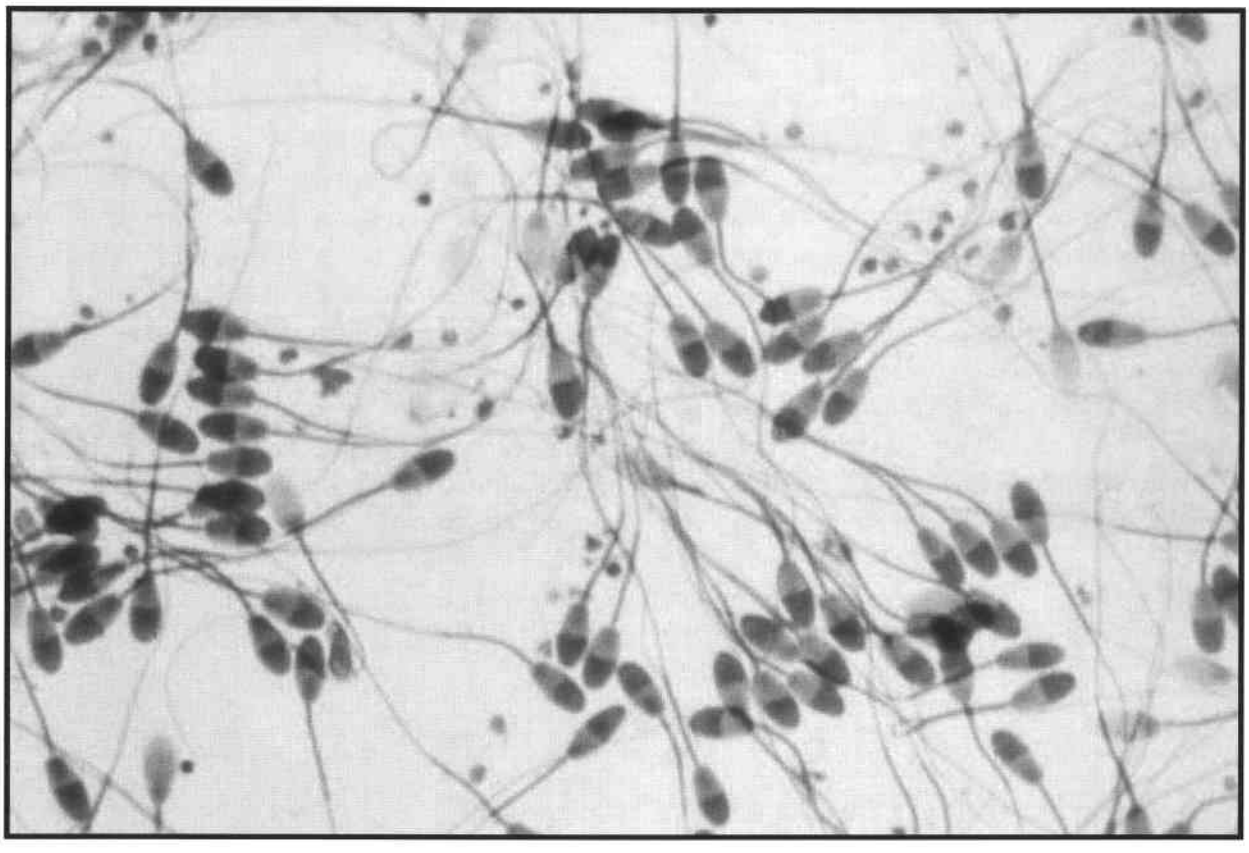
Biochemical and molecular differences in semen between the two elephant species may also be a factor influencing these cryo-protective differences. In fact, one of the major challenges in developing successful semen cryopreservation for Asian and African elephants is the high variability frequently observed in semen quality after manual collection. Interestingly, ejaculate quality from the same bull can vary from containing >70% motile sperm to 0% motile sperm in subsequent collections. The underlying cause(s) of this remains unknown, since many of the bulls exhibiting this phenomenon are proven breeders through natural breeding. Because spermatozoa are mixed with accessory gland fluids that provide both nutrients and other factors, individual differences in these components of the semen can influence the overall semen quality. Investigations to analyze molecular and biochemical differences in ejaculates exhibiting varying semen quality are underway, while comparing individual, intra- and inter-species differences. Alternative methods of semen collection that may produce less variable ejaculates, while remaining safe and non-invasive for the individual bull and elephant handlers are also being investigated.

Conclusions

Increasing our knowledge of basic elephant semen biology and sperm preservation will help enhance and ultimately increase reproductive rates of both Asian and African captive elephant populations. This information and associated reproductive technique development may also one day be important to the genetic management of in situ elephant populations, or at the very least provide genetic material through genome resource banks that can serve as a hedge against extinction.

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Asian elephant spermatozoa with Spermac™ stain to evaluate acrosome status

Gajah 26 (2007) 34-36

Brief Introduction to the Human-Elephant Conflicts in Upper Mekong Region

Aidong Luo

China

When they came out of the forest, the elephants stepping into paddy fields happened to "catch" (trample on) the fish there. It may sound a bit funny, but it really happened here in Xishuangbanna MAB reserve, the Upper Mekong Basin, Yunnan, China (Fig. 1).

Four thousand years ago, the elephant distribution in China extended to the north, reaching Beijing (Elvin 2004) and most of the area of Huang River basin (Sun *et al.* 1998; Li 1998). However, several thousands years later, their range has shrunk. Elephants exist only in the Upper Mekong Basin, the southwestern part of Yunnan, China, bordering Myanmar and Laos. With less than 20,000 km^2, it remains the largest and the last elephant population of China. There are about 200-250 elephants living in Xishuang-banna (Aster 2003).
Two decades ago, the elephants just stayed in the forest while the farmers harvested their crops in the field. No one knows what the exact time was when elephants began to "help" villagers at harvest time. At the beginning, there were just a few elephants that appeared in the fields during the crop harvest season. At that time since Dai minority religion, Buddhism had an influence, the local people regarded elephants as the symbol of luck and wisdom. So the villagers were excited about seeing elephants coming out from of the forest to their fields.

As time went by, more elephant herds seemed attracted by the taste of crops in the fields, and that led to a large number of elephants appearing around the village. They seemed to "know" when the crops will be harvested and where the crops were cultivated. Main crops like rice, maize, sugar cane and banana were encroached by elephants. Based on the reserve statistic, the total amount of crop loss from 1991 to 2004 was 50,895 tons, worth about 150

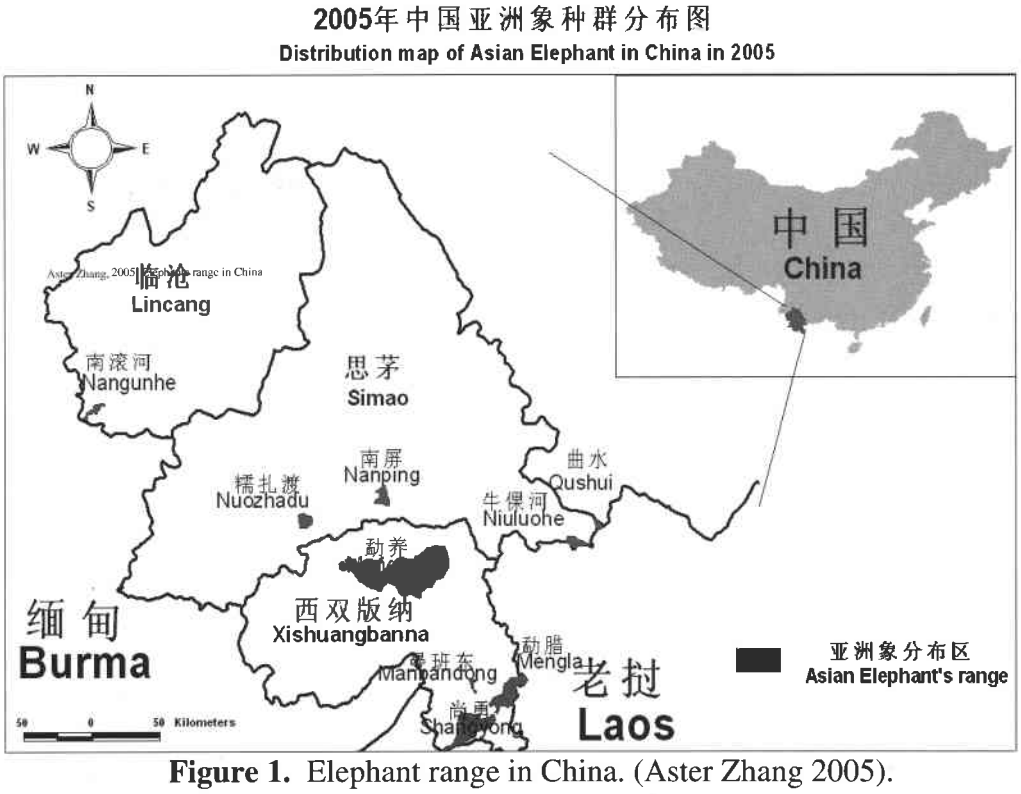


Figure 1. Elephant range in China. (Aster Zhang 2005).

million Yuan RMB (about 20 million US Dollars) direct economic value.

Chart 1 gives the incresing trend of annual loss since 1991. Additionally, the number of household crop loss increased from 612 in 1991 to 16,380 in 2004. This grew nearly 30 times more within decades. Besides the damage to crops, people injured and killed by elephants was another serious problem. Since 1991 to 2004, there was a total of 132 people injured by elephants and among those people, 24 were killed. Based on historical records (Chart 2), the number of people injured and killed annually has increased, indicating that the situation has got worse.

According to reports, accidents happened when people suddenly encountered wild elephants in the forest or at the edge of forest within elephants range. Only a few cases showed elephants had actively attacked people. Although the exact reason why elephants attacked humans has not been revealed, one thing is certain: the conflicts occurred when elephants and human beings 'meet'. No matter whether human being are cutting into elephant range or elephants encroached hum-an settlements, the conflict would get worse.

Therefore, we need to find a solution to solve it. Due to human being injured and killed by elephants and crop loss, local people doubt the benefits from wildlife conservation. They complained about the damage caused by elephants and inadequate government com-pensation fund for their losses. In order to handle the problem, the local government and Xishuangbanna MAB Reserve had tried some measures such as villager settlement relo-cation, building electric fences, establishing anti-elephant ditch and anti-elephant wall. Unfortunately, not all measures worked efficiently.

Currently, the reserve is exploring the ele-phant habitat improvement project, enhancing the habitat quality for elephants. Several food bases were established in the serious elephant damage areas. The favourite plants of ele-phants like bamboo, palm, banana, sugar cane and maize were cultivated to meet elephants foraging demand. However, the results need to be seen in the future.

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Chart 1. Elephants damage crops loss (in tons) and the householder involved in the Upper Mekong basin (1991-2004)

