

## 2008 Progress Report

### The Regulation of Social Relationships in Spider Monkeys

Filippo Aureli, Liverpool John Moores University, UK

Colleen Schaffner, University of Chester, UK

2008 has been another successful year for our long-term project on the social and ecological factors affecting the organization of spider monkeys (*Ateles geoffroyi*) in Santa Rosa National Park, Costa Rica, which started in 2000. With the data collected this year and in previous years we continue to address open theoretical and empirical issues and provide information relevant to conservation initiatives.

#### Specific progress during 2008

During 2008 data collection continued following the strong foundations built in previous years. We continued our well-established ecological and behavioral data collections. We collected monthly data on the phenology of over 30 species of trees on which the spider monkeys feed to estimate monthly food abundance. We also continued to collect data on the behavior and ranging patterns of the spider monkeys using GPS. We successfully continued our behavioral data entry into computer files that takes into account the methodological difficulty of documenting fission-fusion dynamics.

Apart from monitoring demographic changes in the spider monkey group due to birth, death, immigration of young adult females and the disappearance of a subadult females (probably due to dispersal to other groups), we continued documenting the remarkable patterns involving adult males. In previous years we witnessed the first ever reported cases of group take-over by males in a spider monkey population. The males in this species are thought not to disperse from their natal group, so the events are really remarkable. The fact that we were able to document these events here is probably due to the long-term nature of our study and the ability to recognize individuals over extended period of time. One of the immigrant males that joined the group in 2005 is still in the study group, as well as five of those that joined in 2006. One other male joined the 2005 male. The two sets of males seemed avoiding one another, but given the fission-fusion nature of their social systems both sets of males are able to associate with the group females at different times. In 2008 we continued to monitor this unique situation to provide evidence about the nature of male-male social dynamics under these special conditions and document whether a new group take-over may occur. Given that the situation seems to be stable with no new immigrant males in the past two years, we are ready to write an article describing these patterns in combination with genetic data on relatedness of the involved males obtained from fecal samples (see below).

The component of our long-term project involving comparisons with our field site in Mexico has continued with our PhD student Claire Santorelli analyzing the data collected at both field sites. The cross-site comparison project

involves not only behavioral observations, but also the recording of vocalizations. The data analysis has revealed interesting results that will be the basis for an excellent PhD thesis and subsequent publications. During her project Claire has documented some unusual feeding habits of the spider monkeys. In certain periods of the year, they eat some rocks and this behavior seems to be associated with feeding on *Phoradendron* mature leaves, which are potentially highly toxic. In 2007 we have started an in-depth project involving PhD student Lyn Rostron to investigate the relation between eating rock and *Phoradendron* leaves. During 2008 Lyn analyzed samples of the rock and *Phoradendron* leaves collected during previous years. Preliminary results are intriguing and suggest possible digestive functions. She will continue her analyses in the next few years. Related to this project, we have started a pilot study in order to quantify parasite load as the monkeys may eat the rock and/or *Phoradendron* leaves to reduce parasite loads at certain time of the year. In 2008 we collected fecal samples, which will be analysed in 2009.

In 2008 we completed a one-year study funded by a British Academy small grant in order to better understand the impact of fission-fusion dynamics. The study had two main specific aims. The first aim was to investigate what factors, such as aggression or differences in the activities among subgroup members, lead individuals to fission. The second aim was to track what individuals do in different subgroups to ascertain the impact on fission and fusion events. Specifically, if the monkeys take different courses of action after fissioning, then it could explain how fission provides opportunities for individuals to follow their own fitness interests. Differences in group dynamics in different subgroups may also provide insights about the factors leading individuals to merge with other subgroups and about why some fusion events lead to aggression and others do not. Elvin Murillo Chacon, our long-term assistant, and a volunteer assistant carried out simultaneous data collection on two subgroups. They also mapped the location of each visible group member within a 100-meter radius at given intervals using a GPS in order to produce a quantitative definition of subgroup. The preliminary results are very promising. We plan to write 3-4 articles on these data and probably collect more data in 2009.

Postdoctoral fellow Dr Norberto Asensio continued to analyze the data and write papers based on his data collection in Santa Rosa. The main goal of his project was to investigate the degree of food competition among females. Species living in groups with high fission-fusion dynamics, like spider monkeys, are expected to experience low levels of food competition because subgroup size can be adjusted to local food availability. An article on Dr Asensio's results on the role of fission-fusion dynamics in reducing contest food competition was published in *Behaviour* in 2008. The article also presents data suggesting that there is however hostility between long-term resident females and newly immigrated females. Another paper on the role of fission-fusion dynamics in reducing scramble competition by adjusting subgroup size to local resource availability and so not increasing travel costs was accepted for publication in *Behavioral Ecology and Sociobiology*.

In 2008 our invited chapter on social relationships in spider monkeys, in which we also reviewed and presented data from Santa Rosa, was published in *Spider Monkeys: Behavior, Ecology and Evolution of the Genus Ateles*. Furthermore, a 19-author paper proposing theoretical and methodological frameworks to study fission-fusion dynamics, which we coordinated, was published in *Current Anthropology*.

### **Future developments**

We are planning to continue the current data collection on ecological and social variables counting on the invaluable support of our assistant Elvin Murillo Chacon. Dr. Norberto Asensio will continue to analyze GPS data to document ranging behavior and identify factors affecting core areas and their variation across seasons, years and individuals. Claire Santorelli will write her PhD thesis including data on the cross-site comparison and a larger scale comparison with other three sites in Central America. Lyn Rostron will continue to analyze samples of rock and *Phoradendron* leaves and run experiments simulating the digestive process to examine the beneficial role of each and the interaction between the two. We will continue the collection of fecal samples for the ongoing productive collaboration with Dr. Shoji Kawamura and Dr. Chihiro Hiramatsu on the implications of variation in color vision for foraging and social behavior (one article was published in *PlosOne* in 2008 and one was accepted for publication in *Animal Behaviour*). Fecal samples have also been used to determine the genetic structure of the population and the degree of relatedness between group members in collaboration with Dr. Anthony Di Fiore. The combination of these genetic data with our behavioral data will lead to a series of exciting publications. We will evaluate the results of the pilot study on parasite load and may consider some future developments which may involve collect hair samples, and possibly also tissue or bones from dead individuals, for stable isotope analyses. For the collection and the exportation of these samples we will apply for the relevant permits with the help of the Guanacaste Conservation Area staff members.

We look forward to another year of productive work in Santa Rosa National Park within our long-term project on this little-known primate species. We will continue our effort in data collection and analysis with the support of students and local assistants and the helpful assistance of the Guanacaste Conservation Area staff members.