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Articles

MULTIPLE SIMULTANEOUS BREEDING FEMALES IN A PYGMY MARMOSET GROUP (*CEBUELLA PYGMAEA*)

Michael Schröpel

Callitrichids form polygynandrous social units and have communal breeding systems. In natural groups there are one or more adult individuals of both sexes, as well as subadults, juveniles and infants. The sizes of the groups vary inter- and intragenerically, and inter- and intraspecifically, as well as between different populations, probably depending principally on the resources of the habitat, population density, predator pressure, or the filling of niches by other species. Nonetheless, there are specific tendencies evident in the distinct genera. The *Callithrix* species tend to have larger groups (7-8 members on average) than *Saguinus* and *Leontopithecus* which have 5-6 members on average; this seen especially in the *Callithrix* forms of the Atlantic forest region. They feed to a large extent on tree exudates such as gums, a food source available year-round and concentrated on just a few trees, with enough to feed the group. The main foods of *Saguinus* and *Leontopithecus* are the more dispersed, more seasonally available, fruit and nectar, as well as small animals, as is found with all callitrichids. *Cebuella* is an exception to this trend, feeding principally on tree exudates, and fruit plays a minor role in its diet. The groups, however, are generally smaller (averaging 6 to 7 animals: Hernández-Camacho and Cooper, 1976; Soini, 1988, 1993) than those typical of *Callithrix*, but larger than in the tamarins and lion tamarins. Ranging behavior, which is singular in callitrichids, is evidently correlated (Ferrari and Lopes Ferrari, 1989; Soini, 1993). The home ranges used at any one time are extremely small (sometimes only 0.1 acre; Soini, 1988), and are often ephemeral. When the available exudate trees are insufficient, the groups split or move to a new area. This is possible because the home ranges of different *Cebuella* groups are isolated and distant from each other.

A general characteristic of all callitrichids is the restriction of reproductive activity to just one adult female in the group. The other group members, especially the father but also other adult and subadult individuals, take part in the rearing of the offspring, especially by carrying them (communal breeding system). The causes for this altruistic behavior by the group members in their rearing the young of the reproductive female have not yet been clarified completely, although this phenomenon has been widely discussed in the literature. Callitrichid females usually give birth to twins, which combined comprise about 20% of the mother's weight. Help in carrying the infants is, therefore, seen as a necessity because of the energetic constraints on the mother during lactation (Eisenberg, 1977; Leutenegger, 1980; Garber *et al.*, 1984; Goldizen and Terborgh, 1989). There are, however, examples from

the wild and from the captivity which show that mothers can rear their young by themselves (Soini, 1982a; König and Siess, 1986; Rothe and Darms, 1993). The sociobiological explanations of communal in tearing vary (increase of the inclusive fitness, gaining experience for the rearing of own offspring, submissive behavior for securing group membership, etc.) (Epple, 1975b; Rylands, 1989; Cleveland and Snowdon, 1984; Ferrari and Lopes Ferrari, 1989).

Monogamy is considered to be another characteristic of reproductive strategies in callitrichid societies (Hampton *et al.*, 1966; Epple, 1967, 1970; Kleiman, 1977). Reproduction limited to the dominant pair in a group is seen as the basic pattern. There are proven divergences from monogamy, but at a very low percentage in the wild as well as in captivity. Possible deviations from sexual monogamy in wild *Cebuella* and *Callithrix* groups have been found in about 3% of the cases studied. There are even fewer cases of non-monogamous reproduction in captivity (Rothe and Darms, 1993). Reports of polyandrous matings are most frequent, especially in tamarins in the wild. In general, however, closer investigation has shown that only one male in the group has access to the reproductive female in the estrus periods. This does not contradict the observation of polyandrous copulation out of theceptive periods of the female, but it has often led to the interpretation of a polyandrous reproductive strategy. In principle, functional monogamy is maintained (Ferrari and Lopes Ferrari, 1989). On the other hand, polyandrous reproductive patterns are hard to prove or deny. Theoretically, the dizygotic twins might have different fathers, but genetic finger-printing techniques have failed to answer this question either way because of germ cell chimerism in the early fetal stage (Dixson, 1993).

Group structure alone can indicate reproductive activity in more than one female. More than one reproductive female in wild groups have been observed by Soini (1982) for *Cebuella pygmaea*, by Scanlon *et al.* (1988), Digby and Barreto (1993), and Digby and Ferrari (1994) for *Callithrix jacchus*, as well as by Dietz and Baker (1992) and Dietz and Kleiman (1986) for *Leontopithecus rosalia*. There are reports of more than one reproductive female in captive groups by Abbott (1978, 1984), Rothe (1978), Jämmrich (1985), Anzenberger and Simmen (1987), and Adler and Jämmrich (1991) for *Callithrix jacchus*, as well as by Wim Mager (pers. comm. in Rothe and Darms, 1993) for *Cebuella pygmaea*.

