Social relationships of wild juvenile Asian Elephants *Elephas maximus* in the Udawalawa National Park, Sri Lanka

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Abstract: Social relationships of juvenile wild elephants (3-6 years old) in the Udawalawa National Park were studied. Focal animal sampling was employed to quantify behaviour of juveniles encountered on 450 different occasions. Nearest neighbour (NN) and nearest neighbour distance (NND) were considered for proximity analysis and the social relationships of focal animals. Adult females and juveniles were the NN of the study group during 50.8% and 37.6% of the total observed time respectively. The mean NND was 1.62m (SD±2.8), and it was less than 5m 98% of the time while 33% of the time the study group was touching (NND<1m) the NN. There was a significant difference between NND categories ($p<0.05$). Eighty percent of the NN infants stayed at a touching distance and were cared or allo-mothered by the juveniles under discussion. Time allocated for different behaviour patterns by the study group varied with the NN. When the study animals were accompanied by age-mates, they spent 17% of time in social playing and another 3% in non-play social contacts, but only 1% in each behaviour pattern when the adult females were in close proximity. Maximum social contacts were observed between study animals and infants. The findings suggest that juvenile elephants associate more frequently with adult females and near-age mates while they show social relationships in a varying degree with different associates. Play and social contacts of juveniles with conspecifics, especially with peers, provides opportunity to develop skills and social confidence necessary in adulthood.

Keywords: Juvenile elephants, social relationships, Sri Lanka, Udawalawa National Park.

Introduction

Social interactions and relationships among elephants are maintained by communication, interactive behaviour and proximity (Garai 1997; Sukumar 2003). Young elephants spend several years in physical and behavioural development, and the diverse behaviours exhibited by adult elephants reflect this long history of social interaction and learning (Sukumar 2003). Interactions of juveniles with their associates provide opportunities for learning and improving cognitive and motor skills (Sukumar 1994). Social play allows juvenile elephants to understand coping strategies, practice their abilities and learn their position in the hierarchy (especially males), which all contribute to a long-term learning process (Garai & Kurt 2006). Continual contacts between mother and calf reassure the psychological well being of the growing animal (Sukumar 1994; 2003). Female juveniles are interested in younger siblings and demonstrate allo-mothering behaviour frequently (Moss 1988). This behaviour is necessary for the growing female to acquire mothering skills that contribute to adult life (Morris 1990), as experienced females tend to have high offspring survival rates (Garai & Kurt 2006).

Quantified data on relationships formed by a focal animal can help to determine its well-being with respect to the way the individual gets along with others and how others react to him (Russell 1973). In this context, the present study was conducted in the Udawalawa National Park, Sri Lanka with the objective of describing social relationships of juvenile wild elephants. It is expected that the baseline information could be used in assessing adaptability and level of acceptance of rehabilitated juveniles which are integrated with the wild population in the same park.

Methods

Study area

The Udawalawa National Park (UNP) is in the intermediate zones of southern Sri Lanka (06°25'-06°35'N & 80°45'-81°00'E) and currently has 30,821ha (308km²) of scrublands, grasslands and dry-mixed evergreen forests as dominating vegetations. Extensive areas of *Panicum maximum* dominated grasslands, which have resulted from shifting cultivation practiced before constitution of the national park in 1972 (EML consultant 2006), are heavily utilized by the elephants along with seasonal grasslands

adjoining the Udawalawa Reservoir. The authors believe that UNP harbors a healthy breeding population of elephants exceeding 500 individuals (Jayantha & Dayawansa 2006).

Study group

Juvenile animals of estimated age 3-6 years old were observed in the study. This age group is partially parallel to 'young juveniles' as explained by Santiapillai in 2004. Based on Sukumar (1994) the elephant population in the UNP was categorized into eight different groups in the field level (Fig. 1).

1. **INF**: Infants - animals of shoulder height up to the level of ventral abdomen of an average adult female; approximately day 1-1½ years old.

2. **JV I**: Juveniles (Class I) - shoulder height varying between ventral abdomen and neck level of the adult female; approximately 1½ -3 years old.

3. **JV II**: Juveniles (Class II) - shoulder height varying between neck and eye level of the adult female; approximately 3-6 years old. This is the study group and referred to the focal animals in the text.