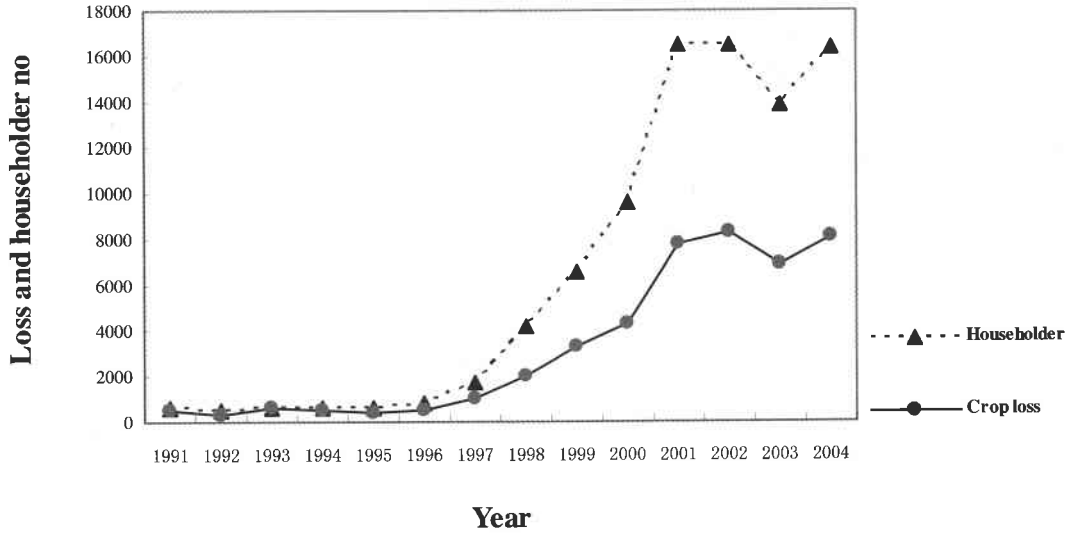
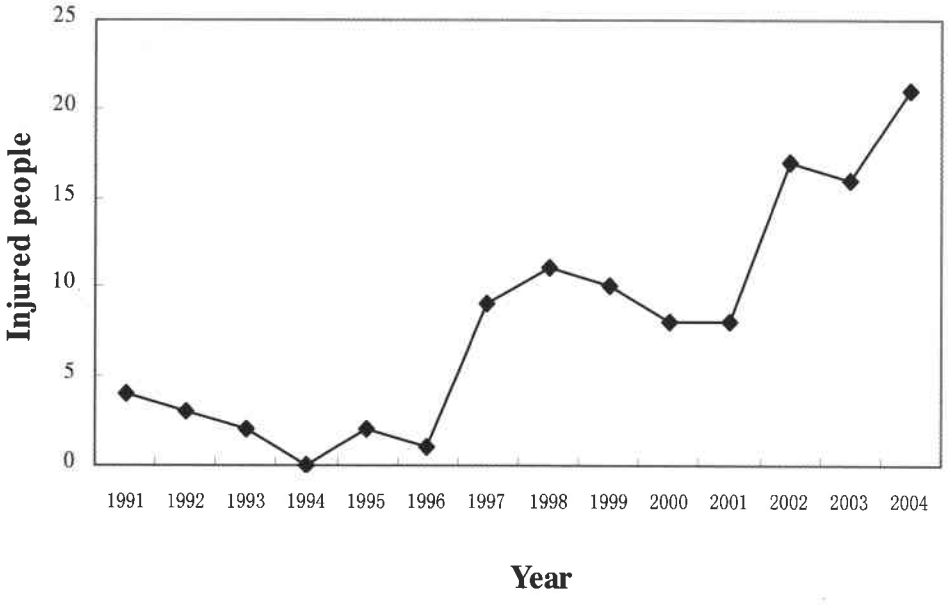


Chart 2. The no. of injured people by elephants in the Upper Mekong basin (1991-2004)



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Elephant mud bathing in Xishuangbanna MAB Reserve, China
Photo by Dong Yonghua

Gajah 26 (2007) 37-42

Human Inflicted Injuries in the Wild Elephants of Assam: Retrospection by an Elephant Veterinarian

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Introduction

Out of the thirteen range countries of the Asian elephants (*Elephas maximus*), India occupies an important position because of its serious official endeavor, as well as people's participation, in the attempt to conserve this important mega-herbivorous species. Assam, the North-eastern state of India, with its thick evergreen forests, green hills and abundant natural sources of water is considered one of the last bastions of the Asian elephant. Large herds of wild elephants once roamed in the forests of the region and, till the middle of the last century, the region was abode to thousands of wild elephants. Clearing large tracts of elephant habitat for tea estates, resettlement of farmers displaced by flood and erosion of the mighty Brahmaputra and tributaries, land conversion by politically motivated transmigration of farmers from within and outside the state as well as the neighboring foreign countries, have rapidly dwindled the centuries old virgin forests, and wild herds are becoming homeless in their own abode

The region is still home to a good number of Asian elephants. The last census recorded around 5500 wild and 2000 captive elephants. However, elephants in Assam are also dying due to electrocution, railway accidents, poisoning and firearm injuries. Elephants are killed for ivory and even for meat. The author wishes to record his tryst with several injured elephants in the region, which were the direct fallout of human-elephant conflict that is growing menacingly and threatens the very existence of the elephant population in this important elephant land.

Injury cases

Case #1

An adult tusker was found shuffling painfully around the Behali Forest Range office in the early summer of 1996. He was suspected to have been shot by ivory hunters and was severely indisposed when spotted; numerous oozing lesions were thought to be caused by gun-shot wounds. The elephant died due to septicemia without giving any scope for treatment. There were twelve gun-shot wounds all over his body.

Case #2

Another huge bull (10.5 feet at the shoulder) was spotted limping in the Lower-Doigrung (Nambor) Reserve Forest under the Golaghat Forest Division during January 1997. He was seen in a badly degraded forest patch cleared illegally for tea plantations. Ironically, the forest tract was credited to be Asia's biggest reserve forest only a century ago where a record catch was bagged in a *Khedda* operation during the British rule. When the bull was visited, he was found to have developed a strange amity with the local populace, who also affectionately gave him a name, *Babu*. There were two huge abscesses on both of his buttocks, the right forelimb was not able to bear his body weight and was flexed and supported on the toe. On closer scrutiny, a hole was spotted on the medial side of the arm region from where purulent discharge was oozing. This caused severe pain and impeded his movements, leading people to believe that he was starving and they started to offer him soaked paddy and fruits. They would place the food in a woven bamboo container some 15-20 meters in front of him and he would reach the feed with short jumps

with the sound limb while dragging the injured limb. This practice continued for some ten days. On investigation, it was gathered that he was a part of a huge resident herd of the area and the injury must have been caused by farmers protecting their crops. He presented a reasonably good appearance in spite of the serious injuries that caused him so much misery. It was already late afternoon by the time we reached him and we had to leave him there for the day as the wild herd came closer.

He was spotted more than a kilometer away from the place he was left on the previous evening, and was darted on foot using 25 mg of Medetomidine and 300 mg of Ketamine in a single metal dart. He was completely immobile in 25 minutes with flaccid tail, trunk, penis and ears drooping forwards. After being satisfied about the safety of handling him, we placed two female* *koonkies* on either flank and tied the hind legs with a long jute rope, used for tying newly captured elephants in Assam. (Female *koonkies* were used as male *koonkies* would not easily go closer to a huge wild bull.) Then we operated on the abscesses. More than two kilograms of pus was drained from each of the abscesses and long raw iron rods (25-30 cm in length, 3 cm in diameter, pointed at the tip) were recovered from each of the abscesses. After properly dressing the cavities, strong tincture of iodine was painted in the cavities and fly repellant ointment was applied.

It was a fearful experience to crouch between his front legs to examine and operate on the hole inside his arm. Inside the cavity, the tract was narrow and was probed but no foreign object could be located; probably another metal rod thrown by a farmer hit him there, but the bull may have removed it with his trunk. The opening was widened for better drainage, tincture of iodine was painted and the surgery finished with application of a fly repellant cream. A long acting antibiotic, NSAID, and Ivermectin was injected post operatively along with tetanus prophylaxis and then the hind legs were released from the loops. The reversal drug (Atipamezole) was injected and the *koonkies* were moved away. The animal made a quick recovery and, interestingly, came back from the jungle around the same time every day to the spot where he was operated to devour the paddy and banana offered by the people in which antibiotic tablets were also concealed. After about a fortnight, he moved away with the herd.

Case #3

A huge ageing tusker came out from the Panpur Reserve Forest and entered deep into the human settlements in the Sootea area of the Sonitpur district on the north bank of the Brahmaputra during the winter of 2000. It was presumed that probably another younger tusker assumed dominance in the area famous for its huge tuskers, as the attempt to drive him back did not work; he would return to the human settlements immediately. The lure of large areas of sugarcane cultivation may have added to his motivation to come back into the human settlement across the Ghiladhari River. He was reasonably harmless as no human life was lost to him but sugarcane ready for harvest suffered severe damages. Meanwhile disturbing information was received that some ivory poachers were pursuing him and had in fact shot at him but the bull managed to survive.

Two female *koonkies* were arranged for the operation. The bull was darted from foot using 700 mg of Xylazine and 300 mg of Ketamine in a single syringe and was com-pletely immobilized in 35 minutes. Here again the *koonkies* were placed in the flanks and the hind legs were looped. Two gun shot wounds were noticed on his body, one at the right buttock and another on the forehead. The bullet from the buttock wound could not be removed but proper dressing was done into the maximum depth of the channel (17 cm) and antibiotic was applied locally. The bullet on the frontal shot at the base of the trunk could have been fatal, but interestingly, it traveled upwards for about 50 cm sub-cutaneously and rested under the skin over the frontal bone. Probably, the bull raised his head when he was shot and therefore the bullet instead of penetrating the skull moved under the skin. A huge abscess was formed at the location of the bullet, which was drained and the bullet was removed. The wound was dressed and fly repellant cream was applied.

With due permission from the Chief Wildlife Warden, his tusks were trimmed to make him less interesting for ivory poachers. Long acting antibiotic and tetanus prophylaxis was administered parenterally. It was interesting to record that the animal moved into his abode, the Panpur Reserve Forest, following the treatment and was seen in company of an adult female rhino for about two months, then at the end of the rainy season, crossed the Brahmaputra and entered Kaziranga National Park. He did not come back to Sootea thereafter.

Case #4

After the high floods of 2001, a makhna was reportedly stranded in the *maijan chapori* (a small river island created by siltations) in the middle of the river Brahmaputra near Dibrugarh town in Upper Assam (Fig. 4). He was thought to have been washed down by the high floods of the river from upstream in Arunachal Pradesh. Initially, he was moving very little and was restricted in a small area. Scouts could see a huge injury on his right arm region, which was exuding blood and pus. Another low flood delayed an attempt to render him medical help and finally the operation began about twelve days after the initial report of him getting stranded in the river island.

As we came to the island, we saw farmers' houses demolished and granaries emptied; the farmers were cursing their ill fate but said no word against the bull as people in this land believe that the elephant will know if he is admonished and would take vengeance. Fresh foot marks in the soft paddy fields revealed that it was a huge animal and there was no evidence of limping. No *koonkies* could be arranged for the operation as there were no captive elephants in the nearby areas. The bull was spotted wallowing in the shallow waters near the bank of a major watercourse of the river. As we approached him in a boat from upstream, keeping some distance from the bank, he got up and walked inland. But the turbulence of the river drifted our boat dangerously close to him and the bull mock charged us, kicking the mud from the bank into the water. While passing by him at speed, he was shot in his triceps with a metal dart containing 700mg of Xylazine and 300 mg of Ketamine. He was immobilized after 35 minutes, but the absence of *koonkies* made it difficult to handle him in the open area, so another supplementary dose of 300 mg Xyla-zine and 200 mg Ketamine was administered with a second dart. He was now fully immobilized and his wound on the right arm region (probably caused by a spear) was examined. The wound was infected. While wallowing, the bull kept the affected leg under water probably as a protection from flies and to get the soothing effect of the cool running water. No foreign body could be located inside the wound. The pus was completely drained, the wound was dressed with tincture of iodine and a fly repellant cream was applied. A long acting antibiotic and NSAID was injected.

The bull was about 60 years old with large areas of depigmentation over the dorsum of the trunk and forehead. The outer borders of the bull's ear pinae had massive corrugations coupled with loss of pigments reflecting his advancing age. It may be noted that until they are very old, the skin depigmentation in elephants of North-east India is much less compared to those in the rest of the country and may be due to the low intensity of the sun and moderate climate. The wound healed in a couple of days and then he was shown his way into the Dibru-Choikhowa National Park using *koonkies.*

Case #5

The infamous elephant poisoning case of Nameri which killed as many as 16 wild elephants in 2001 had serious fallout for another young tusker who lost all the members of his family in the tragedy when he was too young to understand. The calf was barely a year old when he became orphaned and missed the normal learning process that is part of growing up in a social atmosphere. He grew in solitude, loitering aimlessly and sometimes even entering villages. As he grew up to be a young tusker, his visits to the villages started creating trouble. Then he made things worse for himself by knocking down a woman in a paddy field in broad daylight. After about a month he was spotted inside the park limping

severely with pus oozing out from a huge swelling over the right arm region. He was captured by noosing, for which wildlife departmental *koonkies* were used.

The bull calf was sedated with 150 mg of Xylazine and 100 mg of Ketamine administered by a hand held syringe using the *koonkies* to squeeze him between them for restraint. As the anesthesia was induced, the opening of the abscess was enlarged, pus drained out and the cavity was explored. A metal piece, the tip of a spear broken from its bamboo handle was recovered from the depth of the wound (Fig. 1). The spear tip was 13 cm in length. Antibiotic and tetanus prophylaxis was administered and the calf made an uneventful recovery.

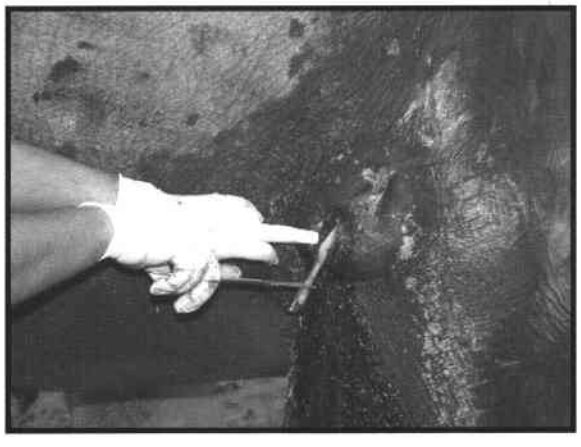


Figure 1. Spear tip recovered from the young bull of Nameri.