Inhibition of reproductive activity in supernumerary adult males is probably caused by the behavior of the dominant male, although the mechanisms are still unknown. The dominant and reproductive female also inhibits reproduction in other adult females in the group, but the mechanisms differ between the genera. Physiological inhibition of ovulation of the other females occurs in *Cebuella* and *Callithrix*. Pheromones of the dominant female may prevent the secretion of gonadotropin in the hypothalamus of these females (Abbott and Hearn, 1978). Experiments involving blocking the sense of smell, however, have shown

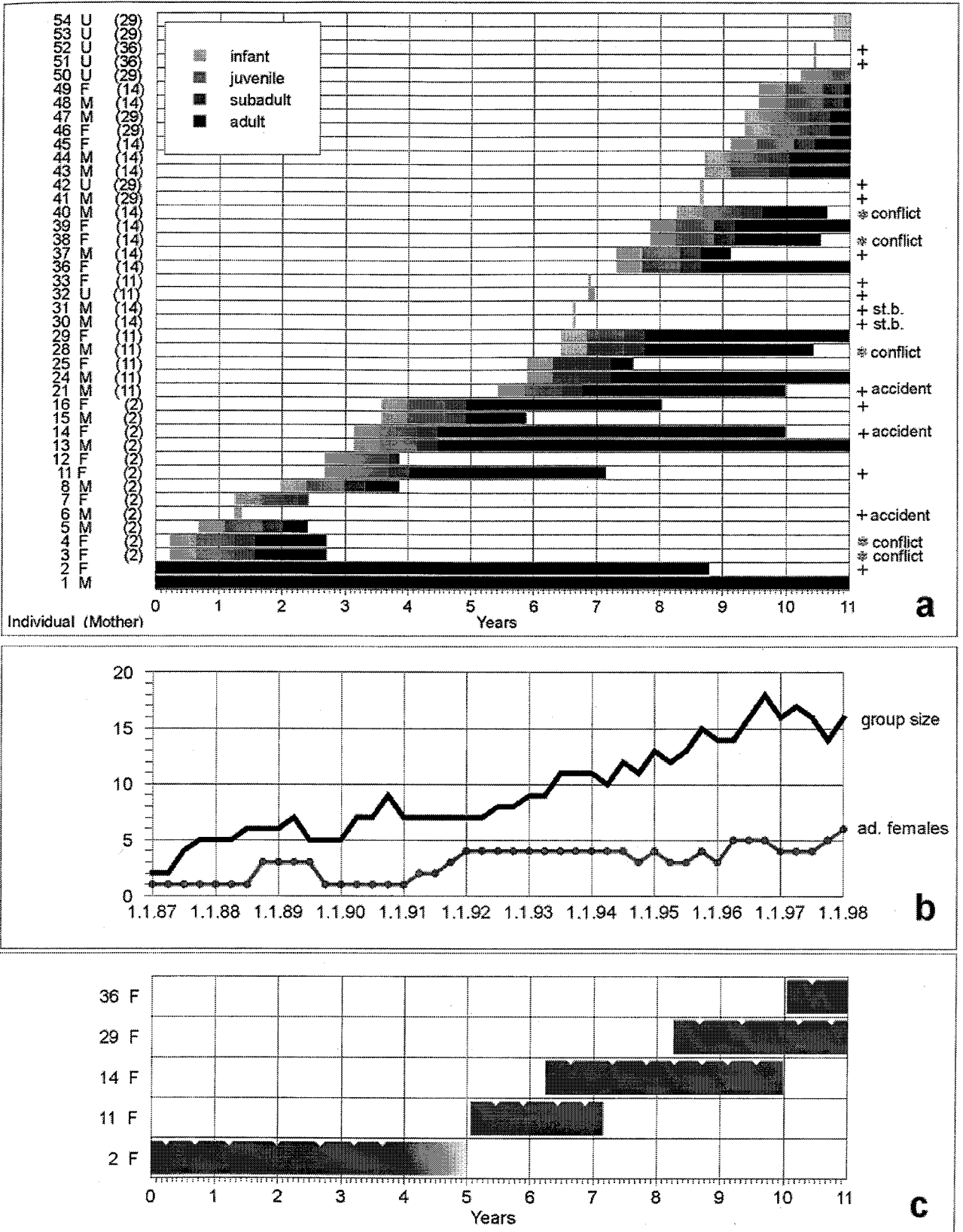


Fig. 1. a) Development and composition of a pygmy marmoset group at Magdeburg Zoo between 1987 and 1997. The left column shows the sex and identification numbers of the group members, and (in brackets) the identification number of the mother. The horizontal bars demonstrate the presence of each individual within the group at the time. The ontogenetic phases (different shades of gray of the bars) were classified following Soini (1988), and mark the infant phase (0-5 months), the juvenile phase (6-12 months), the subadult phase (13-16 months) and the adult phase (more than 16 months). All the marmosets, except M1 and F2, were born in the group. Symbols in right column: + = death; * = removal from the group after agonistic conflict. If there is no symbol at the end of the bars, the animals were separated for transfer to other zoos without intragroup conflicts. b) The group size during the observation period and the number of adult females in the group. c) The reproductive phases of the five reproductive females in the group. The notches on the bars represent the birth dates. Note, there are three phases of simultaneous reproduction of two females.

that the behavior of the dominant female also plays a role (Abbott *et al.*, 1993). The suppression of ovulation in subordinate females seems to be stronger in groups comprised of unrelated individuals than in family groups with mothers and daughters (Rothe and Darms, 1993). In *Callithrix jacchus* one, and only one, daughter of the reproductive female may ovulate (Abbott, 1984). This might be a sign of a forthcoming change in the reproductive and social status of the daughter in the group. Physiological inhibition has also been shown in tamarins (Epple and Katz, 1984; Ziegler *et al.*, 1989). From the diagnosis of progesterone levels in the blood, Tardif (1984) assumed that 50% of the daughters of cotton-top tamarins show ovarian cycles. There is no evidence, however, of physiological inhibition in *Leontopithecus* (see French *et al.*, 1989), although the reproductive female in a group is able to inhibit the other females from reproducing by her behavior (Abbott *et al.*, 1993). Interestingly, the ovarian cycles of all females (including the reproductive one) of a group seem to be synchronized (French and Stribley, 1987). This synchronization could also be pheromonally regulated by the dominant female, and it might give her a greater chance of monopolizing the dominant male during estrus (Abbott *et al.*, 1993).