4. **JV III**: Juveniles (Class III) - shoulder height varying between eye and dorsal canthus of ear opening of the adult female; approximately 6-10 years old. (Juvenile males would be slightly taller than juvenile females of the same age.)

5. **SAF**: Sub adult females - shoulder height varying between dorsal canthus of ear opening and shoulder level of the adult female; approximately 10-12 years old.

6. **SAM**: Sub adult males - shoulder height is just below or as the same that of the adult female; approximately 10-15 years old.

7. **AF**: Adult females - grown females pregnant, lactating or weaned; appearance of mammae (whether suckled or not) is considered.

8. **AM** : Adult males - grown males of shoulder height more than that of an average adult female; approximate age more than 15-20 years.

Study protocol

The selected animal group was observed in UNP from April 2004 to March 2005. Focal animal sampling and continuous recording (Martin & Bateson 1993) was conducted for 14 days per month to quantify behaviour of the juveniles encountered on 450 different occasions. Total sampling time was 4500 minutes. Hides and distant observation (using 8x40 binoculars) were employed to minimize observer effect on the subjects. The nearest neighbour (NN) of the focal animal and distance to the nearest neighbour (DNN) (Garai 1997) were recorded together with the different behaviours expressed. Data analyzed irrespective of the sex and descriptive statistics were used to describe the findings.

Results

1. Nearest Neighbour (NN) frequency: Juveniles of age 3-6 years old were observed approximately half of the time (50.7%) with adult females, possibly their mothers. They spent 37.6% of the time collectively with juveniles showing a preference towards age-mates. Sub adult females and sub adult males were the NNs of the focal group nearly at the same frequencies, 4.2% and 4.0% respectively. Infants were seen near

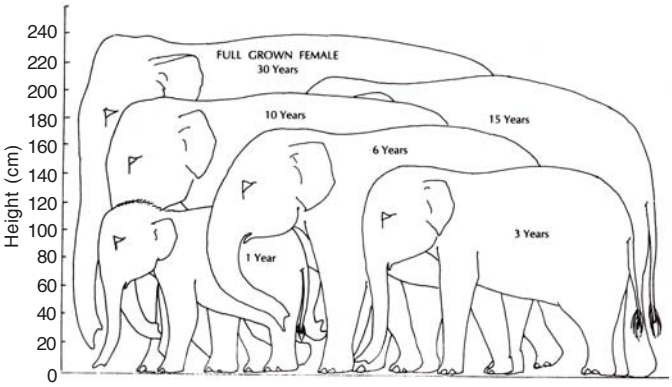

Figure 1. Relative height of young female elephants in relation to full grown female (after Sukumar 1994)

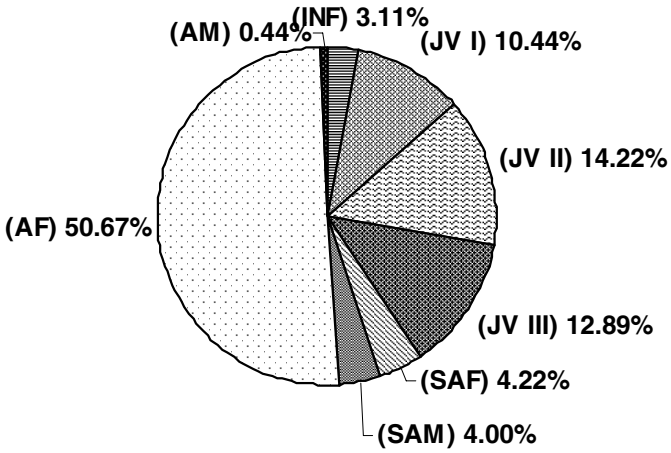

Figure 2. Frequencies of NNs of juvenile elephants as a proportion of total encounters (Symbols as in text)

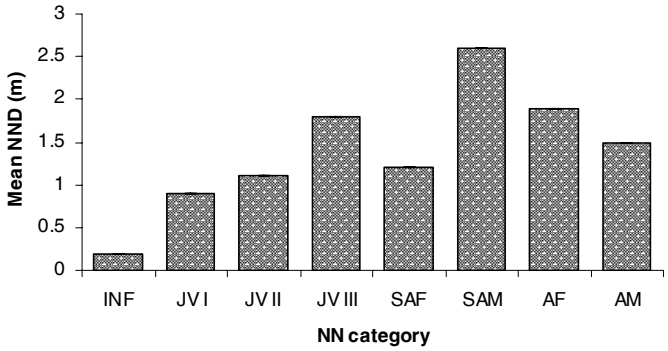

Figure 3. Mean NND between focal juvenile elephants and different NNs. (Symbols as in text)

to the study group 3.1% of the total occasions and it was the adult males that made least NN frequency (0.4%) (Fig. 2).

