

News

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NEWS

NUEVA BIBLIOTECA PRIMATOLÓGICA

La Red-Primatológica de la Asociación Primatológica Colombiana inaugura la nueva Biblioteca Primatológica (BiblioPrim), en dónde podrás acceder a cientos de artículos, libros y capítulos de libros sobre primates. La BiblioPrim cuenta actualmente con enlaces a más de 300 estudios realizados en el campo de la primatología publicados en revistas especializadas como Neotropical Primates, International Journal of Primatology, American Journal of Primatology y Primates, entre otros. Visítala en <http://www.asoprimatologica colombiana.org>.

INFLUENCE OF FRUIT AVAILABILITY AND PHYSICO-CHEMICAL CHARACTERISTICS OF FRUIT ON THE ECOLOGY OF PRIMATES IN A NORTHERN AMAZONIAN FOREST

On November 5th, 2012, Ítalo Mourthé defended his doctoral thesis for the Graduate Program in Ecology at Instituto Nacional de Pesquisas da Amazônia (INPA), in Manaus, Amazonas, Brazil. The thesis was on the feeding ecology and frugivory of primates at Maracá Ecological Station, a large riverine island in the Uraricuera River, state of Roraima, northern Brazil. His supervisor was Renato Cintra Soares (INPA). The study was funded by Conselho Nacional de Desenvolvimento Científico e Tecnológico, Fundação Estadual do Meio Ambiente e Recursos Hídricos de Roraima, Mohamed bin Zayed Species Conservation Fund, and Idea Wild. The following is a summary of his thesis.

The fluctuation of food resources limits plant and animal populations. Although well studied among small frugivores such as birds and rodents in temperate regions, the relationship among the fluctuation of resources, quality, and their effects on the ecology of large tropical frugivores in seasonal forests remains largely unknown. The exuberance and high diversity of tropical forests give a false idea of continuous abundance of food resources, but as seen in other environments, these forests also go through relatively long periods of shortage, imposing limitations to frugivores. Here, I investigate the effects of fruit shortage on the ecology of frugivorous primates at Maracá Ecological Station (MES), a highly seasonal forest in northern Amazonia. The

main focus of the study is on the feeding ecology of an endangered primate, *Ateles belzebuth*. Surveys on primate and fruit density and frugivory were carried out concomitantly through line-transect method. Fruit samples were collected and assessed through morphological and nutritional assays. Additionally, I conducted a detailed study on the feeding ecology of a well-habituated group of *A. belzebuth*.

Fruit supply, especially for Sapotaceae, positively influenced *A. belzebuth* local density, which was concentrated in areas with high fruit density in particular, during fruit shortages. However, *Alouatta macconnelli* and *Cebus olivaceus* did not follow the same pattern. During shortage periods, spider monkeys were more likely to eat fruit with a high lipid and high ash content. Although these nutrients influenced fruit choices, a comparison of the nutritional profile of fruits consumed by spider monkeys and that of fruits available in the local plant pool indicated that nutrients were consumed according to their local availability. A natural experiment concerning pulp variation in four fruits often consumed by several frugivores in the study site, including *A. belzebuth*, showed that unusual droughts do not appear to affect the amount of pulp produced. Finally, a relatively large sampling effort is needed to reach mammal survey completeness in species-poor sites such as in the study site than required in other Amazonian sites, possibly due to the relatively large number of rare species in this assemblage. To survive periods of fruit shortage, *A. belzebuth* adopted foraging strategies of both energy maximization and time minimization. This highly frugivorous primate invests their foraging effort in areas with a high fruit supply of abundant species, and they consume high energy fruits in an opportunistic way.

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DEMOGRAPHY AND LIFE HISTORY OF OWL MONKEYS (*AOTUS AZARAI AZARAI*) IN THE HUMID ARGENTINEAN CHACO

On September 14, 2012, Cecilia Paola Juarez defended her doctoral dissertation at the University of Tucumán, Argentina. Her research draws on work conducted at the Owl Monkey Project of the Argentinean National Council of Research (CONICET) and also at the Centro de Ecología Aplicada del Litoral (CECOAL), Argentina. Her

supervisor was Professor Dr. Eduardo Fernandez-Duque of the Department of Anthropology of the University of Pennsylvania. Her research was funded by an education grant to C. Juárez (CONICET) and investigation grants (Conservation Small Grants-ASP-2010 and Conservation Grant-IPS-2010). The following is a summary of her thesis.