Results

Pygmy marmosets have been kept at the Magdeburg Zoological Gardens since 1986, and have been reproducing regularly since 1987 (Schröpel, 1994). The "main group" has been stable since then and is an extended family unit. All members, with the exception of the original pair (M1

and F2), were born in the group. Temporary, smaller groups or pairs have been formed with some of the individuals from this main group, but they were disbanded or transferred to other zoological gardens. The development and the composition of this group from its beginning are shown in Figure 1.

The largest group size obtained was 18 individuals (five adult females, six adult males, two subadult males, two juvenile females, one juvenile male, and two infants) between September and December, 1996. The first exclusions due to agonistic behavior in the group did not occur when the group was at its largest but in the early years (1989), when it consisted of one adult male, three adult females, one juvenile male, and two neonate females. Perhaps the exclusion of the two non-reproductive females (F3 and F4) was influenced by the mother's giving birth to twins (F11 and F12) a few days previously. Possible hints concerning the reasons for this agonistic behavior can be found in observations of wild *Callithrix jacchus* groups by Digby and Barreto (1993).

For most of the births of the female "Caqueta" (F2) there were no other adult females living in the group. In 1990, however, at the age of 5½ years, this female gave birth for the last time. She stayed in the group up to her death (October 1995, at the age of 10 years and nine months) together with other females (daughters) without agonistic clashes. There were further expulsions through agonistic conflicts in 1997 (two males, four and two years old, and one nonreproductive female, two years old).

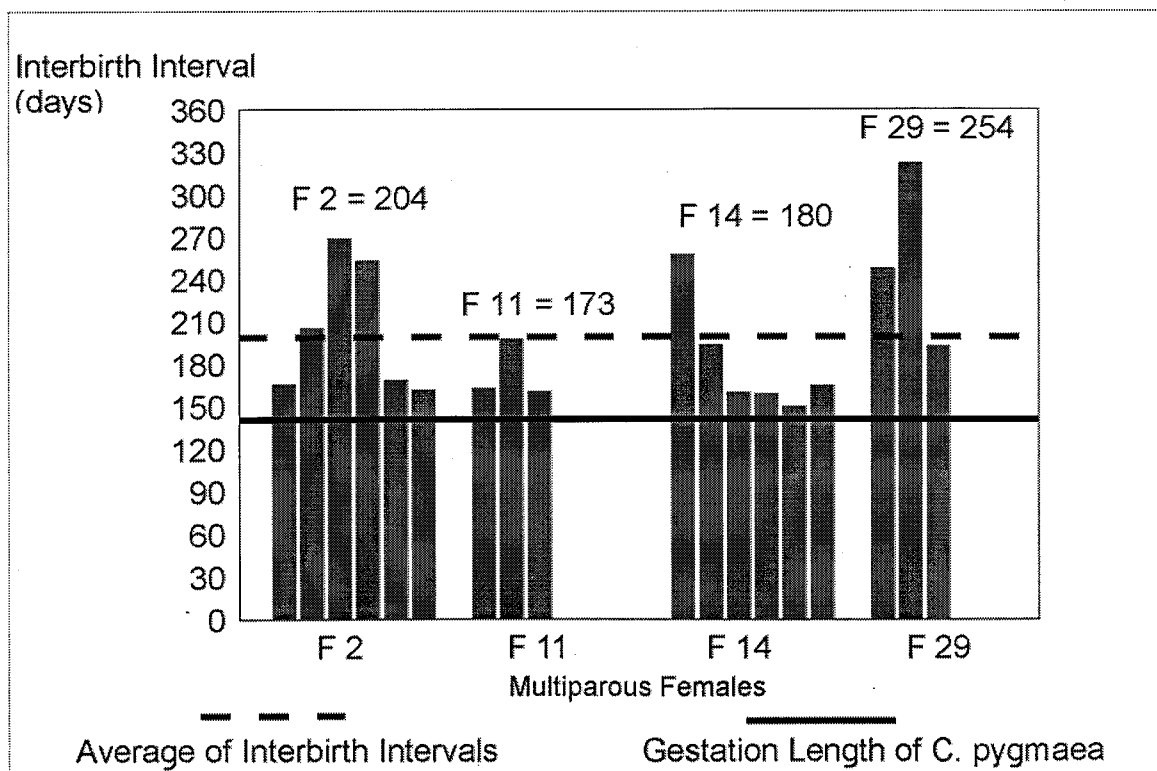


Fig. 2. Interbirth intervals of the multiparous females of the pygmy marmoset group. The last birth of F11 occurred during the first, very long interval (247 days) of F14, 86 days after the first birth and 161 days before the second birth of F14. The *Cebuella pygmaea* gestation length of 137 or 138 days was taken from Soini (1988). Soini (1993) found interbirth intervals of between 5 and 7 months for wild pygmy marmosets.

Almost exactly two years after the last birth of the female "Caqueta" (F2), the daughter of two years and nine months "Cali" (F11) gave birth for the first time to a single young. At that time, she was the oldest female after her mother, who had ceased reproduction. There were then two other adult females in the group, aged 2½ years and 2 years. There were no agonistic interactions evident. This female (F11) gave birth to twins three times, at intervals of 162, 197 and 160 days (see Fig. 2). The twins of the last birth died at the ages of five days and 34 days. Tension in the group was obviously responsible for this, probably affecting the care given to the neonates, although this was difficult to ascertain exactly. The mother "Cali" died of an unknown cause three months after her last birth, at the age of 4½ years.

