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EMIGRATION OF A MASKED TITI MONKEY (*CALLICEBUS PERSONATUS*) FROM AN ESTABLISHED GROUP, AND THE FOUNDATION OF A NEW GROUP

Introduction

The territorial behavior of primates is frequently associated with a monogamous or nuclear family pattern of social organization (Clutton-Brock and Harvey, 1977; Wittenberger and Tilson, 1980). In most cases such groups are composed of the adult pair, which is the reproductive unit, and their offspring of different ages, as is the case in titi monkeys.

The number of members in a titi monkey family varies from two, after group founding, up to six, before a group or individual separation occurs (Kinzey, 1981; Pinto *et al.*, 1993). Under normal conditions, an infant is born each year in a titi monkey family (Kinzey, 1981). As a result a subadult monkey has to leave his group every year or, after the founding a new group, within a four to five year period.

In this paper, I report on the separation of a subadult titi monkey from his family group as well as the founding of a new group. Two different models of emigration and group founding will be discussed: the gibbon- and the titi model. Finally, I will show that territorial shifting, in the sense of Easley and Kinzey (1986), is not the only way for monogamous primates to secure new territories for their offspring.

Methods and Study Site

The study site was a forest segment of about 100 ha at the Estação Experimental Lemos Maia (ESMAI), a scientific field station of the local Cocoa Cultivation Authority - CEPLAC. It is located Una, south Bahia, Brazil (15° 18' S, 39° 06' W). Details of the study site and vegetation types have been described elsewhere (Müller, 1995; Rylands, 1982).

Data were collected on the daily ranging pattern of two nuclear family groups *of Callicebus personatus melanochir*. Radio telemetry was used to accompany the groups (Müller, 1994). The first group (Group I) was observed between August 1992 and December 1992. Data on the behavior of the second group (Group II) were collected after the emigration and the founding of the new group in December 1992. The observations took place up to September 1993. Data were collected during 101 complete days by scan-sampling for ten seconds at five minutes intervals (Altmann, 1974). Measuring, mapping and calculation of the home range of Group I and II have been described by Müller (1995).

Results

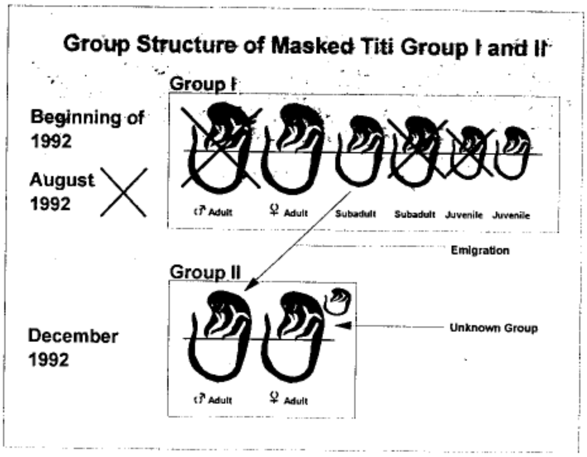
At the beginning of 1992, Group I consisted of six animals: the adult pair, two subadults and two juveniles (Fig. 1). The adult male, a subadult and a juvenile subsequently disappeared, and the Group consisted of three animals when the study was begun. In December 1992, the subadult male of this group, which had a radio transmitter, emigrated. He founded a new group together with an adult female and her infant, which was called Group II. The emigration was not observed in detail, because observations were made only one day before and after the emigration of the subadult male. Before the male left his group he was evidently neither peripheralized nor showed or received aggressive behavior from the adult female of Group I. The separation of the female from her group was not observed, and her origin is unknown. The new group was founded in one day.

When emigration and group founding were complete, some behavioral changes occurred, which may have an important role in titi monkey group structure. Masked titis normally use the same trees for sleeping. During the four months of observations, Group I used a total of 22 different trees. The new Group II used only nine different sleeping trees. Two of them were used on 82% of the occasions when the sleeping site was recorded. Following the emigration of the subadult male, Group I no longer used the same sleeping trees as before. Furthermore Group II never used any of the sleeping trees of Group I, which were located within their territory. In addition, the male of Group II did not participate in caring for the infant (no carrying was observed). Only when the infant began independent locomotion did he start to play with it.

In January 1993, Group II used an area of 11 ha; 43% of which had been taken over from Group I. During February and March, they occupied a further 5 ha. By September 1993, Group II occupied an area of a little more than 24 hectares. By comparison: Group I used about 23 hectares. Seven hectares of the territory were taken from Group I. No contact or encounter between the groups was observed, and it is not known whether their ranges overlapped, although Group I was never seen in the area occupied by Group II.

