Interim report on

Stress as a possible driver of elephant-human conflict in Asian Elephants-A study in the Kodagu-Hassan region of Karnataka, India

We started our fieldwork in October 2013, and aimed to collect data and samples for measurable indicators of the levels of stress in elephants using non-invasive techniques. We collected dung samples from crop raiding elephants as well as elephants found in the core areas of forests to assess the levels of stress hormones in them. We stored a small part of the dung samples for genetic analysis from DNA, for molecular sexing and identification of the individual elephants. Especially in cases where dung samples were collected without observed defecation, this technique would help us to eliminate duplicates, and to have a better understanding of the number of unique individuals in our analyses. We also scored the body condition of elephants using photographs. Since elevated levels of stress are known to affect the metabolism and physiology of an organism, and could possibly deplete their fat reserves, we decided to explore the possibility of a relationship between stress and body condition in elephants.

We hope to gain a better understanding of the response of elephants to various ecological and anthropogenic factors from this study that can be used for the formulation of better conservation strategies by designing the land-use pattern that will foster the coexistence of both human and elephants.

Study sites:

Bandipur National Park and Tiger Reserve, Nagarhole National Park and Tiger Reserve and Madikeri and Hassan divisions were chosen as the study-sites for this study. Study-sites were selected as they lie in two extremes of habitats and represent very different resource availability, as well as human disturbance and crop raiding frequency. Samples were collected from five ranges of Bandipur (N.Begur, Gundre, Kundakere, Bandipur and Moliyur); seven ranges of Nagarhole (DB Kuppe, Nagarhole, Kalahalla, Veeranahosahalli, Anerchowkur, Anthrasanthre, Metikuppe) and three ranges of Hassan (Yeslur, Alur and Sakhlespur).

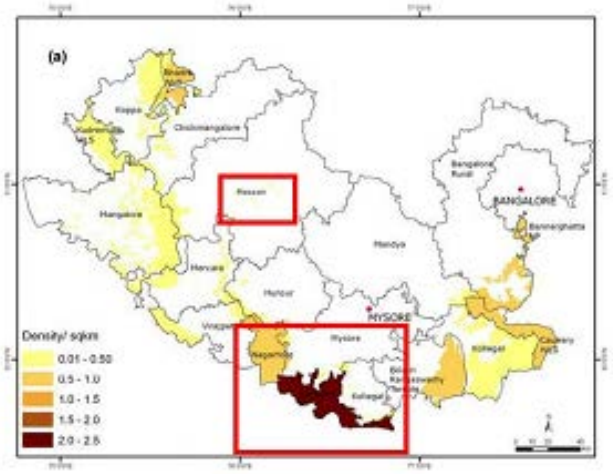

Fig. 1: Elephant density map showing the study sites in inset (Synchronized Elephant Census, 2010)

Methods:

Protocol for dung sample collection:

Population-wise opportunistic dung sample collection were carried out non-invasively. Herds of elephants or solitary individuals were followed and photographed. Individuals were identified and coded based on the cut and venation pattern in ear and tail and tusk pattern in males. Additional information from warts, if any, were also used for identification. Information on wounds and tumours, if any, were also noted, but not used for morphological identification. Group size and composition of the herds were also recorded. Fecal samples were collected soon after the defecation (within 3 hours) from the identified individuals, labelled and stored under appropriate conditions. In Hassan, it was not possible to see and follow the elephants. Therefore, relatively fresh dung samples (up to one day old) were collected opportunistically, without observed defecation. GPS coordinates were recorded for each site where dung samples were collected. Rainfall gradients were also noted.

Body condition scoring:

Photographs were used for defining the body condition score of sampled individuals. Body condition was scored by providing ranks of 0, 1, 2 and 3 to each of the following based on Vidya and Sukumar, 2002.

a. Visibility of intercostal depression (spaces between the ribs)
b. Visibility of pectoral girdle
c. Visibility of pelvic girdle
d. Visibility of vertebral column
e. Depression in the buccal area
f. Temporal depression and the frontal ridge in the head

The rank "0" was used for poor visibility of bones indicating that the individual was of good body condition while "3" for the extreme visibility of the bones and depressions indicating poor body condition. The scores were added up and the individuals with higher total scores were considered to be in poor body condition as compared to those with lower total scores.