Between the penultimate and last birth by the female "Cali", her younger (3½ year-old) sister "Sela" (F14) gave birth for the first time. The twins were stillborn. This was 74 days after the previous birth by "Cali", who gave birth again 86 days after her sister "Sela". After the death of "Cali", the female "Sela" was the only reproductive female of the group, but with two other resident adult sisters. Up to June 1996, "Sela" had given birth to twins on a further four occasions and twice to a single offspring. All of these young survived. The birth interval after the first stillbirth of "Sela" was 247 days, and subsequently 193, 159, 143, 158 and 149 days. "Sela" died in an accident at the end of 1996.

Another female of the group (F29) gave birth to twins between the fourth and the fifth births of "Sela". The female F29 was aged two years and three months, and there was only one other female in the group, F36 aged one year and four months. On the third day after parturition, we found one of the neonate twins abandoned and suffering from hypothermia in the bottom of the enclosure. On the fourth day, the second infant was found with severe bites, and died. The individuals involved in the attack were not identified and it was not possible to say for sure if this was a case of infanticide. F29 again produced twins after an interval of 247 days; 83 days after the penultimate birth by the female "Sela" (F14). This time the young grew up without any problems. Sixty-six days after the birth of the twins of F29, "Sela" gave birth for the last time. F29 continued reproducing, giving birth to a singleton after an interval of 322 days and to twins after a further 192 days. Another female, almost certainly F36, gave birth to twins for the first time between the penultimate and the last birth of F29. The neonates, however, died on the first and second day, respectively.

Five females, therefore, have reproduced in this pygmy marmoset group, with three phases of polygynous reproduction when two females were breeding simultaneously. It is certain that "Napo" (M1) was the father of all the offspring of the original female "Caqueta" (F2), but the paternity of the other offspring was impossible to ascertain. Currently, "Napo" is living in the group together with five other adult males of different ages.

Discussion

The size of the pygmy marmoset group at the Magdeburg Zoo exceeds, by far, the average group size given for this species in the wild, although up to 11 (Soini, 1988, 1993) or 15 individuals (Hernández-Camacho and Cooper, 1976) have been reported occasionally. Soini (1988), however, argued that these larger troops were temporary aggregations of two social units, and indicated that the reproductive male or female of one group may have been the offspring of the reproductive pair of the other. Very large groups, at least when they are extended families, can be stable for a long time under captive conditions (Rothe and Darms, 1993). There is currently a group of golden-headed lion tamarins (*Leontopithecus chrysomelas*) with 13 individuals at the Magdeburg Zoo. In the wild, golden-headed lion tamarin groups are comprised of 5 to 8 (Rylands, 1989), or 3 to 9 individuals (Dietz *et al.*, 1994). The home range for a captive group is always considerably smaller when compared to the wild, but there are certainly no restricting factors for the group size up to a minimum range for normal locomotion and other behavioral functions. Food competition between group members is not an important factor in captive colonies. Dawson (1977) reported that *Saguinus geoffroyi* groups in habitats with stable food resources ("survival habitats") were relatively stable, but in areas with strong seasonal differences in food resources ("colonization habitats") they were unstable. The extent to which social and socio-sexual parameters have an influence on the group size in captivity is not yet known.

It is widely accepted that there is no clear hierarchical structure in callitrichid social units except for the dominant and reproductive pair (Epple, 1975a; Stevenson and Rylands, 1988; Caine, 1993; but see Rothe, 1978). If a hierarchy becomes evident, it is generally related to age and sex. Dawson (1977) refers to this as "age-related, male-female groups" in *Saguinus geoffroyi*. In wild (Soini, 1988) and captive (Christen, 1974) pygmy marmoset groups, the older offspring of the dominant pair are dominant over their younger siblings. However, according to Soini (1988), the younger siblings, during the weaning period especially but also when benefiting from parental protection, are responsible for the peripheralization of their older siblings and their subsequent expulsion from the group. This rarely happens through overt aggression, but is more of a gradual process, involving, for example, exclusion of the individuals from the prime exudate gnawing-sites. The starting point for this may be the reproductive status of the dominant female at the time. She is often intolerant with other group members in the third month of pregnancy. This coincides with the weaning period of the last-born young (see also Kleiman, 1986, for *Leontopithecus rosalia*). Under captive conditions this behavior may subside and offspring stay much longer in the group as a result (see Rothe, 1978, for *Callithrix jacchus*). In captivity, the gradual expulsion process, involving mainly social peripheralization, is difficult to detect (Rothe *et al.*, 1986).

It is only when there is overt aggression that the keepers remove the animals, corresponding to emigration in the wild.

In the *Cebuella* group described here, there was at first a matrilineal transmission of the reproductive position. When the initial reproductive female "Caqueta" (F2) stopped giving birth, her oldest daughter "Cali" (F11), took over after two years. This conforms with the reproductive strategy described by Ferrari and Diego (1992) for marmosets in the wild. When the fertility of a reproductive female is reduced or lost, her daughter takes over. Especially in areas with a high population density and stable social groups, this is a more promising alternative for the young female than emigrating and starting a new group, or taking over the reproductive position of another established group. Ferrari and Diego (1992) did not record any immigrations of females into existing groups of *Callithrix flaviceps*. The possibility of matrilineal transmission is also supported by the results of physiological suppression of the ovulation of the adult female group members by the reproductive female in marmosets (Abbott, 1984). Besides the mother, the oldest daughter is the only female showing ovarian cycles. In the case of the pygmy marmosets discussed here, it is possible that the reproductive decline of the old female was accompanied by a loss in her ability to physiologically inhibit reproduction in her daughter.