In Argentina, owl monkeys (*Aotus azarai azarai*) are restricted to the Chaco and Formosa province. In the Argentinean Humid Chaco, owl monkeys inhabit gallery forest, high canopy forest and low canopy scrub forest (*Prosopis sp.*). Generally this two latter ambient to forest, more xeric, sometimes form islands of different sizes. The goal of this study was to investigate what is the demographic structure of owl monkey populations that inhabit the humid Chaco, how it changes in space and time, and what some of the factors that regulate these changes may be. The working hypothesis proposes that the demography and life history characteristics of owl monkeys will be strongly associated with spatial factors (environmental units different in gallery forest and forest islands) and abiotic (precipitation and temperature). Two studies were conducted to evaluate the hypothesis.

The aim of the first study was to understand the demographic structure of the owl monkey population in the east of the humid Chaco of the Formosa province and how different the social groups when exposed to different spatial factors may be. This work describes and compares, with basic demographic parameter, social groups in gallery forest (continuous forest) and forest islands (naturally isolated environments) inhabiting two areas with similar characteristics: Pilcomayo National Park and Guaycolec Ranch. Since October 2006 to February 2011, I collected demographic data from 84 social groups inhabiting gallery forest (n=54) and forest islands (n=30). For each social group we recorded group size, age structure and estimated the population density (ecology and relative). Four variables were included in statistical models predicting the presence-absence in forest islands: sampling site and surface, forest structure and insolate degree of islands. The aim of the second study was to evaluate changes in demographics and life history in relation with abiotic factors. This work analyses demographic data from nine social groups ("population system") studied between 1997 to 2010. Life history variables were birth rate, mortality rate, emigration and migration related with temperature and precipitation. Life table was constructed and population growth rate was calculated for the owl monkey population in Guaycolec Ranch.

The first study suggests that group size, age structure and birth rate were similar between sampling sites. Density was higher in Guaycolec Ranch than Pilcomayo National Park. The group size differences between continuous forest and forest islands showed that group size and densities were higher in gallery forest than forest islands. Birth rate was higher in gallery forest compared to forest islands in Guaycolec Ranch, but not statistically different between

environments in Pilcomayo National Park. Presence of owl monkeys in forest islands was strongly associated to the surface of forest islands. There is a 50% probability of finding owl monkeys in forest islands with an area of 5.6 ha and a 90% probability of finding owl monkeys in forest islands with an area of 11.4 ha. The second study showed that the owl monkey population in Guaycolec Ranch ("population system") was fluctuating between 11 and -18% with a growth rate (r) of -0.02 over 14 years. The years with higher rainfall were associated with larger group size. But there was no association between mortality rate and dispersals to rainfall or temperatures. Life table showed high mortality from birth to first year of life. After-3-year survival decreases coinciding with the period of dispersal.

In conclusion, low densities of *A. azarai* are found in Rio Pilcomayo National Park, the only nationally protected habitat of owl monkeys, shows that the species has a critical demographic state. The study results show how natural habitat fragmentation can influence the structure of population and basic demographic parameters (such as birth rate, and group size and density). We do not know, however, how individuals survive in patches of forest and how dispersal occurs between patches of forest. This work is important in the conservation of owl monkeys in Argentina as it is the first time that we evaluate density in the only national park designated to their protection. Additionally, study groups of the same subspecies under different environmental conditions contributes to understanding the phenotypic plasticity of the subspecies, which can be used to assess potential effects on different populations under anthropic fragmentation along their distribution.

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EFFECTS OF FOREST FRAGMENTATION ON BROWN SPIDER MONKEYS (*ATELES HYBRIDUS*) AND RED HOWLER MONKEYS (*ALOUATTA SENICULUS*)

The increasing intensity of anthropogenic land use and conversion has immense impacts on ecosystems worldwide and often results in habitat fragmentation. Fragmentation and other anthropogenic disturbances (e.g. hunting and logging activities) pose major threats to numerous animal

species. Species vary greatly in their resilience to these disturbances and in their ability to survive in forest fragments. Animals might have to adjust their behavior, their grouping patterns and/or dietary strategies to survive in anthropogenically altered habitats. Human-induced alterations can also result in long-term elevations of glucocorticoids (cortisol or corticosterone), which can have deleterious effects on growth, reproduction and immune system activity of animals.

