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Oral Communications

Stress and Play Fluctuation in Wild *Lemur catta*

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Key Words: Ring-tailed lemurs · Anxiety · Indicator · Scratching · Playful activity · Madagascar

Strepsirhines have been neglected in the study of animal play. Yet, data from a wide array of primate taxa are needed to understand role, functions and social determinants of play. We investigated play behaviour in wild ring-tailed lemurs *(Lemur catta)* at the Berenty Reserve (Madagascar) where two other sympatric lemur species, and potential resource competitors, live *(Propithecus verreauxi* and *Eulemur fulvus)*. We followed two groups of ring-tailed lemurs (9 and 16 individuals) from November 2006 to February 2007. We evaluated play fluctuation during possible stressful conditions, such as the presence of neighbour groups of conspecifics (C), and the presence of groups of other lemur species (NC). We considered the absence of any other group (A) as the control condition. We first verified whether the presence of other groups did increase stress levels in the study groups. Stress levels were measured via scratching, which previous studies have shown to be a reliable indicator of anxiety in human and non-human primates. Scratching rates in the study animals were higher in the presence of other groups (C+NC) compared to when other groups were absent (A). Overall play rates were highest when other groups were nearby. In presence of NC groups, play rates decreased as NC groups approached the study groups. Instead, when only C groups were in sight, play rates increased as the distance between the study groups and other conspecifics decreased. Moreover, play was highest during extra-group aggressive encounters (involving C groups) whereas it was suppressed during intra-group fights. Our results suggest that play fluctuates in response to different stressful conditions and may be used as a mechanism to cope with anxiety.

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Flexible Feeding Ecology of Collared Lemurs, *Eulemur collaris*, in Littoral Forest Fragments

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Key Words: Forest degradation · Forest fragmentation · Habitat alteration · Malagasy Littoral forests · Nutritional ecology · *Eulemur collaris* · Madagascar

Frugivorous primates are known to be particularly vulnerable to habitat fragmentation and degradation, because of the highly variable spatial and temporal availability of their feeding resources. Lemurs of Madagascar are supposed to be adapted to fluctuating ecological conditions, which naturally occur on the island. This should allow them to cope with some degree of habitat modifications. However, the behavioural and ecological strategies used by frugivorous lemurs to persist in secondary habitats have received little attention. In this study, we compared long-term data on collared lemurs in a degraded fragment of littoral forest of south-east Madagascar with that of their conspecifics in a more pristine area. Data were collected on five lemur groups totalling 1,698 observation hours from 1999 to 2007. In the degraded area, lemurs modified several aspects of their behavioural ecology by decreasing group size and by increasing feeding time, ranging areas and number of feeding patches. The above strategies were apparently able to counteract a clear reduction in both food quality and size of feeding trees. We hypothesize that the observed flexibility is favoured by lemur adaptations to Malagasy rainforests, which are known to undergo periods of fruit scarcity and low productivity.

Acoustical and Structural Development Associated with Age in the Indri's Song

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Key Words: Ontogenesis · Vocalization · Duration · Repertoire · Notes · Strepsirrhine

Interactions between development and spectro-temporal parameters of the vocal output only rarely were thoroughly investigated in non-human primates. Changes associated with age can be related to vocal tract morphological growth, physiological changes, sexual development or learning. We performed a fine-scale analysis of the acoustic and structural properties of calls given during the song of the indri *(Indri indri).* We analysed 431 individual song contributions, emitted by 32 individuals from 10 different family groups. Age of the recorded animals ranged from 2 to 12 years for males and from 4 to 12 for females. Songs were recorded between 2005 and 2009 in three different forest sites near Andasibe (Madagascar): the Analamazaotra Special Reserve, the Mitsinjo Forest Station and Mantadia National Park. Using GLM analysis we found that indris showed a remarkable degree of plasticity in the duration of individual contribution to the song and in the total number of vocalizations emitted. The total number of calls given during the song varied sig-

nificantly with age (N_{males} = 52; $N_{females}$ = 35; F = 35.919; R^2 = 0.462; $p < 0.001$) and changed depending on the interaction between sex and age (F = 4.861; R^2 = 0.462; p = 0.030). The total duration of all utterances varied with age (F = 26.602; R^2 = 0.275, $p < 0.001$), as well as the mean duration of each vocalization (χ^2 = 19.430; d.f. = 10; p = 0.035). The number of notes per note type changed during development (χ^2 = 22.275; d.f. = 10; p = 0.014) but there were no differences in the number of note types emitted per song (t = –0.858; d.f. = 10; p = 0.411). Changes occurring during development showed that the note repertoire did not significantly change after 2 years of age.

Facial Expressions as a Communication Tool in Captive Barbary Macaques

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Key Words: Facial Expressions · Display · Communication · Barbary macaque

Facial expressions in both non-human primates and humans are a fundamental intraspecific communication tool: they are displayed in the social contest and are correlated to the consequences of social interactions. This study provides an overview of the main facial expressions and their use in the Barbary macaques' *(Macaca sylvanus)* colony maintained at Parco Natura Viva – Garda Zoological Park (Italy). In particular we focused on: (i) identifying and describing the facial expressions displayed by the Barbary macaques, compared with those identified in other studies; (ii) observing each facial expression displayed by the subjects of different age classes linked to different behavioural classes; (iii) identifying the facial expressions mainly displayed in each behavioural class. Moreover, this study aimed to observe the function of two peculiar facial expressions: 'silent bared-teeth display' as the possible ancestoral expression of the human smile, and 'relaxed open-mouth display' to verify the hypothesis of it as the possible ancestral expression of human laughter. The results of this study support findings in the literature with regard to the Barbary macaques' facial expressions by reporting the different frequency of different facial expressions both in age and behavioural classes. In addition, this study shows that the 'silent bared-teeth display' is shown mainly when associated with affiliative behaviour and by adult subjects, while the 'relaxed open-mouth display' is shown mainly with social play and by juveniles and infants. These outcomes seem to reveal the evolutionary origin of human facial expressions since some pre-existing traits could be observed in non-human primates.

Visitor Impact on Macaques' Behaviour in Captivity: Implications for Welfare

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Key Words: Primates · Visitor impact · Welfare · *Macaca sylvanus*

Several studies have reported significant effects of zoo visitor density and intensity on the behaviour of captive animals. In particular, most species were found to be stressed by high num-