Case #6

Another bull calf of similar age (approximately 5 years old) was spotted wandering aimlessly in the fringe of a tea garden in the north of Durrang district (Fig. 2). He was behaving erratically and even walked into the labour lines in broad daylight. There was a deep puncture wound on his right forearm region oozing blood. Unfortunately, the calf died before medical care could be arranged. A necropsy was performed and a deep gaping wound was discovered on his right arm region, which, on dissection revealed a burned deep circular hole to the depth of tissues up to the bone. The wound was apparently caused by a red hot spear stabbed into the elephant. Some undigested rice was also recovered from his stomach, but whether it contained any poisons could not be confirmed.



Figure 2. Young bull killed in Darrang district, probe in the arm shows the spear injury.

Case #7

Yet another towering older *makhna* was noticed lame on his right foreleg by the forest guards in the Laokhowa Wildlife Sanctuary. A deep circular cut mark was also observed in his tail. He was tranquilized on 15th of March, 2006 by darting him from the ground using 500mg of Xylazine and 300 mg of Ketamine which was supplemented by a second shot of 200mg of each of the drugs 20 minutes after the first shot. It was interesting to note that when he was located, he was wallowing in a stream inside the park dipping his tail under water in an attempt to avoid the annoyance of flies. When the bull was completely still, he was approached and a deep hole was discovered on the inside of his right arm region. The channel was probed but no foreign body could be recovered; probably a pointed spear used by fishermen of the area was thrown and pierced him, but he might have removed the object with his trunk. The cavity was curetted and dressed with tincture of iodine.

The circular cut in the middle of the tail was curious as the injury appeared quite mysterious (Fig. 3). No person could have inflicted an injury like this as it cut into the tissues uniformly from all sides of the tail at the same level. It resembled an indentation that develops around

the trunk of a tree that is tied with a metal ring at a young age and as the trunk grows the ring cuts into the wood. There were a few maggots at the margin and the wound emitted an offensive smell. It was very painful to touch and the animal moved the tail when handled even at the height of the sedation, and once even raised his right hind leg to kick. The absence of *koonkies* was felt while handling him. However, a jute rope was used to tie the hind legs in a figure of eight knot, and then the tail wound was handled. On careful exploration, a plastic ring was discovered at the depth of the wound, which was carefully cut and removed. The circumference of the ring was 29 cm whereas the circumference of the tail at the area was 44 cm. How and when the bull got it tied around his tail remains a mystery. His tail was full size around thirty five years ago and could the plastic remain intact for such a long time if it was there for so many years? Why and how would one tie a knot around the tail of a wild elephant? Was it a feral elephant? But no evidence of a past captive life like scars around the neck or the legs could be seen. It seems this mystery will never be solved.

A few other tennis ball sized swellings, one at the left arm region and two on the right buttock were also noticed as testimonies of gun-shot wounds that he must have received as punishment for raiding crops or villages. A long acting antibiotic, NSAID and tetanus prophylaxis was injected. The tail wound was dressed, antiseptic and fly-repellant cream was applied liberally. The bull made a quick recovery from the leg and tail wounds.



Figure 3. The bull of Laokhowa with the plastic band cutting into the tail.

Summary and conclusion

The foregoing discussion of treatment rendered to wild elephants injured in the hands of humans in the North-eastern region of India is probably only a tip of the iceberg; there are scores of other elephants which received minor injuries caused by retaliation by farmers when their crops or villages had been raided. This author has seen many wild elephants with visible swellings in different parts of their body mostly caused by shots from firearms. The human-elephant conflict situation is becoming worse with every passing year. The attempts by the government and non-government agencies are falling short in resolving the conflict as fresh areas are being opened by land-greedy farmers and elephants are progressively losing their areas to humans. Some conclusions that the author seeks to draw from his experiences of treating the injured wild elephants in the North-eastern region of India could be summarized as follows:

1. Wild elephants respond to treatment well, and it is worth attempting to render medical care to save the life of an injured wild elephant rather than allowing it to die painfully.

2. Wild elephants keep exudating wounds submerged under water to get relief from pain and the annoyance from flies; many gaping wounds would probably heal naturally if there are suitable water bodies in the area.

3. A considerable amount of supplies and expertise are required on the part of the team attempting such a medical care operation.

4. *Koonkies* are very useful in handling sedated animals for the safety of the operating team.

5. All the elephants that were found injured were males, though the percentage of females in the elephant population of the region is quite high; adventurous by nature, and loose attachments with the herds probably exposes males to injuries more frequently.

6. A rapid reaction team of experts with all needed supplies should be constituted for such purposes by the government to be able to help

an injured wild elephant, as early treatment is likely to yield better results.

7. Serious attempts should be made to reduce the human-elephant conflicts to eliminate such man-made injuries in wild elephants.

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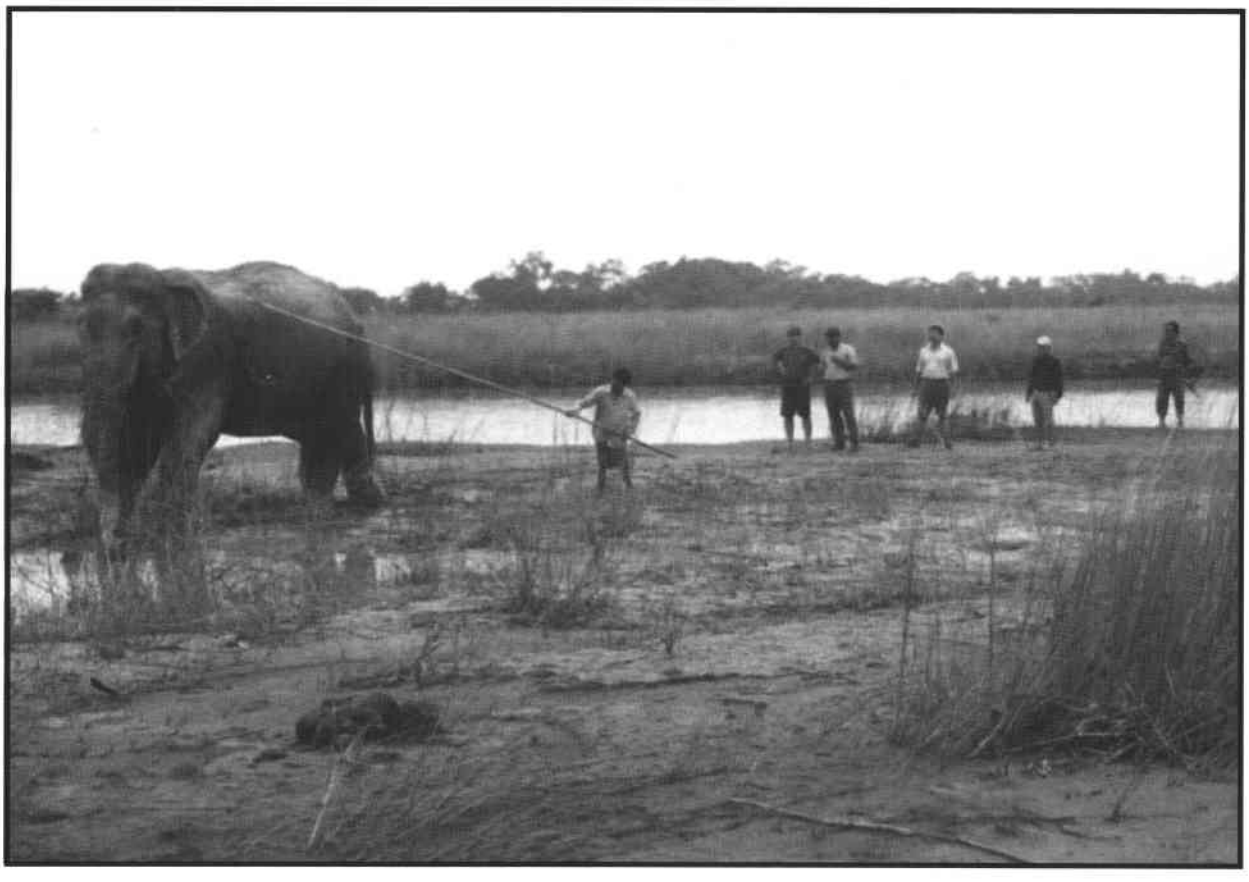


Figure 4. The old bull in the Brahmaputra near Dibrugargh.

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Commentary

Simon Hedges

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In an influential and still widely-cited article, "An Elephant Crackup?", published in the New York Times Magazine in October 2006, Charles Siebert reports on work by Gay Bradshaw and several of her colleagues and argues that elephant populations are "suffering from a form of chronic stress", "that what we are now witnessing [is] a precipitous collapse of elephant culture", and that elephants are seeking revenge on humans as a result. He writes, "[all] across Africa, India and parts of Southeast Asia, from within and around whatever patches and corridors of their natural habitat remain, elephants have been striking out, destroying villages and crops, attacking and killing human beings" and "it is not only the increasing number of these incidents that is causing alarm but also the singular perversity — for want of a less anthropocentric term — of recent elephant aggression."

Siebert goes on to write, "[the] fabric of elephant society [in parts of Africa], Bradshaw and her colleagues concluded, had effectively been frayed by years of habitat loss and poaching, along with systematic culling by government agencies to control elephant numbers and translocations of herds to different habitats. The number of older matriarchs and female caregivers (or 'allomothers') had drastically fallen, as had the number of elder bulls, who play a significant role in keeping younger males in line. In parts of Zambia and Tanzania, a number of the elephant groups studied contained no adult females whatsoever. In Uganda, herds were often found to be 'semipermanent aggregations,' as a paper written by Bradshaw describes them, with many females between the ages of 15 and 25 having no familial associations." These are real and pressing problems, and should be acknowledged as such by those concerned about elephants, but I think Siebert goes astray when he tries to generalize from such findings to suggest that elephants are exhibiting "a kind of species-wide trauma" (although he does not say which species he is referring to here the article implies all elephant taxa are affected) and that human–elephant conflict can largely be attributed to this phenomenon.

To support this contention, Siebert suggests that human–elephant conflict is a relatively new problem, or at least that it has only recently become significant; take, for example, his comments, "these attacks have become so commonplace that a whole new statistical category [sic], known as Human-Elephant Conflict, or HEC, was created by elephant researchers in the mid-1990's to monitor the problem" and "'[everybody] pretty much agrees that the relationship between elephants and people has dramatically changed,' Bradshaw told me recently. 'What we are seeing today is extraordinary. Where, for centuries humans and elephants lived in relative peaceful coexistence, there is now hostility and violence'". However, human–elephant conflict is not a recent phenomenon: crop depredations by elephants have long been widespread in both Africa and Asia. In Africa, pre-colonial and early nineteenth century historians describe areas where elephant crop depredations caused food shortages or forced people to relocate their settlements, and some authorities believe human–elephant conflict has been a problem since the beginning of agriculture (Bell 1987; Naughton *et al.* 1999; Naughton-Treves 1999; but see Martyn 1991). In Asia, ancient Indian sources refer to conflict between elephants and agriculturalists as early as the fifth or sixth century B.C., and again both the pre-colonial and colonial era literature refer to crop depredations by Asian Elephants (Sukumar 2003). Records of extensive killing of elephants also go back for centuries (Sukumar 2003), yet there is no evidence to suggest these have played any role in increasing elephant attacks on humans or their property in the long term. The pattern that emerges consistently is

one of competition for resources, particularly space, food, and water.

Nevertheless, human–elephant conflict is apparently intensifying, and it is now identified as one of the most serious threats to elephants in both Asia and Africa despite the fact that habitat loss and hunting have reduced the geographical range and numbers of Asian and African elephants alike (Hoare 1995, 2000a; Kangwana 1995; Barnes 1996; Kemf & Santiapillai 2000). A partial explanation of this seemingly paradoxical situation is that where elephants persist they are often forced into close contact with people, and contemporary social conditions often lower people's tolerance of elephants (Naughton *et al.* 1999). Siebert's article seems to downplay this—to my mind—important human dimension to the problem. It is not just to elephant psychology that we should be looking when seeking to understand and reduce human–elephant conflict: human psychological, sociological, and economic factors need to be considered too.