To broaden our understanding of how animals cope physiologically and behaviorally with anthropogenic disturbances I studied two Neotropical primate species, brown spider monkeys (*Ateles hybridus*) and red howler monkeys (*Alouatta seniculus*) for my doctoral thesis at the University of Göttingen, Germany (Rimbach, 2013). The specific aims of this thesis were to 1) validate an enzymeimmunoassay (EIA) for the analyses of fecal glucocorticoid metabolite (FGCM) levels of both study species, 2) to investigate the species-specific differences in the physiological responsiveness to anthropogenic disturbances and 3) to examine how spider monkeys adjust their grouping patterns and social behavior when living in a small forest fragment.

The validation of the EIA, for which I used the stress response to anesthesia and reverse-phase high pressure liquid chromatography analysis (HPLC), was a crucial pre-requisite for the analyses of FGCM levels. The results demonstrated that both species differ in terms of basic factors influencing their adrenocortical activity (e.g. diurnal rhythm of GC excretion) (Rimbach *et al.*, 2013). To investigate the physiological responsiveness to anthropogenic disturbances of both species I collected fecal samples in several forest fragments in Colombia that differed in size (4.21 ha - 500 ha) as well as in the level of human impact (determined through the occurrence and/or absence of hunting and logging activities). Using the previously validated EIA I determined FGCM levels and examined species-specific differences in the physiological responsiveness to both fragment size and level of human impact. Fragment size did not influence FGCM levels of either species. But spider monkeys showed elevated FGCM levels in fragments where both hunting and logging occurred, whereas howler monkeys did not show such a response. This suggests that hunting and logging activities can potentially create long-term elevations of GC levels in brown spider monkeys and emphasizes why they are at a higher extinction risk than red howler monkeys when living in anthropogenically altered habitats (Rimbach *et al.*, in revision).

To better understand how spider monkeys cope with fragmentation, I studied the flexible grouping patterns and social behavior of two brown spider monkey groups living in a small forest fragment (65 ha) in Colombia. I collected data on subgroup sizes, aggressive interactions, habitat-wide fruit availability and collected fecal samples to determine FGCM levels. Both groups ranged in smaller subgroups and showed higher FGCM levels in periods of high fruit

availability compared to periods of low availability. These results were unexpected because (1) primates like spider monkeys and chimpanzees, that exhibit fission-fusion dynamics, typically show the opposite grouping pattern and (2) a major function of glucocorticoids (GC) is the release of energy during the stress response. Consequently, GC levels typically increase in periods of low resource availability. Spider monkeys are generally considered to be ripe fruit specialists. However, both study groups have a more folivorous diet than has been reported for other spider monkey populations. This could be a strategy to reduce the level of competition for fruit, especially in periods of low availability. When fruit availability is high in this fragment it appears that the intra-group feeding competition for fruit is also high. This would also explain why FGCM levels were higher and subgroup size smaller in periods of high fruit availability. This is further reinforced by high rates of female-female aggression, which were higher in periods of high fruit availability than in periods of low availability. These results illustrate how fragmentation can alter the grouping patterns and social behavior of this species and that the relationship between resource availability, grouping patterns, aggression rates and stress levels can be more complex than assumed so far.

Population densities are often high in forest fragments and resource availability is frequently altered. Moreover, animals that live in fragments often have to reduce the size of their home range. These conditions can potentially lead to high levels of intra-specific competition for resources and space. The confinement to a small amount of space can furthermore result in inter-specific competition, especially between species that overlap in their ecological niches. I report several cases of severe aggression and two cases of interspecific infanticide from spider monkeys directed at infant howler monkeys and capuchins in a small fragment with high primate population densities. This behavior might be either "pathological" or a strategy to eliminate potential future competitors for resources or space (Rimbach *et al.*, 2012). In conclusion, this study demonstrates species-specific differences in the ability to cope with anthropogenic disturbances and that these differences might be, at least partly, due to different levels of physiological responsiveness. In addition, the results suggest that hunting and logging activities may create long-term stress for spider monkeys that could impair their long-term population viability. Importantly, this thesis illustrates the use of GC measurements as a tool to monitor populations in disturbed and fragmented areas, and to evaluate and improve conservation strategies.

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