After three births by the new reproductive female "Cali" (F11) and a time span of one year, there were two reproductive females in the group, with her younger, primiparous sister "Sela" (F14) also breeding. The neonate twins of "Sela" were, however, stillborn. Digby and Ferrari (1994) argued for a correlation of high population density and the presence of two reproductive females in wild *Callithrix jacchus*. However, they were referring to mother and daughter, while the two reproductive females in this pygmy marmoset group were sisters. Since emigration, as explained above, is not necessarily the best alternative, permitting reproduction by a second female may be an effective solution, if the reproductive success of the female is not compromised (i.e., enough helpers are available for infant care, there is sufficient food, etc.). Multiple reproduction may also increase the inclusive fitness of both females in cases where they are close relatives (Digby and Ferrari, 1994). These factors still apply even though population density is not a factor in captive groups.

The female "Cali" died a short time after her subsequent birth, and again there was only one reproductive female, "Sela". All her offspring from the six following births survived. Shortly before the fifth birth by the female "Sela", another female began reproducing; the female F29, a daughter of "Cali" (F11). This gave rise to the same situation as before between "Cali" and "Sela". The liveborn offspring were neglected and abandoned. Unfortunately it was not possible to observe which group members were responsible for the deaths of the offspring (the mother and/

or others). One of the young animals was bitten to death, and infanticide was possible. About eight months later, and 83 days after the birth of a singleton by "Sela", the female F29 again gave birth to twins, which she reared normally. At the time of writing this, they are already adult. There were, as such, therefore, two reproductive females breeding successfully in the group. The older reproductive female "Sela" (F14) later gave birth for the last time, but died in an accident at the end of 1996. Immediately after her death, another female (F36) became reproductive and gave birth to twins, between the births of F29. The neonates did not survive, however. Both the females (F29 and F36) were alive at the end of 1997.

The simultaneous reproduction by two females in one group succeeded, therefore, in only one case. The question arises whether the simultaneous fertility of two females can be considered a reproductive strategy at all. There is the possibility that it is merely a failure of the physiological inhibition of ovulation of the subordinate females by the reproductive female. Other mechanisms, probably behavioral, then prevent the survival of the offspring of the second female. The breeding pattern remains monogynous. Price and McGrew (1991) found some cases of simultaneous reproduction by mother and daughter in captive *Saguinus oedipus*. The offspring of the daughter, however, did not survive. In one of the cases, it involved infanticide of the offspring of the daughter by her mother. Evaluation of the one success in simultaneous reproduction of the two females in the pygmy marmoset group is dependent on further data. The premises for multiple reproduction as an effective alternative to emigration (the participating females being close relatives, enough helpers in the group, a large supply of food) among wild *Callithrix jacchus* as assumed by Digby and Ferrari (1994) apply to the present case. But there are, however, other factors considering the captive conditions, in this large group particularly, which perhaps may play a role, and referring to it as a reproductive strategy as such may be unwarranted. The helpers would often sit with the dependent young of both mothers in close contact, and there was no obvious agonistic behavior between the mothers.

Nothing can be said concerning the paternity of the offspring except that incest was involved, with the exception of the original pair "Napo" (M1) and "Caqueta" (F2). So far, there have been no adverse consequences. There are several reports of incest among callitrichids in captivity (Epple, 1970; Abbott, 1984; Jämrich, 1985; Anzenberger and Simmen, 1987; Price and McGrew, 1991; Rothe and Darms, 1993), but no information from wild groups, because the family relationships are mostly unknown. Considering, however, the stability of wild callitrichid groups, incestuous reproduction cannot be completely ruled out. Immigrations in groups are often re-immigrations. For example, out of 18 immigrants in *Saguinus geoffroyi*, 13 had formerly emigrated from the group, and were, therefore, closely related (Dawson, 1977). Few immigrations have been recorded for *Cebuella* and *Callithrix* (Soini,

1988; Rylands, 1982; Ferrari and Diego, 1992; Digby and Barreto, 1993). New members mostly result from births. Perhaps in callitrichids inbreeding resulting from long-term stable groups may have contributed to genetic drift and be responsible, therefore, for at least part of the enormous variety of forms of this primate group, in a similar fashion to island populations. Such a hypothesis is very speculative, but requires consideration. In captive management there is always a conflict between the problem of avoiding incest, available space, and the usually undesirable measure of breaking up stable social groups by excessive manipulation.

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THE EFFECT OF RAINFALL SEASONALITY ON THE GEOGRAPHIC DISTRIBUTION OF NEOTROPICAL PRIMATES

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Introduction

Studies carried out on the geographic distribution and ecology of New World Primates (for example, Pagel *et al.*, 1991; Ross, 1992; Rosenberger, 1992; Strier, 1992; Ford, 1994) all find that environmental variables such as temperature and rainfall have an important effect on the morphological adaptations and behavioral ecology of the platyrrhine primates.

There is a general relationship between overall body size and ecological, behavioral and physiological traits in mammals (for example, Calder, 1984; Clutton-Brock and Harvey, 1983; Eisenberg, 1981; McNab, 1987; Peters, 1983; Schmidt-Nielsen, 1984). In primates there is a consistent relationship between body size and feeding ecology (Ford and Davis, 1992). Body size by itself, therefore, is a useful predictor of a species' adaptations (Damuth and McFadden, 1990), and appears to be related to numerous life-history variables (Clutton-Brock and Harvey, 1983; Harvey and Clutton-Brock, 1985).