It is clear to many of us, therefore, that conservationists need to increase local people's tolerance of elephants. This will require reducing crop depredations, which in turn will often require a better understanding of why elephants are raiding crops in the areas affected (e.g. Naughton *et al.* 1999; Hoare 2000b; Sukumar 2003). It is also important to recognize that no single factor will explain human–elephant conflict across Africa or Asia. As Richard Hoare notes, elephants and agriculture meet and mix in many different ways with varying consequences (Hoare 1995). As a result, the development of data collection systems that describe site-specific characteristics but which also contribute to a general understanding of human–elephant conflict has been identified as a priority need (Parker & Osborn 2001). The African Elephant Specialist Group's development of practical tools, including a standard Data Collection Protocol, is helping meet this need (Hoare 1995, 2000b; Dublin 2003) both in Africa and in Asia where the AfESG's tools have been modified for use in Asian conditions (e.g. Hedges 2004). Other standardized protocols have also been developed (e.g. WWF 2005).

Nevertheless, much uncertainty still exists about the actual magnitude of human–elephant conflict. Those of us of who work in this field know that rural people's memory of when incidents occur is often faulty, and that something which occurred, say six years ago, is repeatedly reported as having happened last year. Siebert actually gives examples of this in his New York Times Magazine article. In addition, farmers often exaggerate crop losses caused by elephants in the hope of receiving compensation or other assistance towards reducing the problem (Bell 1984; Naughton *et al.* 1999; Hill *et al.* 2002; Hedges *et al.* 2005). Furthermore, the damage caused by other species, especially rodents, primates, birds, or insects, is often greater than that caused by elephants (Naughton *et al.* 1999; Hill *et al.* 2002; Hedges *et al.* 2005) but because elephants are large dangerous animals that often injure or kill people during crop raiding incidents, the reactions they inspire are far stronger than those generated by smaller and less dangerous animals. As a consequence people living in central African forests "fear and detest" elephants (Barnes 1996). Many similar examples could be listed for other parts of Africa and Asia. As Naughton et al. (1999, page 6) note "This animosity is an ominous sign for future elephant survival, particularly given the trend toward decentralized wildlife management throughout Africa. Under current conditions, most local farmers would eliminate elephants from their environment if given the choice." Even when such extreme reactions are not the case, people affected by elephant depredations typically demand protection or compensation from government authorities, and if this is not forthcoming they will often retaliate by killing elephants themselves or by facilitating access to the area by poachers. More generally, people can express their frustrations by sabotaging conservation and development projects (Hill *et al.* 2002).

For all these reasons it is imperative that the conservation community continues to address human–elephant conflict as a matter of urgency but I do not believe it is accurate to suggest that elephants are undergoing a taxa-wide stress-induced "breakdown" and are will fully targeting humans as a result. While few would

doubt that stress can result from the disruption of elephant social structures, portraying human–elephant conflict as a vendetta issue is not so much missing the point as actively misleading. It also belittles the complexity and importance of the problem and diverts attention away from its real causes and potential solutions.

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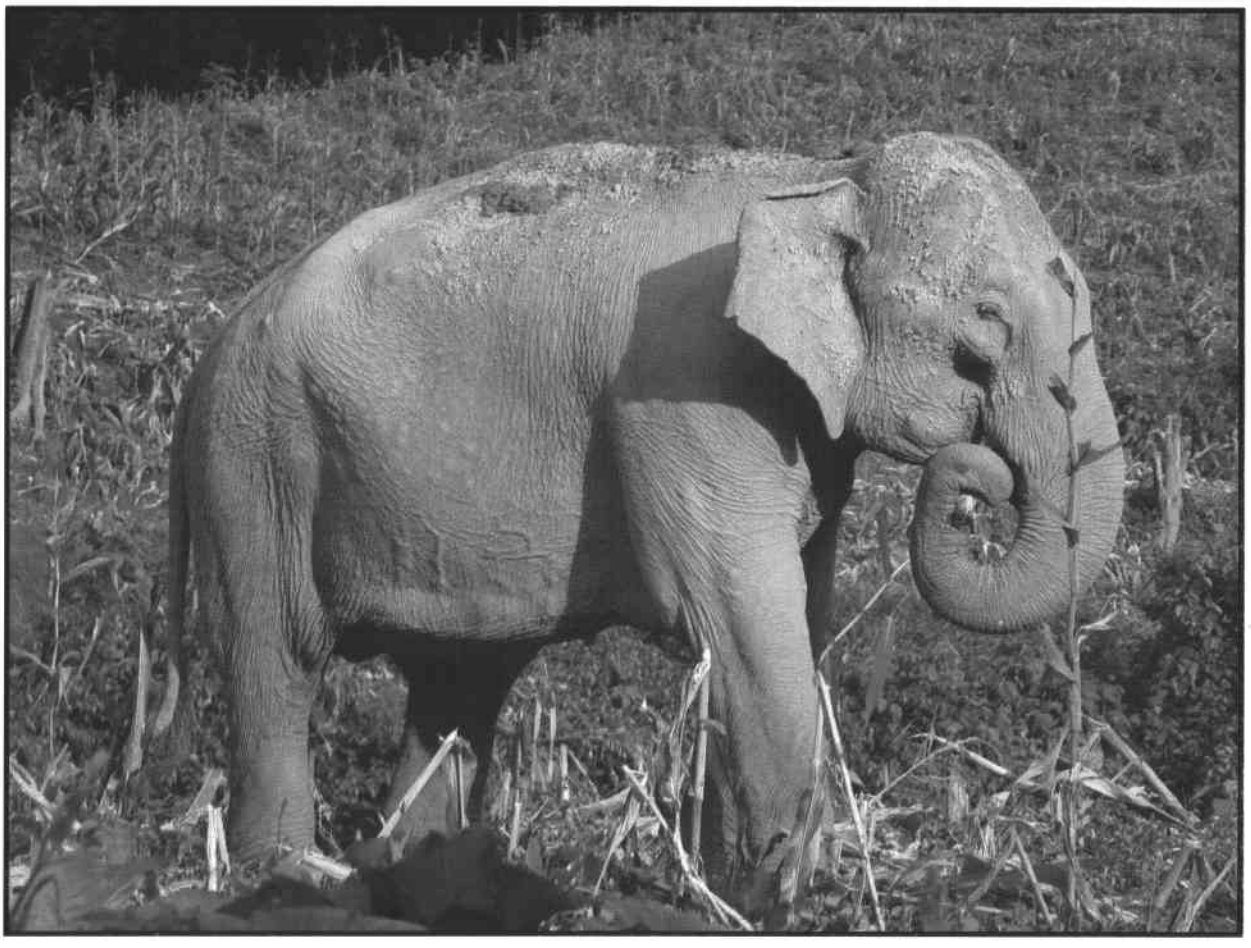
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Elephant in China
Photo by IFAW

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Elephant Response Units (ERU)

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Following is a summary of a discussion initiated in March 2006 by Dr. Meenakshi Nagendran of the U.S. Fish and Wildlife Service. Inputs were received from members of the Asian Elephant Specialist Group from various Asian Range States. Heidi Riddle edited the collective inputs and the main points are published below.

The idea suggested for discussion is the use of Elephant Response Units (ERU) to mitigate for human-elephant conflict (HEC). ERUs would be a committed group of individuals who respond to the presence of a wild elephant or a herd near a village, and effectively drive the elephant or herd back into the forest/natural habitat. Potentially such elephants could also be fitted with GPS collars so one could have advance warning about the approaching wild elephant/herd. ERUs may not be feasible for every village but might be feasible at a district level. Captive elephants could be used to drive back unwelcome wild elephants from villages.

Regional experiences

Sri Lanka

The Department of Wildlife Conservation (DWC) in Sri Lanka had initiated in 1968 what they called Elephant Conservation Units (ECU). Three ECUs had been established to cover three provinces. Each ECU had about 15 DWC personnel and a jeep. Their main function was to provide villagers with guidance and assistance to manage crop raiding. Generally the villagers with problems went to them and the ECU would do a site visit and advice the villagers on what and how they should work to minimize raiding. The ECU also distributed Elephant Thunder Flashes and flares. There was no radio collaring but they did chase elephants and there were also some major drives to move large populations of elephants to the closest national parks during the late 60s and the early 70s.

Currently whenever elephants raid crops, the villagers complain to the DWC and officers chase the elephants. The greatest value in the exercise is that it may help the relationship between villagers and authorities.

However, in general ERUs in common with activities like driving, translocating, and fencing, ultimately end up becoming an end in themselves and a substitute for a conservation strategy. Consequently, it ends up being a 'strategy' that is basically putting out fires and not addressing the causation - which soon becomes a treadmill. Using such activities as strategies rather than tools to achieve a particular end in a planned conservation strategy makes them largely useless at best and detrimental to conserving elephants at worst. While ERUs and other such tools are of use in some particular instances, they are not a panacea for HEC, and may end up creating more problems than they solve when used out of context of a proper conservation strategy.

Specific problems associated with 'chasing' elephants through ERUs are:

- Elephants become unresponsive to things like firecrackers and firing in the air, ultimately leading to the drive either becoming ineffective or having to resort to more lethal deterrents such as shooting.
- State sponsored ERUs also reinforce the idea that the state is responsible for protecting people from raiding elephants, leading to worsening of relationships when the elephants become unresponsive to chasing and/or the authorities cannot respond quickly.

- When elephants are 'chased' from one locality, they probably just move to another locality, which is not so protected. Because elephants have large ranges, the area of HEC is vast, and it is not logistically possible to undertake such activities across the entire area. So one ends up chasing elephants from one crop area to another and back again.

Like almost all Asian elephant issues there are no data on the elephant side of HEC and raiding. Given the scale of the problem, the costs of using GPS collars as a warning method is economically or logistically difficult. However, if used in a proper study, such collars would provide baseline data on elephant raiding behavior and their response to activities such as chasing, which will be extremely useful for developing a manage-ment strategy and deciding the appropriate use of different tools.

With regards to using captive elephants to chase crop raiders – some things to consider are that raiding occurs at point locations over a very large area (a single elephant can move 10 km a night, they have ranges that cover tens to hundreds of square km), occurs almost exclusively in the night, mostly in remote areas without electricity.

ERUs could be a useful tool in particular instances, if used as part of a conservation strategy, with a clear idea of what one is trying to achieve, but could too easily become a liability if used inappropriately.

India

In North Bengal a system of wildlife squads guide and assist communities in driving away elephants while distributing crackers, torches, etc. These squads communicate with and operate through local eco-development and forest committees and receive substantial support from these. In addition to being somewhat effective in preventing crop-raiding (to be carefully assessed) these squads provide a very visible demonstration of the government's resolve in addressing conflict issues thus enhancing the wildlife department's image. They are also equipped with tranquilizing equipment and necessary training in its operation and can intervene fairly rapidly if elephants have to be captured.

It is important to discuss land use issues. In countries like India where the density of humans and settlements is high, the point of no return for effective land use planning may have been reached.

However there are still a few kinds of landscape transformations that could be targeted for HEC mitigation.

1. In Eastern India (West Bengal, Orissa and Jharkand) social forestry plantations maintained through joint forest management have exacerbated elephant human conflict. These plantations increase forest cover and provide elephant "colonizers" access to crop-lands (e.g. the rich vegetable gardens in south West Bengal are today more attractive than habitats in Jharkand (formerly Bihar) battered by mining and other forms of development). These mono-culture plantations have little in the way of elephant food species, so all elephants sheltered within crop-raid incessantly (and kill scores of people while doing so).

2. In several parts of India, degraded forests are often converted to Eucalyptus and Acacia plantations and form "bivouacs" for raiding herds. Despite recommendations that these should be de-foliated, the forest department is reluctant to do so given the plantations' high revenue generating capacity. These are often patchy or have tattered edges making them difficult to barricade and increasing the interface with human settlements.

3. National Parks on the edges of some major Indian urban centres (e.g. Bangalore and Bhubaneshwar) maintain artificially inflated densities of elephants due to habitat enrichment (e.g. water holes, salt-licks, etc.). These areas are usually sinks for source populations living in less attractive, though more natural areas.

4. Disruption of elephant flow along corridors is a significant cause for conflict. There has already been much talk about this.

5. The loss of natural forest cover in tea-plantations and proliferation of paddy cultivation within, are frequently cited as an example of conflict in West Bengal and Assam. Given the recession in the Indian tea-industry, this is presently a complicated issue to address.

6. Alternate cropping is an attractive solution and would require collaborations across several agencies.

With respect to the "self-help" conflict resolution committees, unfortunately the prevailing sentiment in most of India is that elephants are government property and thus compensation (cash or kind) for their existence should be borne by the government. This sentiment has been re-enforced by large grants from multi-lateral agencies and the budgets of federal agencies like Project Elephant that get bigger very year. The concept of local communities being more empowered to source de-centralized funds from existing donors as well as others (e.g. through corporate social responsibilities) could reverse this sentiment and make communities more accountable in conflict management.