2. Nearest Neighbour Distance (NND): Mean NND was 1.62m (SD±2.8, range 0-40m). Mean NND for different NN categories varied significantly (ANOVA, one-way, $p<0.05$). A clear pattern of mean NND was evident when young animals (<10 years old) considered as the NN collectively; with increasing age (and body size) NND increased (Fig. 3).

Overall, the NN was within 5m away from the focal animals 98% of the time, and during 33% of the encounters they were

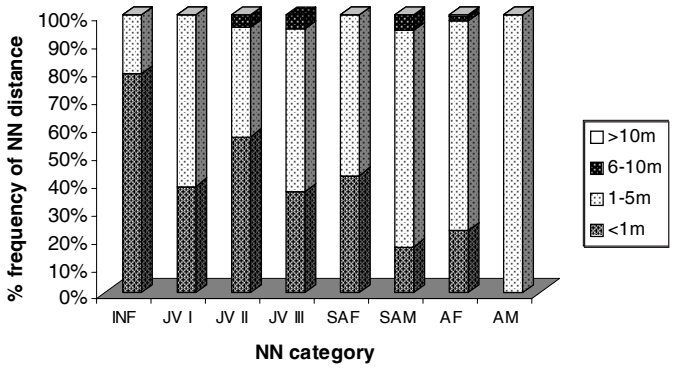

Figure 4. Percentage frequency of NND in relation to NN categories (Symbols as in text)

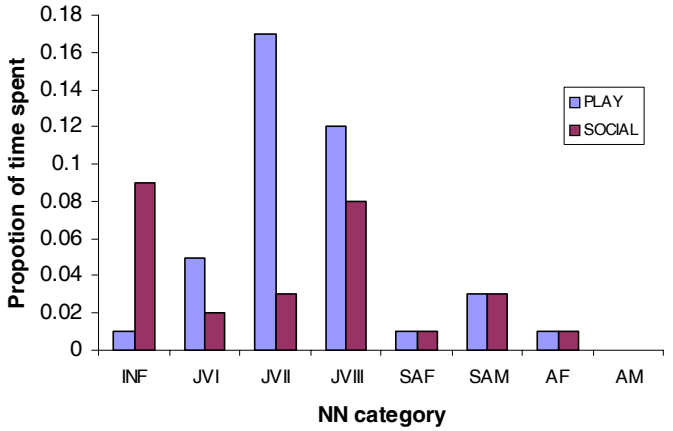

Figure 5. Proportions of time spent for social play (Play) and non-play social (Social) contacts by the juvenile elephants with each NN category. (Symbols as in text)

touching the NN (NND<1m). Eighty percent of the total juvenile-infant associations was close proximity (NND<1m). The study group stayed between 5-10m away from the NN in less than 2% of observations, and were very rarely at a distance >10m (Fig. 4).

***3.* Social behaviours in relation to the Nearest Neighbour:** The juveniles under discussion expressed different behaviour patterns; only three patterns were directly related to the current social context. They are social play, non-play social contacts and agonistic interactions. Since only four agonistic behaviours were recorded (hit by adult females twice, hit a sub adult female and a Class II juvenile) for the total of 450 encounters, agonistic behavior is not considered in the discussion.

Elements which were recorded under social play and non-play social contacts are presented in Table 1. Time allocated for each pattern was calculated as a proportion of the total time the focal animals spent in association of different NN categories (Fig. 5).

Social play was generally high when the study group had juveniles as the NN; the most time was spent with age mates (17%). Non-play social contacts were highest between infants and the study animals. Focal animals spent relatively little time in association with sub adult and adult females for social play and non-play social contacts. They had no play or social contacts with adult males. The interactions with sub adult males probably have brought about by the juvenile males. The findings are summarized in the Table 2.

Table 1. Elements of behaviours expressed by the juvenile elephants related to the current study.