Platyrrhines are thought ideal for examining morphological adaptations to diet, because of their monophyletic origin, universal arboreality, and variation in food prefer-

Table 1. Mean body weights (adapted from Ford and Davis, 1992) of the platyrrhine primates, and their presence in the phylogeographic regions (Rylands *et al.*, 1995). *CCCH = Cerrado/Caatinga/Chaco; AM = Amazonia; SA = Southern Andes; MA = Middle America; NVC = Northern Venezuela-Colombia; NA = Northern Andes; AF = Atlantic forest.

Species	Male weight (g)	Female weight (g)	Mean weight (g)	Phylogeographic region
<i>Alouatta belzebul</i>	7270.0	5525.0	6397.5	AM
<i>Alouatta caraya</i>	6800.0	4605.0	5702.5	CCCH
<i>Alouatta fusca</i>	6175.0	4550.0	5362.5	AF
<i>Alouatta palliata</i>	7150.0	5350.0	6250.0	MA, NA
<i>Alouatta pigra</i>	11352.0	6434.0	8893.0	MA
<i>Alouatta seniculus</i>	7200.0	5600.0	6400.0	SA, MA, NVC
<i>Aotus azarae</i>	933.0	953.0	943.0	CCCH, AM
<i>Aotus lemurinus</i>	955.0	968.0	961.5	MA, NA
<i>Aotus nancymae</i>	923.0	940.0	931.5	AM
<i>Aotus trivirgatus</i>	920.0	950.0	935.0	AM
<i>Ateles belzebuth</i>	6200.0	5800.0	6000.0	AM, NVC, NA
<i>Ateles fusciceps</i>	8890.0	8800.0	8845.0	MA, NVC, NA
<i>Ateles geoffroyi</i>	8210.0	7456.0	7833.0	MA
<i>Ateles paniscus</i>	7460.0	9750.0	8605.0	AM
<i>Brachyteles arachnoides</i>	12125.0	9450.0	10787.5	AF
<i>Cacajao calvus</i>	3450.0	2880.0	3165.0	AM
<i>Cacajao rubicundus</i>	3450.0	2880.0	3165.0	AM
<i>Cacajao melanocephalus</i>	3450.0	2880.0	3165.0	AM
<i>Callicebus brunneus</i>	854.0	805.0	829.5	AM
<i>Callicebus calligatus</i>	1098.0	1075.0	1086.5	AM
<i>Callicebus cinerascens</i>	1098.0	1075.0	1086.5	AM
<i>Callicebus cupreus</i>	1012.0	1119.0	1065.5	AM
<i>Callicebus donacophilus</i>	1098.0	1075.0	1086.5	CCCH, AM
<i>Callicebus dubius</i>	1098.0	1075.0	1086.5	AM
<i>Callicebus hoffmannsi</i>	1098.0	1075.0	1086.5	AM
<i>Callicebus moloch</i>	1000.0	860.0	930.0	AM
<i>Callicebus oenanthe</i>	1098.0	1075.0	1086.5	SA
<i>Callicebus olallae</i>	1098.0	1075.0	1086.5	AM
<i>Callicebus personatus</i>	1325.0	1285.0	1305.0	AF
<i>Callicebus torquatus</i>	1300.0	1307.0	1303.5	AM
<i>Callimico goeldii</i>	640.0	530.0	585.0	AM
<i>Callithrix argentata</i>	357.0	320.0	338.5	AM
<i>Callithrix geoffroyi</i>	290.0	190.0	240.0	AF
<i>Callithrix humeralifera</i>	280.0	310.0	295.0	AM
<i>Callithrix jacchus</i>	256.0	236.0	246.0	CCCH, AF
<i>Cebuella pygmaea</i>	130.0	126.0	128.0	AM
<i>Cebus albifrons</i>	2480.0	1814.0	2147.0	AM, SA, NVC, NA
<i>Cebus apella</i>	3050.0	2385.0	2717.5	CCCH, AM, SA, NVC, AF
<i>Cebus capucinus</i>	3868.0	2666.0	3267.0	MA, NVC, NA
<i>Cebus olivaceus</i>	2974.0	2395.0	2684.5	AM, NVC
<i>Chiropotes albinasus</i>	3020.0	2510.0	2765.0	AM
<i>Chiropotes satanas</i>	3100.0	2600.0	2850.0	AM
<i>Lagothrix flavicauda</i>	8335.0	5750.0	7042.5	SA
<i>Lagothrix lagothricha</i>	8335.0	5750.0	7042.5	AM
<i>Leontopithecus chrysomelas</i>	620.0	535.0	577.5	AF
<i>Leontopithecus chrysopygus</i>	614.0	557.0	585.5	AF
<i>Leontopithecus rosalia</i>	607.0	578.0	592.5	AF
<i>Pithecia irrorata</i>	2010.0	1875.0	1942.5	AM
<i>Pithecia monachus</i>	2795.0	1900.0	2347.5	AM
<i>Pithecia pithecia</i>	1732.0	1515.0	1623.5	AM
<i>Saguinus bicolor</i>	430.0	430.0	430.0	AM
<i>Saguinus fuscicollis</i>	387.0	403.0	395.0	AM
<i>Saguinus imperator</i>	400.0	400.0	400.0	AM
<i>Saguinus inustus</i>	423.0	454.0	438.5	AM
<i>Saguinus labiatus</i>	451.0	465.0	458.0	AM
<i>Saguinus leucopus</i>	490.0	490.0	490.0	AM
<i>Saguinus midas</i>	586.0	432.0	509.0	AM
<i>Saguinus mystax</i>	577.0	560.0	568.5	AM
<i>Saguinus nigricollis</i>	470.0	480.0	475.0	AM
<i>Saguinus oedipus</i>	411.0	430.0	420.5	AM
<i>Saguinus tripartitus</i>	423.0	454.0	438.5	AM
<i>Saimiri boliviensis</i>	1015.0	700.0	857.5	CCCH, AM
<i>Saimiri oerstedii</i>	829.0	695.0	762.0	MA
<i>Saimiri sciureus</i>	852.0	675.0	763.5	AM, NVC
<i>Saimiri ustus</i>	910.0	795.0	852.5	AM
<i>Saimiri vanzolinii</i>	950.0	650.0	800.0	AM