Northeast India

There is a need to decentralise the protection to the local farmers. Otherwise HEC schemes work as long as they are supported, funded and under the supervision of wildlife biologists. They fall apart the moment the support group leaves. This is landscape level HEC mitigation work, but has a big local component to it.

In the North Bank Landscape (NBL) in Assam, Anti Depredation Squads (ADS) have been established:

- There are 50 ADS, based purely on volunteers from the villages, like a chain along the southern boundary. This comes from watching such squads function in North Bengal.
- In cooperation with the forest department, a chain of 14 kunkies (i.e. trained elephants) was set up along the southern boundary of NBL.
- In many cases local people know that the conflict is mainly because of habitat loss of a recent nature, but were angry because no forest personnel came and shared their loss or grief when elephants raided.

For two years now, there are declining losses of elephants and 80% of the drives by ADS to push the elephants back into the forest have been successful. To make it more local and sustainable, groups are encouraged to become almost like registered local societies or NGOs that can then source funds directly to carry out their anti-depredation work. The current problem is that funds are not reaching the ground. So if these local groups can be formal and become civil society pressure groups, they can put pressure on their local politicians to make sure that the money reaches the ground and is spent in a way that is meaningful to them.

The challenges:

1. In some places people can get very angry and manhandle the forest personnel. In one such case, a decision to undertake a major drive got postponed for two weeks. A group of over 100 elephants mulled about for two weeks and ended up killing 3/4 people in addition to destroying huts.

2. Possible Solution: Police security for forest personnel who conduct these drives. The tea gardens in which this type of incident happens need to invest time and energy to prevent this from happening. Maybe fencing in the people since most of the deaths occurred in the nights. Tea gardens maintain some of the best fences, but their temporary labour is not protected.

3. The ADS are quite functional during the conflict season, but very laid back in talking about a more formal structure in the non-crop raiding season.

4. It is very difficult to find trained kunkie elephants. A trained kunkie actually participates in these drives by moving to

cut off stragglers, etc. An elephant training school needs to be established in order not to lose this art form. There are very capable people in Assam, but they need more support to get this going.

One fortunate situation is that the Government in India by law is forced to defend elephants very rigorously and there are outcries against any elephant deaths, which forces the retaliatory killings (or captures) to be stopped instead of getting carried away. Also while it is very easy to say that these elephants who have lost a significant portion of their home ranges to humans have no future, we have to learn to conserve elephants who live part of their time in human dominated landscapes.

Malaysia

At the moment, one of the elephants collared in Kinabatangan Wildlife Sanctuary provides good information on movement and habitat utilisation. The information gathered from this activity provides data on which area should be maintained or is critical for corridor. A long term solution or mitigation focus in Kinabatangan would be providing a continuous corridor for the elephants. Using an elephant to control elephant encroachment in Kinabatangan would be a new issue for the villagers, since the villagers' culture is not related to the elephant, unlike India or Sri Lanka.

The main problem for the work in Kinabatangan includes:

- Lack of communication system/network, where data on elephant location (in real time) can be channeled, perhaps a long range radio could solve the issue. At the moment, data on elephant location is provided every 3 days to the local wildlife office in Kinabatangan so they can monitor the movement.
- Only one elephant in a group (where this elephant represents 40-60 elephants, from 120-150 elephants) is collared. There is a need to use another 2 satellite collars, since the elephants sometime split into several groups when they enter the village areas.

Using captive elephant to mitigate the elephant conflict in Kinabatangan would

- require higher costs (for elephant food and maintenance).
- be suitable for short term mitigation measure.
- not be suitable for the culture in Kinabatangan.
- need a cost-benefit analysis - for long term solution in reducing HEC, providing a continuous corridor would be able to reduce encroachment into the village area.

North Sumatra

Using camp elephants to drive wild elephants in HEC areas is the immediate response usually applied by several patrol teams as part of HEC mitigation.

During the driving, the patrol team is also doing assessments on the various aspects involved in the conflict. The two most important things are the likely viability of the elephant population involved in the conflict and the condition of the habitat in the conflict area. This is very important, because the human-elephant conflict situation is very site specific. So, before we start to think about a trial for any method, we need to ensure having the information about these two aspects, otherwise we may be in danger of wasting resources and ignoring the elephant conservation aspect of the conflict resolution.

One example is Saree-Aceh, where conflict incidents occurred several times a year. In this location, implementing various physical and psychological barriers, which may cost a lot of money, may help the community but never the elephants. This is a group of 11 all female elephants wandering in an isolated small block of forest that is already separated from other forests by the development of roads and residences. Unless this group can be connected to others by maintaining corridors, or transporting them to other viable habitat with more genetic resources, this group will not sustain itself. Having GPS collars would be very useful to verify whether this group uses other habitat and connects with other groups, before considering whether to translocate this group or rebuild the corridor.

The opposite case is the conflict in Aceh Tenggara, at the edge of over 1 million hectares of continuous and protected habitat. In this case there is no reason to capture or translocate the animals. Various methods, such as barriers, could be applied and tried for this case. Whatever the option, barriers potentially work if they are properly designed and applied in the right conditions. Of course ditches will not work if applied in a swamp, or power fencing with no power or maintenance, etc. There have been both failures and successes of some barriers; the success is mainly dependent on how people apply it. The failure may not be caused by a method that is wrong, but by the wrong way to implement the method.

The other option is to have alternative land use, without trying to limit the elephants' natural movement pattern drastically. If people grow crops not liked by elephants, they can still use the area for a migration route with minimum impact. This approach needs an involvement of regulatory framework and should be part of the land use planning policy.

South Sumatra

Some experiments with Elephant Response Units - called Crop Protection Units - in southern Sumatra (at Way Kambas National Park) were found to be counterproductive (and certainly not sustainable) because they encouraged the farmers to rely on outsiders to solve the HEC problem for them rather than adopt and use low cost/low tech methods themselves. This experience is a common one and has resulted in a growing recognition of the need to decentralize responsibility for crop protection to the farmers themselves. Current work at Way Kambas NP aims to facilitate local self-reliance, while also providing new tools and ideas from the experiences of others working on HEC elsewhere in Asia and in Africa.

The relative ineffectiveness and expense of most large-scale methods of reducing human-elephant conflict, including electric fencing and translocations, have led to increasing calls for the development of land use plans that address human-wildlife conflict and other conservation issues. In theory, addressing human-wildlife conflict at the planning stage could help prevent conflicts, although in many areas settlements are too well established for such an approach. Moreover, it is now generally accepted that the resolution of human-elephant conflict will require small-scale, site-based, participatory approaches to the crops farmers select, the way they lay out their fields and the methods they adopt of keeping elephants out of their fields.

A key strategy in many places is likely to be the creation of buffer zones between agricultural areas and elephant habitat (including but not limited to protected areas). The creation of buffer zones will help to establish a zone of 'reduced attractiveness' between the crop fields and the elephants' habitat. An optimal buffer zone should contain unpalatable crops grown adjacent to sub-optimal elephant habitat. Furthermore, the active management of a buffer zone with low-cost string fences, coupled with a vigorous deterrence regime, may instill recognition in elephants attempting to raid that the fence demarcates a "no-go" area. Increased farmer vigilance together with a new range of deterrents seems to reduce the damage caused by elephants, but convincing farmers that they can - and should - take responsibility for protecting their own crops is the key to the success of this approach. The central theme that emerges from examination of the failures of intervention is the need to decentralize responsibility for crop protection to the farmers. This represents a considerable shift in thinking, because farmers have historically depended on centralized PAC [Problem Animal Control] units to reduce this conflict. Furthermore, the methods adopted need to be financially and technologically within the capacities of the people implementing them if they are to be sustainable.

The use of telemetry

Integrating new technologies such as GPS telemetry, etc., into the operation of potential ERUs may be a very good idea but there are some issues to be initially considered. The expense of telemetry ($4000-5000 per GPS transmitter/collar + costs of associated IT and

other running costs e.g. immobilization, etc) places a limit on the number of elephants that can be collared. The question is, for a given area, what is the optimal number that needs to be tagged? Of course if we know that most HEC is caused by a set of recognizable animals the answer is fairly trivial. But what if most elephants crop raid, like in North Bengal? We may be assisted here by one facet of elephant ecology that needs to be looked at. Anecdotal information from India seems to indicate that in fragmented habitats elephants tend to aggregate in large numbers during the harvest season, and such aggregations may be responsible for a high proportion of crop raiding incidences. Thus if we could determine how many such aggregations do occur and how fluid are these aggregations, we may have some clues to the number of animals we may need to tag. Obviously this itself is an independent study but must be carried out if we were to use this technology.

Even though the costs of telemetry appear high, a cost benefit analysis may ultimately indicate that knowledge of the real time location of raiding aggregations could offset costs associated with the search for offending aggregations, crop and property damage caused by late arrival of squads and the lack of coordination in planning interventions and consequent increase of risks to personnel.

A project in West Bengal began with the older technology satellite transmitter (PTT) being attached to a bull. But PTTs do not work very well under heavy cover and several triangulated locations have too large an error bar to be useful. However the intention was to demonstrate the use of this technology as one that could provide "early warning signals" for pre-empting conflict by habitual raiders.

The project then moved on to GPS. There are four elephants fitted with such transmitters with the data being downloaded, decoded, put on maps and the maps sent daily by email to a number of wildlife officials in West Bengal. The basic idea of this programme is to test and develop the technologies needed for "real time" transmission of locational data of crop raiding elephants to wildlife authorities with the explicit intention of pre-empting elephant-human conflicts. It is quite encouraging that wildlife staff found two of the collared animals with crop raiding cohorts and, spontaneously realizing the relevance of this technology, requested locations closer to "real time".

If collaring is chosen as an option, it is advised to use GSM collars tied to a GPS like the ones used in Iain Douglas-Hamilton's study in Africa. These have a higher likelihood of real time data flow than GPS collars and are cheaper (cost around US$ 2000/- plus airtime).

The experience with GPS-satellite collars in Sabah, Malaysia is that the success rate of locations is good in deciduous habitats, moderate in fragmented-degraded evergreen habitats and only 20-30% of attempts result in a successful location under very thick canopy. So this would not be good for real time data flow that would be required to pin point areas of incursion into human habitats. The one way to potentially work around this is to use existing GPS satellite collar data and model the time series incursions to build a GIS model to predict future incursion areas based on the last location. This is very time consuming and would need investment in human and hardware resources at a local site.

Conclusion

It appears that variations of the ERU theme are being applied across the range. There may be no need to change anything in certain places, and there may be a need to explore different approaches in other locations. Captive elephants, where they are not part of a culture, should likely not be introduced into a culture for various reasons. Yet habitat maintenance, enhancement and corridors are the most important issues.

Some countries have a lot of elephants in captivity currently, but very few of these are "kunkies", although some projects use captive elephants for patrolling purposes in forests. In regions where there are captive elephants, some of these elephants may also be good means of transportation for tourists into forests for viewing wildlife. It is also important that

revenues generated benefit local people, and not just corporations, so the benefits of wildlife and their habitats are more than a buzz-word for locals.

There are numerous means to address HEC mitigation, and these are tools, which would be effective for a while. With creative permutations they could be effective for longer periods. Only if local communities become involved with the mitigation processes can there be sustainability. Every technique faces numerous challenges, but the HEC mitigation tool box combined with good policy would, for the most part, be good for elephants and people. Translocation should be an outlier, to be carried out only under extreme circumstances, and should be well researched as translocated elephants are further likely to be involved in HEC at another location.

There are a few projects trying hard to protect existing habitat, and a few that are acquiring more habitat. The creation of corridors, protecting, enhancing and increasing habitat should become policy decision at National and State levels. Land use issues and policies should also be addressed by National and State agencies. Then there is the human population dimension and corporations going wild with unsustainable resource extraction and land conversion.

Clearly a multi-disciplinary approach to wildlife management is necessary, especially when dealing with problems such as those faced by Asian elephants, in the face of exploding human populations and rapidly rising economies.

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Notes from the Co-chairs IUCN/SSC Asian Elephant Specialist Group

Simon Hedges[1] and Ajay Desai[2]

Firstly, we would like to take this opportunity to thank Jayantha Jayewardene for his time and efforts as the new editor of *Gajah* and to thank the former editor, Charles Santiapillai, for his sterling efforts over the preceding years. We intend that *Gajah* will be published twice a year, in January and July. It will be published in both hard copy and electronic (PDF) versions available for download from the World Wide Web. The International Elephant Foundation, Singapore Zoo, and the US Fish & Wildlife Service have all indicated a willingness to fund *Gajah*. We encourage you all to submit articles for publication in *Gajah* as its success will depend on the willingness of the AsESG's members to publish in the journal.