Stress hormone metabolite analysis

Protocols mentioned in Ganswindt et al. (2003a, b, 2005) will be followed to extract the fecal-samples and to analyse the metabolites. From fecal extracts, Glucocorticoid metabolite concentrations will be measured using a validated enzyme immunoassay (EIA) for 11-oxoaetiocholanolone (Mostl et al., 2002)

Results:

A total of 213 samples were collected of which, 65 samples were from Bandipur Tiger Reserve, 67 samples from Nagarhole Tiger Reserve and 81 samples were from Hassan division. 86 of the samples were collected from crop-raiding elephants of Moliyur (Bandipur Tiger Reserve), Veranahosahalli (Nagarhole Tiger Reserve) and Yeslur and Alur ranges (Hassan division). All samples collected from Yeslur and Alur ranges were crop raiders. Many of the dung boli contained coffee beans and paddy or ragi grains.

Body condition scoring:

We analysed the body condition scores for a small subset of 24 adult individuals from the wet season and 37 adult individuals from the dry season. We observed that it was more difficult to obtain good scorable photographs during the wet season due to poor visibility and poor light. The photographs of both adult males and adult females from Bandipur and Nagarhole were analysed based on the body condition scoring technique described in the methods section. Only photographs with a clean shot of the lateral view were scored, so as to obtain information about all the parameters in our scoring criteria (based on Vidya and Sukumar, 2002). For example, if the photographs captured the animal only in a feeding posture, scoring for buccal depression was not possible. Similarly scoring for scapula was not possible if the individual was in a walking posture. Such photographs were excluded from analysis.

Based on the scoring chart, the individuals exhibiting poor body condition had higher scores than the individuals with better body condition. A comparison between the dry and wet season showed that most of the individuals in dry-season exhibited higher scores (mean body condition score = 8.78, SD= 2.92) than the individuals in wet-season with lower scores (mean body condition score = 6.6, SD= 2.51) (Fig. 2).

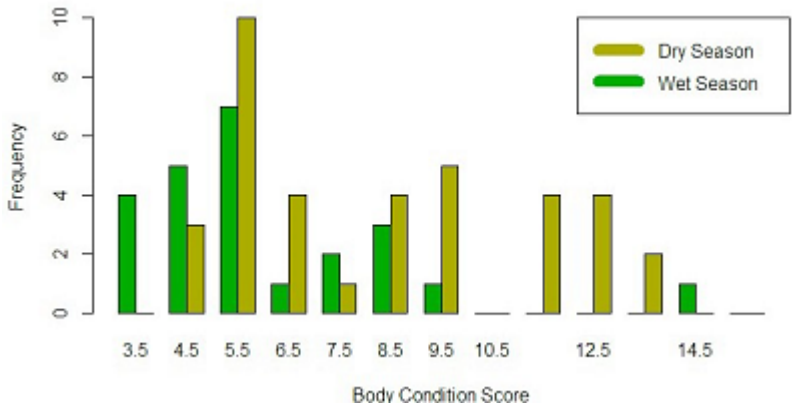

Fig. 2: Histograms, built using R, showing the frequency of sampled individuals based on their body condition scores. Higher scores indicate a poor body condition while lower scores indicate a better body condition.

Work to be done:

1. We are in the process of standardizing the protocols for analysis stress hormone metabolite levels from the dung samples. Once the standardization is complete, we would like to establish a baseline for stress levels in the Asian elephants of southern India through our analyses, and carry out further analyses to compare levels of stress across seasons, across habitat fragmentation, as well as between crop raiding and non-raiding individuals.
2. We have refined the body-condition scoring index to include a more detailed scoring, and are testing it more photographs of elephants. We hope to draw a statistically significant correlation between body condition and season, and explore the possibility of its correlation with stress levels as well.
3. Finally, we plan to correlate the results obtained from the above analyses with various ecological factors such as rainfall, availability and nutritional content of forage, habitat fragmentation, crop raiding behaviour etc.

Acknowledgements:

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