Element	Description
Social play	
Play chasing	Run after another animal; inoffensive
Play charging	Rush towards a partner; inoffensive
Play hitting	Stroke with trunk; inoffensive
Play trunk twist	Wrapped trunks; inoffensive
Play tusking	Stroke with tusks/tushes; inoffensive
Play mounting	Climb up on partner's back; not sexual
Play pushing	Press partner hardly; inoffensive
Pressing	Gentle push on partner with head or body; inoffensive
Trunk over	Place trunk over partner
Non-play social contacts	
Touching	Touch and feel a partner with trunk
Testing	Smell organs of the partner with trunk

Discussion

Juvenile elephants spend the highest proportion of time with the adult females, particularly with their mothers and other adult females of the group (Kurt 2002; Lee 1986; McKay 1973; Sukumar 2003). This fact is further supported by the current study. The association must have significance in the social context beyond the mere biological need for suckling as only six observations were made of suckling focal animals, which were near their weaning age during the study period. The high associations between juveniles (2-10 years old) can be described as 'peer socialization', during which most of the juvenile contacts are made with members of the group other than the mother (Moss 1998; Sukumar 2003). It was observed during the study that juveniles of 2-10 years old formed social groups within the cow-calf groups. The study group also accompanied infants, parallel to Lee's (1987) and Moss's (1988) observations of how juvenile females accompany younger siblings. The term 'allo-mothering' (Santiapillai 2004) describes this association as the juvenile or adolescent females comforting, assisting and protecting their younger siblings in the family. Nursing infants stay with their mothers 100% of the time according to Gunawardene et al. (2004) in Sri Lanka; it is worthwhile to note the possible overlapping of age and size categories of the two studies.

The focal animals stayed in close proximity with their nearest neighbours. However, the mean nearest neighbour distance for different age and size categories varied showing a particular trend among growing animals. From infant to sub adult age or size, the distance increased gradually, probably because young elephants move away from their nearest neighbours with increasing age to explore their environment (Gunawardene et al. 2004; Sukumar 2003). According to Garai (1997), close proximity of juvenile elephants is a sign of less social confidence (i.e. the juveniles are not comfortable being solitary).

Playing is an important aspect of learning in juvenile elephants. Playing in mammals can be acrobatic (primates), exploratory (felids) or social (Morris 1990). Social play in juvenile elephants allows them to recognize kin and to form of social bonds useful in the future (Sukumar 2003). Juveniles of

Table 2. Percentage NN frequency, mean NND, percentage time spent for social play and non play social contacts regarding each NN category. (n = number of individuals). (Symbols as in text)

NN category	% NN frequency	Mean NN distance (m)	% time spent for social play	% time spent for non- play social contacts
INF (n=14)	3.1	0.2	1	9
JV I (n=47)	10.5	0.9	5	2
JV II (n=64)	14.2	1.1	17	3
JV III (n=58)	12.9	1.8	12	8
SAF (n=19)	4.2	1.2	1	1
SAM (n=18)	4.0	2.6	3	3
AF (n=228)	50.7	1.9	1	1
AM (n=2)	0.4	1.2	0	0

3-6 years old spent most of their play time with near-age animals. The same observations have been made on Amboseli elephants (Lee 1987). With infants, they allocated more time for non-play social contacts which indicates possible allo-mothering. Focal animals had less social interactions with sub adults and adult females compared to young animals.

The focal juveniles associated least with adult male elephants. In cow-calf groups, adult males are seen occasionally. However, the interactions between growing animals and adult males become important during their adulthood. For example, juvenile male African elephants that grew up without the presence of adult bulls, became delinquent and showed aberrant behaviour such as intra and inter specific aggression in South Africa (Slotow et al. 2000; Slotow & van Dyk 2001), suggesting that normal behaviours are learnt through modeling.

Conclusions

Close proximity of juvenile elephants of 3-6 years old with the adult females and near-age juveniles coincides with social interactions. The majority of the time they stayed within 5m distance from their nearest neighbours, showing less social confidence to do so. Social play and non-play social contacts were the primary behaviour patterns of interest regarding social relationships. The first pattern was frequent among near-age juveniles and the second was predominant between infants and juveniles. Young animals form juvenile groups of near-age members and young juveniles sometime play allo-mothering role for infants. Play and other social interactions experience by juvenile elephants would help in acquiring social skills expressed in later life.

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