Discussion

Although the monogamous mating system is uncommon in primates, lifestyles are remarkably similar among those which have this mating system (Hrdy, 1981). They are characterized by a group size that is always small. Maximum group size in *Callicebus* is six animals (Kinzey, 1981; Kinzey and Becker, 1983). What factors keep the group size in this narrow range? In gibbons, another well-studied monogamous primate, group size is regulated by the parents. On becoming adult. a subadult gibbon suffers same-sex aggression within the group, and he is subsequently chased away by his parents. The natal group prepares the territory for his offspring (Aldrich-Blake and Chivers, 1973; Tilson, 1981). In contrast to the gibbon model, group size in *Callicebus* is evidently regulated by the offspring. In the beginning of 1992, when our study group comprised six individuals, three members of the group disappeared. In December 1992, a subadult male left his natal group unexpectedly. Neither large group size nor limited resources could be causes leading to this emigration because group size had been reduced beforehand. No aggression, peripheralization or other behavioral changes were observed prior to the subadult leaving his natal group. Therefore, we conclude the mature offspring, in this case, did not leave his natal group because of agonistic behavior from the parents. It would seem that intrinsic developmental changes in the offspring themselves are the reason, possibly through hormonal changes at subadulthood, leading to the needs to obtain a mate and a territory of its own. This could be an evolutionary successful mechanism to avoid incest. Furthermore, and in contrast to gibbons, the emigration and group founding observed were abrupt. Group founding was completed within one day and no reversal was recorded, as has been seen in gibbons (Tilson, 1981).



In a very detailed report, Easley and Kinzey (1986) demonstrated a territorial shift in a group of *C. torquatus* over a period of seven years. The areas used by the group at the beginning and end of the study were completely different and not overlapping. Unfortunately they did not observe emigration nor group founding of the mature offspring, which left the natal group during their study.

Complementary to the observations of Easley and Kinzey (1986), we have observed the emigration and establishment of a territory for the first time in *Callicebus*. Unfortunately, the duration of the study and the restricted area in which it was carried out, made it impossible to observe territorial shifting. Our observations indicate, however, that the preparation of a space for the mature offspring may involve another process, which would seem to involve a territorial stretching and retraction, as has been observed in siamang (Aldrich-Blake and Chivers, 1973). Prior to the departure of the mature offspring, the parent group defended a larger area, but subsequently gave over part of the territory. Unfortunately, we have no data on whether the natal group of the female also prepared a part of the newly established territory.

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RELATIVE REPRODUCTIVE SUCCESS IN THE MANTLED HOWLER MONKEY: IMPLICATIONS FOR CONSERVATION

Introduction

The structure of primate groups is thought to result from the tendency of females to select rich patches of food and that of males to select large aggregations of females (Wittenberger, 1980; Emlen and Oring, 1977). Because patch richness and the consequent number and quality of females may vary, the relative reproductive success (RRS) of females may also vary over space and time. Relative reproductive success is a population parameter, since it is one characteristic of demographic or life history traits describing sub-units of a species within and between environmental regimes (see Vehrencamp and Bradbury, 1984). RRS is important to the field of conservation biology since an increase in the variance of reproductive success in a population reduces effective population size (Primack, 1993). Information about RRS facilitates viability analysis of population fluctuations required for recovery from environmental perturbations.

Methods

This report analyzes relative reproductive success (RRS) of mantled howler monkeys (*Alouatta palliata* Gray) in two Central American forests as the mean number of juveniles plus infants (J + I) per female group size per site. This report uses data from several studies (Carpenter, 1934; Mittermeier, 1973; Thorington, 1975; Malmgren, 1979; Clarke *et al.*, 1986; Glander, 1980; Jones, unpubl., Table 1) at two research sites where mantled howler monkeys have been studied most intensively: Guanacaste (GTE), Costa Rica in a tropical dry forest environment (Heltne *et al.*,1975) (n= 51 groups) and Barro Colorado Island (BCI) in a semideciduous lowland tropical forest environment of Panama (Heltne *et al.*, 1975) (n= 73 groups). Mantled howler monkeys, large cebids distributed throughout the forests of Middle America and the Pacific coast of northern South America, are classified as endangered in the United States Endangered Species Act of 1991 (Groves, 1993).

Results and Discussion

Fecundity is thought to be related to group size (see Pulliam and Caraco, 1984; Terborgh and Janson, 1986; Wittenberger, 1980; Robinson, 1988). Results differ, however, depending on methods of calculation. Calculations of absolute values per group (i.e., the total number of juveniles and infants per group compared to the total number of adult females in a group) may exhibit