Last year was characterized by the increasing participation of the group's members in AsESG activities, starting with the debate over the future of *Gajah* and continuing through the whole-group review of the IUCN Global Mammal Assessment (GMA) entry for the Asian Elephant and related preparations for an updated IUCN Red List entry for the species, and including the group-wide review of the proposed Elephant Rescue Centre for Project Elephant (in India). This last example is particularly heartening as it shows that Governments are willing to look to the AsESG for support and advice; this willingness was also evident during the Asian Elephant Range States' Meeting in Malaysia in January, which was facilitated by an IUCN/SSC team including the AsESG's two co-chairs.

In the latter part of 2006, the group also discussed the creation of AsESG Task Forces, and again it was heartening to see a diversity of views expressed. A final review of the various inputs is now in hand and by the time you read this the Task Forces should have been created and begun their work. An AsESG listserv/forum board was proposed by us but the membership thought that this was unnecessary (citing low participation in other related listservs). Nevertheless, we feel that with time it may be useful to review that decision as members are increasingly drawn into the group's activities, particularly those of the Task Forces.

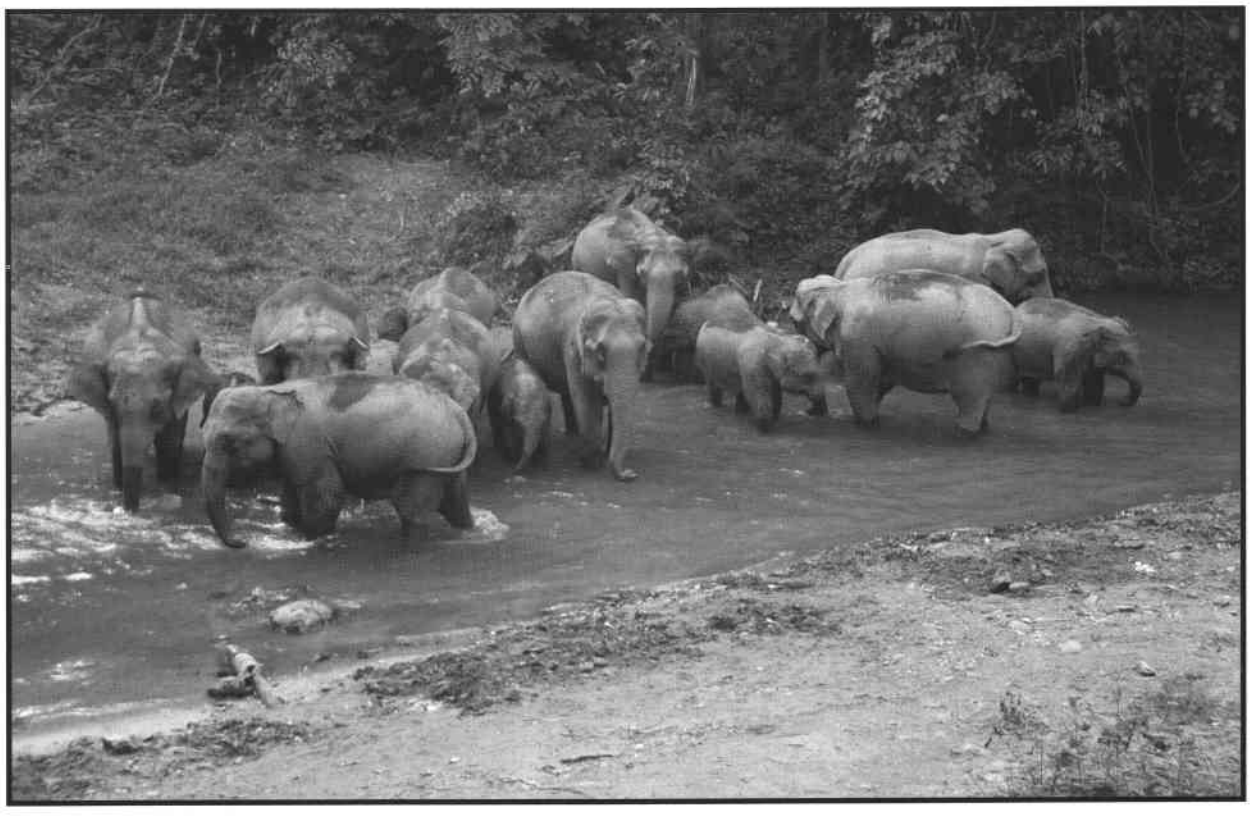
As co-chairs, we have endeavoured to make sure that group's members are made aware of the funding opportunities that are available for Asian Elephant conservation projects, and to inform members about people who wish to seek help from or work with the group – be it students, film makers, or other information seekers and potential collaborators. We would be grateful if members could continue to keep us informed of such opportunities so that we can circulate them to the wider group as appropriate.

Looking to the future, we hope to organize a Sumatran elephant conservation strategy workshop in 2007 and funds have been secured from WWF and the Wildlife Conservation Society (WCS) to that end. We are also looking at the possibility of holding an AsESG meeting in 2007 particularly if an opportunity to "piggy-back" on another meeting presents itself. Other activities that we hope will bear fruit in the near future include a "Human–elephant conflict in Asia" review publication, prepared by the AsESG and partners in Governments and NGOs, the purpose of which will be to provide a review of past Asian human–elephant conflict mitigation practices and a discussion of successes and failures. The US Fish & Wildlife Service has informed us that it would be happy to fund such a review. Another likely group project will be the creation of an Asian Elephant Database similar to the widely used African Elephant Database. Both the database and human–elephant conflict review ideas received governmental support at the Asian Elephant Range States' Meeting in 2006.

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Elephants in China
Photos by IFAW



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Sumatra Mahout Workshop Leads to New Communication Forum

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Due to problems faced by the Pusat Konservasi Gajah (PKG) or Elephant Conser-vation Centers (ECC) and other elephant facilities in Sumatra, an idea was developed to conduct a mahout workshop and find solutions to these problems. The first Sumatra Mahout Workshop was held November 29-30, 2006 in the Elephant Conservation Center of Bengkulu, and was facilitated by Balai Konservasi Sumber Daya Alam (BKSDA) Bengkulu (Nature Conservation Agency), the International Elephant Foundation, and Fauna & Flora International.

The intent of this workshop was to bring together Sumatran mahouts from all the different elephant conservation centres, elephant management units and conservation organizations to discuss the various issues in these facilities, as well as conditions, technical and management problems faced by mahouts and PKG in their work with elephants and habitat conservation efforts.

The main result of this workshop was the creation of a Communication Forum among mahouts in Sumatra. This Forum establishes a means to address the mahouts' ambition of increasing their part in the development and management of elephant conservation centres, as well as achieving an agreement and understanding about the role of mahouts in the Nature Conservation and Forest Protection's (PHKA) scope to support elephant conservation efforts in Sumatra.

The workshop participants came from all over Sumatra: Tahura Bukit Barisan Tongkoh Berastagi (2), PKG Seblat, PKG Minas (3), PKG Sumsel (2), PKG Way Kambas (4), UPG Aras Napal (2), PKG Saree (4), CRU Tangkahan (2), PKG Holiday Resort Sumut (4), and Flying Squad Team (3).

The workshop was officially opened by the Director of Indonesian Biodiversity Conservation, Pak Adi Susmianto. Each PKG made a presentation about their situation (i.e. number of elephants, number of staff, specific use of the elephants, etc.) and any problems. This was followed by discussions on techniques and demonstrations of elephant care and management, and a general discussion session.

An important outcome of this meeting was the creation of the Sumatra Mahout Communication Forum (Forum Komunikasi Mahout Sumatera) whose initial membership consists of all participants attending the workshop.

The forum's vision is to achieve mahout professionalism in Sumatran elephant work and habitat conservation efforts; whereas the mission is to increase the capacity and competency of mahouts in Sumatran elephant work and habitat conservation efforts, to create an information and communication system between mahouts in Sumatra, and to increase the welfare of mahouts and Sumatran elephants.

To achieve the forum's goals, ongoing activities are planned:

- Increasing capacity and competency of mahouts in Sumatran elephant work and habitat conservation efforts through training and comparative studies, by creating mahout competency standards and certification, and by finding solutions to conflicts in PKG areas
- Creating an information and communication system among mahouts in Sumatra through a mahout-elephant database; issuing a twice-yearly updated information sheet; creating a website and a secretariat, and conducting an annual mahout meeting

- Increasing mahout and Sumatran elephant welfare through studies and recommendations to the government and other concerned institutions; incentive standardization in the PKG; professional allowance, insurance, staff status, on-time monthly administration management; camp facility renovations; recommendation and development of an ethics code; recommendations of elephant welfare efforts and fund raising by the Forum.

The Chairman of the Forum, elected by the members, is Nazaruddin one of the most senior mahouts in Indonesia from PKG Way Kambas, the elected Secretary is Khairil from PKG Holiday Resort (Sumatera Utara). The meeting also defined and elected other positions in the Forum organization such as Treasurer, Partnership Coordinator, Capacity Building Coordinator, Data and Information Coordinator, Mahout and Elephant Welfare Coordinator. Regional Coordinators, from each PKG province, were also elected. Adi Susmianto (Director of Biodiversity Conservation Ditjen PHKA) and Widodo S. Ramono are nominated to sit on the Forum Advisory Board.

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Participants of the Sumatra Mahout Workshop.
Photo by International Elephant Foundation

Book Review

"A Trunk Full of Tales" by D.K. Lahiri Choudhury

Reviewed by Jayantha Jayewardene

Prof. Lahiri Choudhury is a man of great stature. Not only physical stature but also stature of academic achievement, elephant knowledge, gentle and exemplary conduct. He is professor emeritus of English at the Rabindra Bharati University, Calcutta. In the field of elephants he is the author of many articles, papers, study reports and books. The quality of this book adds to his stature.

In A Trunk Full of Tales the professor gives the readers the anecdotal benefit of his long association and relationship with elephants with a wide spectrum of anecdotes and stories.

The first chapter titled Growing up with elephants is the longest. It deals with the author's personal interactions with elephants, which he has started at a young age. He talks of his Great Grandfather's involvement with elephants. He had 30 elephants in his Pilkana or elephant stables. What comes through in this chapter is the author's love for elephants, his intimate knowledge of elephants both tame and wild and the many activities that he has engaged in to understand, manage and conserve elephants.

In the chapters that follow he writes about individual elephants and their unique behaviour.

In the next section of the book the author deals with rogue elephants and marauding elephants that cause much damage to both crops and human lives. These are all elephants that he has had a personal experience with.

Professor Choudhury's love for elephants is also reflected in another way. He devotes a chapter to 'Lalji' Chandra Barua, perhaps India's best known 'elephant person' in recent times. The author covers the background of Lalji's ancestors, who were closely connected to elephants and some of these deeds. He also gives the detailed descriptions of the lives of some of the elephants that Lalji had. This chapter gives the reader a deep insight into the elephant world of that time.

In the chapter Rogues and Marauders, the author discusses elephant shooting in India and Sri Lanka, both as a sport and also as a means of protecting crops. He goes on to trace the development of legal protection afforded to elephants from the 19th century to date. This chapter also discusses the human – elephant conflicts that have developed.

The author's experiences with elephants over the years in Cachar, the Garo Hills, East and West Medinpur, Dalma and North Bengal follow. These chapters give the readers an insight into the conditions then and many descriptions of elephant behaviour. These chapters are full of anecdotes, which have a personal touch.

This book will capture the attention of anyone who is interested in elephants. The empathy and love that the author has for elephants, which comes through in this book will certainly whet the interest of the reader and maybe move them to some action towards the conservation of this majestic species.

A Trunk Full of Tales
D.K. Lahiri Choudhury
2006, Orient Longman (Pvt) Ltd, Delhi
ISBN : 81-7824-166-8
Rs.495.00

Appreciation

Professor L. Elizabeth. L. (Bets) Rasmussen (1938-2006)

By Heidi Riddle

On September 17, 2006, elephants around the world lost a great friend when Dr. L.E.L. (Bets) Rasmussen passed away. Bets was a Research Professor in the Department of Environmental and Biomolecular Systems at the Oregon Graduate Institute (OGI) in the USA. Bets received her A.B. degree in Biology with Department Honors in 1960 from Stanford University. She received her Ph.D. degree in Neurochemistry in 1964 from Washington University in St. Louis. Bets and her husband Rei Rasmussen (a professor of Atmospheric Chemistry at OGI) came to what was then the Oregon Graduate Center in 1977. During her studies Bets was the recipient of a National Institute of Health Predoctoral Fellowship and, in 1994, was awarded a Guggenheim Fellowship for her work on chemosensory signaling and elephant reproduction. Bets was a long-time member of the IUCN Asian Elephant Specialist Group.