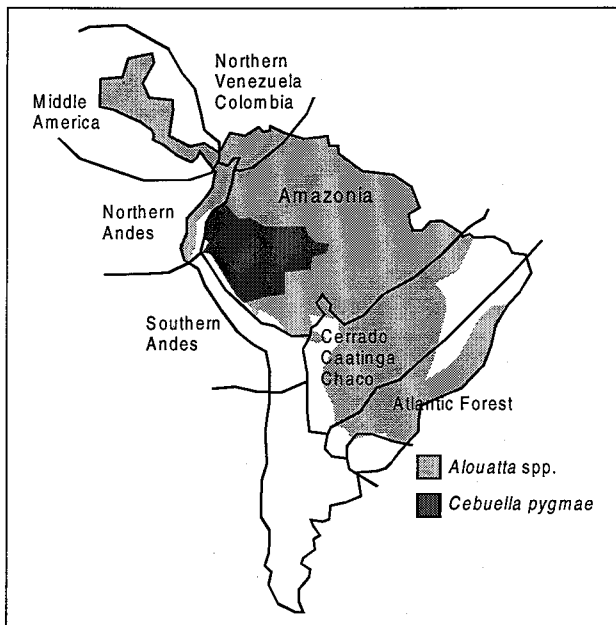


Figure 1. The geographic ranges of a large (*Arouatta*) and a small (*Cebuella*) platyrrhine, overlaid with the seven phytogeographic regions of Gentry (1982).

ences (Anapol and Lee, 1994). Differentiation of body size is a significant factor in the partitioning of platyrrhine diets and foraging strategies (for example, Temerin *et al.*, 1984; Janson and Boinski, 1992; Garber, 1992; Rosenberger and Strier, 1989; Strier, 1992).

There are currently three main hypotheses, based on ecological determinants, to explain the maximum body-weight thresholds of platyrrhines.

Terborgh and van Schaik (1987) suggested that the fruit and leafing cycles in the Neotropics are 'in-phase', therefore the species have to adapt to a seasonal environment. This leaves two options; either to specialize as folivores, or to exploit insects in periods of fruit scarcity.

Fleming *et al.* (1987) suggested that the low diversity of fleshy fruits in the Neotropics, in combination with a greater variety of fruit species, would have favored the evolution of small-bodied frugivores.

The 'brittle-branch' hypothesis (Cristoffer, 1987) proposed that the Neotropical forests had a more 'fragile' vegetation structure than its Paleotropical counterpart (Emmons and Gentry, 1983) and would have limited the evolution of large-bodied arboreal vertebrates.

All of these theories converge on one simple statement: the body size of Neotropical primates seems to be indirectly affected by climate. However, such theories do not explain the current geographical distribution of species. In this context we make two assumptions:

The larger platyrrhines, such as the atelines are distributed more evenly in the Neotropics because they are buffered against long periods of reduced food availability during the dry season (Boyce, 1979; Lindstedt and Boyce, 1985).

Table 2. Climatic variables calculated from long term records from randomly sampled weather stations (Wernstedt, 1972) for each of the phytogeographic regions (adapted from Gentry, 1982). CCCH = Cerrado/Caatinga/Chaco; AM = Amazonia; SA = Southern Andes; MA = Middle America; NVC = Northern Venezuela-Colombia; NA = Northern Andes; AF = Atlantic forest.

Phytogeographic region	Climatic variables*						
	n	T	P	RDV	Z	MO<50	P>2T
CCCH	38	21.45	1116.62	0.74	0.89	3.65	8.68
AM	30	25.08	2118.01	0.71	0.90	2.18	9.79
SA	8	23.46	1407.29	0.81	0.89	3.13	10.67
MA	20	25.73	2876.04	0.82	0.89	2.00	9.90
NVC	11	22.60	2198.11	0.79	0.90	2.55	9.36
NA	7	21.31	772.75	0.91	0.85	6.00	6.57
AF	7	21.21	1439.75	0.79	0.90	2.71	9.57
CCCH/AF	**	21.33	1302.18	0.78	0.90	3.18	9.12
CCCH/AM	**	23.26	1641.31	0.74	0.89	2.19	9.24
AF/AM	**	23.14	1778.88	0.75	0.90	2.45	9.68
AM/SA	**	23.18	1443.37	0.81	0.87	4.09	8.18
AM/NA	**	20.34	1444.83	0.82	0.89	3.71	9.90
AM/NVC	**	23.83	2158.08	0.73	0.90	2.36	9.58
NA/MA	**	23.51	1854.58	0.87	0.87	4.00	8.24
NA/NVC	**	21.95	1485.42	0.87	0.87	4.27	7.97
MA/NVC	**	234.16	2357.07	0.89	0.89	2.27	9.63

*n = number of weather stations sampled; T = mean annual temperature; P = mean annual precipitation (°C); RDV = rainfall diversity index; Z = Simpson's index of diversity; MO<50 = number of months where mean rainfall is greater than 50mm; P>2T = number of months where rainfall (mm) is greater than two times the temperature (°C).