Bets' animal-related studies started with sharks and rays and went on to include whales, dolphins, manatees and elephants. Her research focused on mammalian pheromone chemistry, and elephant olfaction became a passion. Bets did much of her groundwork with elephants in captive facilities around the world – collecting samples and running bioassays in western facilities and forest camps of southern India, then corroborating results with field observations of wild elephants. Not only did she care about the elephants, but she was eager to learn any tidbit of information from the people who worked directly with elephants. Bets made several landmark discoveries in the field of olfaction, showing that even a very sophisticated and complex animal such as the elephant uses some of the same chemical signals found in the insect world. One of her proudest moments came after many years of analyses - and hundreds of gallons of collected urine samples! - when she identified the Asian elephant estrous pheromone (Z-7-dodecenyl acetate), a signal also used by many species of moths. She then documented further remarkable chemical convergences between the insect and elephant world with the discovery that mellifluous secretions in the moda musth state of young Asian male elephants contained some of the same chemical blends used by honeybees. Furthermore Bets identified the presence of frontalin, a musth pheromone, in elephant secretions - the same compound is a phero-mone of bark beetles. To help identify means to protect and conserve elephants, Bets dedicated herself to unraveling how chemical signals facilitate elephant societal interactions.

Bets was a highly respected scientist world-wide, having published multiple papers in top scientific journals such as Nature, and was an inspiring keynote speaker at many prestigious international meetings. A very thorough and precise scientist, Bets insisted that the scientific method was the most important path to follow in any research, and willingly shared her knowledge through countless manuscripts, presentations and numerous collaborations with young and established scientists around the world.

Bets found humor in life's situations and was one of the friendliest and most enthusiastic people anyone could hope to meet. Despite long hours in the lab she always made time for family, friends and her other passions: scuba diving, swimming and water skiing on the Columbia River at any time of year. Bets was jokingly known as the toughest member of the OGI water ski team!

In the words of some of her many friends and colleagues, Bets was "truly a dynamic individual, full of energy and inspiration", "fun and fascinating", "a wonderful person, a brilliant scientist, and a decent human being ",

"she will be missed - she was supposed to find so many more answers for us".

Professor Bets Rasmussen's passing is a true loss for elephants and for the community of people who care for them.



Elephant in Cambodia
Photo by Gareth Goldthorpe

Appreciation

Lyn de Alwis (1930 – 2006)

By Ravi Corea

On November 22nd 2006 one of Asia's leading wildlife conservationists, Lyn de Alwis, passed away. For many people who knew him professionally Lyn de Alwis symbolized the various achievements and benchmarks he set in the national and international zoo and wildlife conservation forum. For those who knew him personally Lyn leaves behind a void that will never be filled and a yearning nostalgia for an era that will never come back.

Most people, not surprisingly, knew Lyn de Alwis as either the Director of the National Zoo at Dehiwela or the Director of Wildlife or Director both. However Lyn was much more than this. Whilst he achieved much in the cause of wildlife conservation in Sri Lanka as well as Asia, it would not come as a surprise to know that he was also a good friend, colleague, father, husband, advisor and mentor.

Among his professional achievements Lyn provided the leadership for the Department of Wildlife Conservation as well as the Dehiwala Zoo to boldly step into areas where they had never ventured before. Lyn, with the help of the World Wildlife Fund and the Smithsonian Institution, led the Wildlife Department to conduct scientific research which brought Sri Lanka right into the forefront of the international conservation forum.

Lyn was the Director of the Department of Wildlife Conservation from 1965 to1969 and again from 1978 to 1983. During his Directorship in the 1960s Lyn managed to convert almost all the intermediate zones into national parks, i.e. in 1967 and 1969 the Wilpattu West Intermediate Zones into the Wilpattu National Park and in 1969 the Yala Intermediate Zone into the Yala National Park. At the same time he also established special Elephant Control Units to attend to the increasing human-elephant conflicts in the Hambantota and Anuradhapura regions. In 1970 he had an amendment made to the Fauna & Flora Protection Ordinance to include jungle corridors for the free movement of elephants between wildlife reserves. In 1978 he got a Cabinet Paper passed to establish one-mile wide buffer zones to the protected areas.

During his tenure the Department of Wildlife conducted the first capture and translocation of elephants. A pocketed herd of elephants was captured using traditional noosing methods in the forests of Bata ata and Hungama and again in 1979 a herd of eighteen elephants, pocketed in the Deduru Oya region, was relocated to the Wilpattu National Park. During his second tenure in the 1980s he designed a network of protected areas for the Mahaweli Development Project.

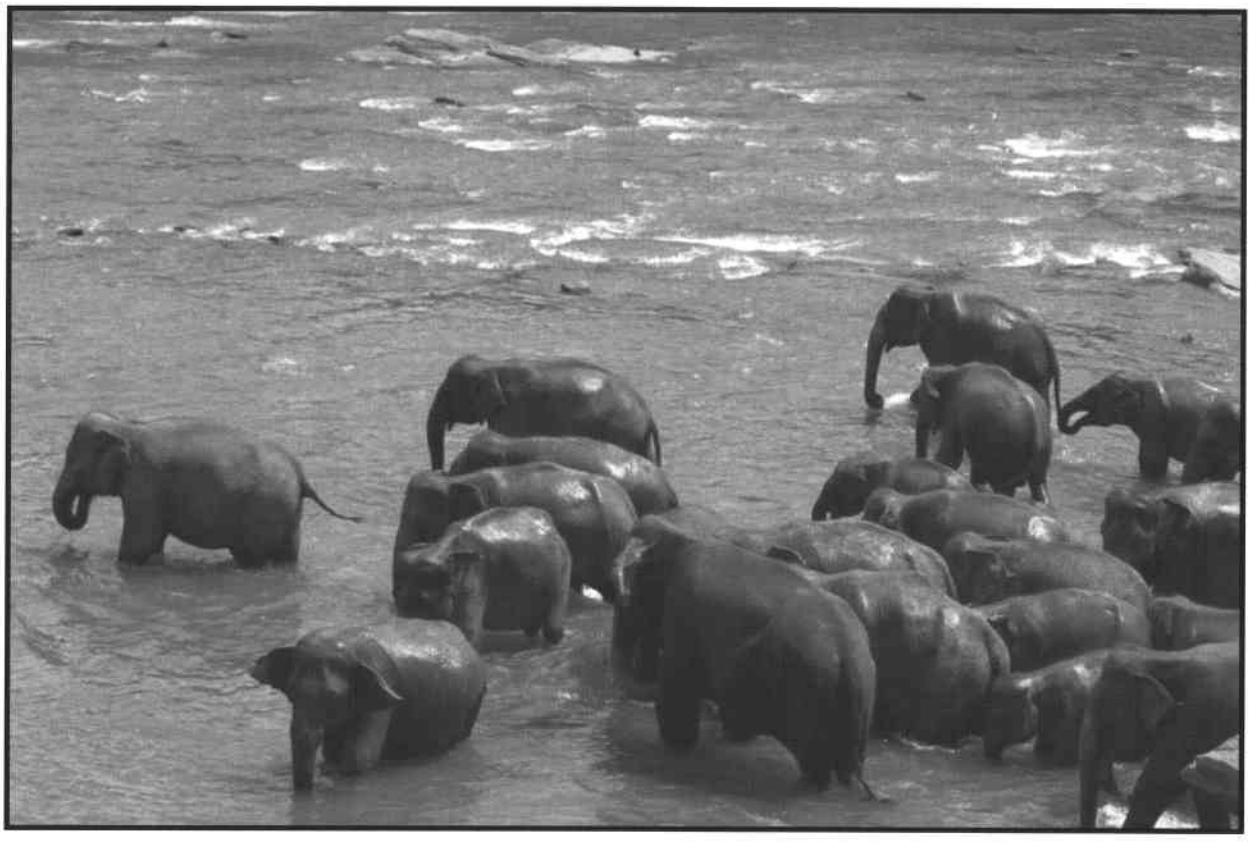
He established the now famous Pinnawala Elephant Orphanage. Additionally Lyn established the Zoo Development Fund and the Zoo Welfare Society for the zoo staff.

Lyn also designed the Night Safari at the Singapore Zoo establishing benchmarks in modern zoo development.

Lyn was a founding member of the IUCN/SSS Asian Elephant Specialist Group and a long standing member. Later he was the Chairman of the AsESG. As Chairman he paved the way for this international conservation forum to gain access to countries such as Burma, Cambodia and Vietnam that were closed to the outside world. He initiated many elephant conservation activities in these countries as well as in the other range states. Initially he himself penned and edited the newsletter of the AsESG, which later became the journal *Gajah*.

He along with several of his contemporaries was instrumental in getting the group functioning successfully and his contribution to elephant conservation through the AsESG and independently was great and it will always be remembered. He believed that we all work and contribute as individuals but we needed to make efforts to think of all our efforts as being those of the group - a selfless way of thinking in a world of ' I ' or 'my organisation'. We need to live up to his expectations.

It was a great loss for Sri Lanka the day Lyn passed away. His immediate family lost their patriarch. I personally lost a mentor, advisor and a friend. Lyn was a monument as well as a foundation stone of Sri Lanka's conservation forum and he will continue to be so through the people whose lives he has touched.



Elephants at the Pinnawala Elephant Orphanage, Sri Lanka, bathing in the river
Photo by Prithiviraj Fernando

News Briefs

1. Mangrove elephants facing extinction

Independent Online
April 4, 2006

Yangon, Myanmar - Elephants that once roamed the mangrove swamps of Myanmar's vast Ayeyarwaddy Delta are headed for extinction, with only two of its kind still alive, a local newspaper said Monday.

The two survivors live in the delta's Meinmahla island wildlife sanctuary about 130 km south-west of Yangon, the Flower News weekly newspaper said. "These elephants are different from other wild elephants. Their toes are more delicate and they cannot survive in harsh terrain," the paper said, quoting a forest ranger from the island sanctuary.

A substantial number of wild elephants once roamed the mangrove swamps but the population fell to 27 by 1989, and to 14 by 1994. Ten of those 14 survivors were transferred to Ngaputaw, north of Meinmahla sanctuary in the Ayeyarwaddy Delta, but all perished due to their change in habitat and an overall degradation of the mangroves, the report said.

http://www.int.iol.co.za/

2. New study of the world's smallest elephant

Cardiff University press release
December 8, 2005

The world's smallest elephant species, the newly described Bornean elephant, will be the focus of a Cardiff University study in Sabah, Malaysia for the next three years.

The Bornean elephant has recently been confirmed as a separate sub-species, dramatically increasing its importance for bio-diversity. Bornean elephants are the world's most endangered member of the elephant family with an estimated 1100-1500 surviving in the wild.

The Cardiff School of Biosciences study led by Prof. Michael Bruford and funded by the Department of Environment, Food and Rural Affairs, will provide the Sabah Wildlife Department with a range of essential conser-vation and management information concerning the ecology, genetics, social structure, dispersal and conflicts with agriculture.

Dr Benoît Goossens who will carry out the research, said the need for the project was identified by wildlife authorities in Sabah during a previous Darwin Initiative grant to study orangutans. He said: "There is clearly an urgent need to undertake sound conservation action. Our work will provide information that is currently lacking, including identification of priority areas for the species that should be kept under forest cover.

Project partners are the Sabah Wildlife Department, Kinabatangan Orang Utan Conservation Project and the Institute for Tropical Biology and Conservation at University Malaysia Sabah.

http://www.eurekalert.org/pub_releases/2005-12/cu-ns120805.php

3. WWF flying to rescue of elephants (Indonesia)

Hyginus Hardoyo, The Jakarta Post
September 13, 2006

The Sumatran elephant, a subspecies of the endangered Asian elephant, is engaged in a battle for habitat — human development has cut down much of its natural jungle habitat. Instead of having the large space to roam around in that elephants need, Sumatran elephants are finding their freedom is rapidly being curtailed, something that often puts them in direct conflict with humans.

World Wildlife Fund (WWF) Indonesia says their numbers have dropped greatly over the last 10 years or so, from around 1000 to 1600 in 1995 to about 300 or 400 today. Unfortunately, protecting their habitat is proving to be a difficult task.

While initially poaching was a serious problem for the elephants, more recently deforestation has meant they now face poisoning and attacks. Habitat loss has forced the elephants into closer contact with humans, often resulting in violent attacks on and by both parties. Deforestation appears to be taking place at an uncontrollable pace in many areas.

Currently 38,576 hectares, the park is expected to be expanded to 100,000 hectares. The problem — besides parts of the proposed expansion areas being owned by three separate forest concession holders — is that an increasing number of people are living in the forest illegally. Forest fires to the escalation of human-elephant conflict are among concerns that have been raised.

Conflict between humans and elephants is an inevitable result of forest fires, logging and illegal forest activities, as they force the animals out of the forests to look for food.

WWF Indonesia believes that the flying squad system, coupled with the provision of adequate food supplies within the sanctuary, will go far towards solving the problem. Residents and businesses will be free from elephant attacks, and the Sumatran elephant will survive, instead of becoming another environmental casualty.

http://www.thejakartapost.com/detailnational.asp?fileid=20060913.G03&irec=2

4. Study to tackle elephants' intrusion

Navhind Times Staff Reporter, Panaji
Jan 24, 2006

Senior officials of forest departments of Goa, Maharashtra and Karnataka evolved a joint strategy to tackle the problem of intrusion of elephants into human habitat and decided to set up a study of reasons behind frequent movements of pachyderms from one state to another.

The study would be conducted by Centre for Development of Asian Elephants Research and Conservation Centre of Indian Institute of Sciences and financial assistance and other support have been sought from the Union ministry of environment and forests, on how to keep the menacing elephants at bay.

He also said that conditions in Tillari catchment area were ideal for elephants to make it their temporary habitation, as they provided enough food and water for them. Besides, pachyderms being nomads they travel large distances in search of food and that it was difficult to predict their movement and behaviour.

The forest officials of three states also agreed to give priority to control the damage to villages and to focus on strategy to limit the strayed and straying elephants to Karnataka, besides studying their migration, the herd size, patterns of migration and recurrence.

Other strategies agreed to by the officials include study of land use pattern in the states, habitat continuity, fragmentation, degradation and the threats to animals and strengthening of communication network and inter-state co-ordination.

With regards to recent intrusion of elephants in Goa, the forest officials said that since the herd was very small comprising two females and one calf, it had in all probability broken away from main herd and would reunite with it sooner or later.

Since the calf was small it would not travel great distances and restrict its movements to smaller areas, they added.

The principal chief conservator of forest (Maharashtra), Mr B Majumdar, said that intrusion of elephants was a new phenomenon to the state, like Goa.

In all over 40 officials from three states participated in the day long programme.

http://www.navhindtimes.com/stories.php?part=news&Story_ID=012539

5. Government plan aims to save Vietnam's declining elephants

VietNamNet Bridge
September 13, 2006

The number of elephants in Vietnam has plummeted from 2,000 to 130 over the past 30 years. To counteract this alarming trend, the Ministry of Agriculture and Rural Development launched a national action plan for elephant conservation last week in Hanoi.

The Vietnam National Elephant Action plan, developed by the Ministry's Forest Protection Department (FPD), aims to conserve and develop wild and domestic elephant populations in the country in a sustainable way. The plan, which will extend through 2010, also includes provisions for the conservation of elephant habitats.

According to Tran The Lien, a representative from the FPD, a statistically documented drastic drop in the number of elephants in Vietnam prompts action. Areas that once were home to large herds currently have few if any elephants.

The new plan will include methods to minimise human-elephant contact using electric fences and trenches to prevent elephants from raiding agricultural areas, in addition to the use of noise and smells that elephants dislike to drive them away from roads and people's property.

In locations inhabited by both people and elephant, farmers will be encouraged to reconsider their crop choices so as not to attract elephants. To handle situations where human-elephant contact does occur, detailed plans will be drawn and implemented.

In addition, the new plan will entail the protection of elephant habitats and efforts to ensure adequate production of food for elephants. Elephant sanctuaries will be built in Dac Lac, Dong Nai and Nghe An provinces, regions that contain large elephant habitat areas and well-populated herds. In areas with smaller elephant populations, habitats will be examined to create optimal conditions for the elephants' long- term survival.

When all other options have been exhausted without success, the possibility of relocating elephants will be considered.

Provisions for the domesticated elephant population will also be put into motion, with a new control and management system that includes placing tracking devices on domesticated elephants.

With this system, domestic elephant populations will be able to be more easily monitored for their protection and for research their reproduction, facilitating the conservation and development of domestic elephant populations.

To prevent illegal poaching and the international trade of elephant products, the plan will fine-tune the current law enforce-ment system to ensure its effectiveness.

6. China offers hungry elephants "dinner halls"

Reuters
July 1, 2006

Chinese officials hope to lure hungry wild elephants away from farmland by offering "dinner halls" with banana and sugar on the menu, state media reported.

Last year three villagers were killed by elephants around nature reserves in Xishuang-banna in the southwest province of Yunnan, Xinhua news agency reported. Crops belonging to 12,000 families were also destroyed.

Wildlife officials are planning "dinner halls" of banana plantations and sugarcane planted several kilometres from villages to entice the animals away, Xinhua said. So far, 70 ha (170 acres) have been set aside.

Twenty years ago, Xishuangbanna had only 80 wild elephants compared to some 300 today.

In April, the Yunnan province government set aside 4 million yuan (270,460 pounds) to compensate farmers for crops lost to hungry elephants, Xinhua said. "So far the experiment has had mixed results," it said of the new dining initiative, but did not elaborate.

http://today.reuters.co.uk/news/newsArticle.aspx?type=oddlyEnoughNews&storyID=2006-07-01T051425Z_01_PEK155986_RTRIDST_0_OUKOE-UK-CHINA-ELEPHANTS.XML

7. Elephants may get IDs, more protection (Thailand)

Janjira Pongrai, The Nation
September 10, 2006

Public opinion will be sought on a proposed new law relating to elephants before a final revision of the draft bill is submitted for parliamentary consideration, the vice minister of the Natural Resources and Environment Ministry said yesterday

Noppadol Pattama said the bill, which the ministry has recently drafted, complies with and consolidates about 10 existing elephant-related acts and contains 17 key provisions to protect both wild and domestic elephants. These include controversial new regulations regarding the issue of elephant identification documents and the establishment of a DNA database of the animals.

Under the new law, the birth of a domestic elephant must be reported to the ministry within seven days for an elephant ID card to be issued. If an elephant dies, the owner must report the death to officials within 24 hours. The draft bill also states that a DNA database will be set up when such technology is available in the country.

It has been more than a decade since the government and conservationists first tried to revise all elephant-related laws. The bill also covers the process of importing and exporting elephants, as well as measures to provide welfare for the animals.

http://nationmultimedia.com/2006/09/10/national/national_30013230.php

8. Elephants as Partners in Conservation (Sri Lanka)

F. Samath, Inter Press Service News Agency
March 5, 2007

Decades after unsuccessful attempts to minimise the elephant-human conflict in Sri Lanka, authorities are trying out a bold experiment — allowing both mammals to live together in harmony with the environment.

Some 50 to 60 people — mostly chena (slash and burn) cultivators — are killed annually by marauding elephants in search of food. Drives to shift herds to nature parks, away from human settlements, have not been very successful.

New research by Sri Lankan scientists have found that, rather than clashing with the large animals, humans can recruit them as partners in the protection and conservation of these animals generally considered their number one enemy.

Thousands of poor Sri Lankans venture into the jungle and grow cash crops on government land without permits In the experiment based on scientific data, the Department of Wildlife Conservation and scientists are embarking on a model project to ensure that elephants and cultivators live alongside each other, with the cultivators being the protectors of elephants.

Prithiviraj Fernando, senior researcher at the Centre for Conservation and Research, told IPS that the most crucial factor in the recently introduced National Policy for the Conser-vation of Wild Elephants is finding a viable solution to the human-jumbo conflict.

Elephants and chena cultivation are inextricably linked, says this research scientist - who

studied the animals for his thesis and is studying their ecology. He believes the human-elephant friction and elephant management and conservation are complex issues.

Farmers also get a pittance for their produce. Fernando says as soon as the yield is collected they can get about 35 rupees (35 US cents) for a kg of string beans, for example, but gradually the price drops to about two rupees (0.02 cents) a kg, often leaving them with huge losses.

The scheme will link cultivators to elephant conservation and make them feel that they are beneficiaries while protecting and conserving elephants and not handouts.

The model project follows the new elephant conservation policy launched last year in which representations were invited from the public. There are no exact figures of Sri Lanka's elephant population but the number being spoken of by conservationists is around 4000.

9. International Congress and Symposium

Elephant census in South India

Elephant census in South India from May 7 to 9 An extensive census of elephants roaming the forests of South India will be carried out from May 7 to 9. According to Chief Conservator of Forests (Wildlife), Bangalore, Anur Reddy, forest officials of Karnataka along with their counterparts in Tamil Nadu, Kerala and Andhra Pradesh will carry out a census of elephants for three days to estimate their numbers. Officials were carrying out a synchronised head-count of the pachyderms in view of their tendency to migrate across state borders. The census will be carried out by direct counting on sighting elephants or, indirect method like dung-counting. The census assumes importance in Karnataka as the state probably has 4,500 elephants which is the highest for any
http://www.khaleejtimes.com/DisplayArticleNew.asp?xfile=data/subcontinent/2007/April/subcontinent_April566.xml&section=subcontinent&col=

Wild elephant census in North Bengal this month (India)

The Hindu
April 8, 2007

Cooch Behar (WB), April 8. (PTI): Census of wild elephants in North Bengal will begin on April 23, a senior forest department official said here on Saturday.

To be conducted in two methods - 'dung density' and 'direct sighting' - the census was expected to be completed by April 26, he said. While in 'dung density', the census workers have to measure the density of fresh dung of elephants to find out their numbers in a select zone, in 'direct sighting' the employees count elephants by seeing. In the 2005 census, the number of wild elephants was 350, against the number of 292 in 2000, he said.

Elephant population has been steadily on the rise in the forests of North Bengal in the past few years.

Article at the following link:
http://www.hindu.com/thehindu/holnus/002200704080311.htm

10. International Elephant Research Symposium

The International Elephant Foundation and Feld Entertainment, Inc./the Ringling Bros. and Barnum & Bailey Center for Elephant Conservation, are pleased to announce that the International Elephant Research Symposium will be November 2-4, 2007, in Orlando, Florida. Additional support for the Symposium will be provided by Disney's Animal Kingdom and Busch Gardens Tampa Bay.

This important symposium, on the research and conservation needs of captive and wild populations of elephants, invites researchers from around the world to present conservation projects and research results on human-elephant conflict, population management, health, nutrition, reproduction and behavior.

Abstract deadline: July 1, 2007
www.elephantconservation.org

Instructions for Contributors

Gajah welcomes articles on all aspects of Asian elephants, of interest to those involved in conservation, management and research on Asian elephants and the general public. Articles may include but are not limited to research findings, opinions, commentaries, anecdotal accounts and book reviews. Readers are encouraged to submit comments, opinions and criticisms of articles published in *Gajah*. Such correspondence should be a maximum of 300 words, and will be edited and published at the discretion of the editorial board.

Manuscripts should be in British English and double-spaced on A4 paper. An article may have a maximum of 5000 words.

Tables and figures should be kept to a minimum. Each needs to be on a separate page at the end of the manuscript. Legends should be typed separately (not incorporated into the figure). Use of black and white figures is encouraged to facilitate reproduction. Refer to figures and tables in the text as (Fig. X) and (Table X). Include tables and figures in the MS WORD document you submit.

References should be indicated in the text by the surname(s) of the author(s) with the year of publication as in the example below:

(Baskaran & Desai 1996; Rajapaksha *et al.* 2004)

If the name forms part of the text, it may be cited as in the following example:

Sukumar (1989) demonstrated that...

Avoid if possible, citing references which are hard to access (e.g. reports, unpublished theses). Format citations in the 'References' section as in the following examples, writing out journal titles in full.

Baskaran, N. & Desai, A.A. (1996) Ranging behavior of the Asian elephant (*Elephas maximus*) in the Nilgiri biosphere reserve, South India. *Gajah* **15:** 41-57.

Olivier, R.C.D. (1978) *On the Ecology of the Asian Elephant*. Ph.D. thesis, University of Cambridge, Cambridge, UK.

Rajapaksha, R.C., Mendis, G.U.S.P. & Wijesinghe, C.G. (2004) Management of Pinnawela elephants in musth period. In: *Endangered Elephants, Past Present and Future*. Jayewardene, J. (ed.) Biodiversity & Elephant Conservation Trust, Colombo, Sri Lanka. pp 182-183.

Sukumar, R. (1989) *The Asian Elephant: Ecology and Management*. Cambridge University Press, Cambridge, UK.

Manuscripts should be submitted as a MS WORD file by e-mail to the editor <romalijj@eureka.lk>. If unable to do so, a hard copy can be sent to: Jayantha Jayewardene, 615/32 Rajagiriya Gardens, Nawala Road, Rajagiriya, Sri Lanka.

Deadline for submission of manuscripts for the next issue of Gajah is 30th June 2007.

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