**No sample size given since means for the overlapping sub-regions were calculated from the means of two neighboring regions.

Smaller species, such as the callitrichids, are more restricted in their geographic distribution due to their nutritional requirements (see Fleagle, 1988).

To illustrate this observation two genera were selected: a larger ateline with a wide distribution (*Arouatta* spp.), and the smallest platyrrhine genus (*Cebuella* spp.) which has a relatively restricted distribution (see Fig 1).

In this paper we test whether rainfall seasonality has an effect on the geographic distribution of platyrrhine species.

Methods

Southern and Middle America can be divided into nine phytogeographic regions (Gentry 1982), which give an accurate description of Neotropical vegetation diversity. In a review of platyrrhine distribution, Rylands *et al.* (1995) listed the species occurring in seven phytogeographic regions, adapted from Gentry (1982) (see Fig. 1). They did not consider two regions, the Caribbean, because no primates occur there, and the Guyana sub-region, which is subsumed into the Amazonia region. We use the species list of Rylands *et al.* (1995) because of the detailed information on distributions provided (see Table 1).

Indexing habitat productivity and rainfall seasonality

The main climate variables influencing plant and animal life are water availability and temperature, and can be used alone to characterize vegetation patterns and plant productivity globally (Walter, 1979; Box, 1981; Le Houerou

Table 3. The smallest species for each weight category, rainfall diversity (RDV) and mean annual temperature for each of Gentry's (1982) phytogeographic regions. P values and r^2 values listed for weight category versus RDV regressions.

Phytogeographic Regions	Body weight categories (g)						
	< 500	600-1000	1000-1500	1500-2500	2500-3300	3300-6400	6400-11000
AM	128.0	807.0	1004.0	1732.0	3165.0	6200.0	7621.0
AF	246.0	1933.0	1004.0	*	2675.0	5362.0	10788.0
CCCH	246.0	607.0	1004.0	*	2171.5	5702.0	*
MA	420.5	955.0	*	*	3267.0	6250.0	7833.0
NVC	420.5	955.0	1065.5	*	2675.0	6400.0	8605.0
NA	490.0	955.0	1303.5	*	2675.0	*	7621.0
SA	*	955.0	*	*	2675.0	6400.0	7042.5
Diet***	I, Fr, G	I, Fr, Pr, ScFr	ScFr	*	ScFr	Fol	Fr, Fol
p values	0.001	0.01	0.04	**	0.5	0.28	0.81
r^2	0.87	0.62	0.93	**	0.28	0.20	0.06

* No species of that weight category for that particular phytogeographic region.

** No statistical tests conducted.

*** I = insectivore, Fr = frugivore, G = gummivore, ScFr = sclerocarpic-frugivore, Fol = folivore, Pr = vertebrate predator.

and Popov, 1981). However, plant productivity can be indexed indirectly in a variety of ways; plant evapotranspiration being the most accurate. Potential evapotranspiration (PET) measures the potential amount of water released into the atmosphere through plant evaporation, respiration and transpiration. In the absence of data to compute evapotranspiration, it has been suggested (Bagnouls and Guassen, 1953; Walter and Leith, 1967) that the number of months where precipitation (P), in millimeters, is less than two times the mean annual temperature (t), in degrees Celsius ($P > 2t$) is an excellent substitute for PET. This is shown by the high correlation between the two measures ($r^2 = 0.938$, $p = 0.00$; Williamson, 1997). The advantage of the $P > 2t$ index is that the data are readily available.

Seasonality of Gentry's phytogeographic regions

Gentry (1982) characterized the phytogeographic regions in terms of plant species richness, (canopy trees and lianas; epiphytes and palmettos). Clinebell *et al.* (1995) further suggested that Neotropical tree and liana species' richness are best explained by annual rainfall and rainfall seasonality. In this analysis we characterized each of the phytogeographic regions in terms of climate, with a view

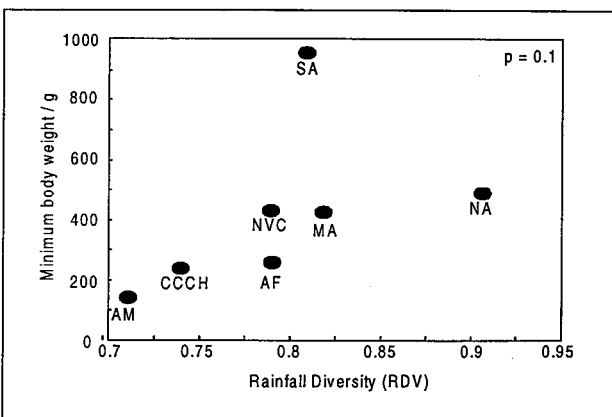


Figure 2. The smallest platyrrhine species' body weight in each of the phytogeographic regions (Gentry, 1982), regressed against rainfall diversity (RDV). CCCH = Cerrado/Caatinga/Chaco; AM = Amazonia; SA = Southern Andes; MA = Middle America; NVC = Northern Venezuela/Colombia; NA = Northern Andes; AF = Atlantic forest.

to predicting habitat productivity. There is also strong evidence that insect abundance, and fruiting and leafing phenology is highly correlated with rainfall seasonality (Wolda, 1978; Terborgh, 1983; Poulin *et al.*, 1992).

Weather stations from a worldwide climatic data source (Wernstedt, 1972) were chosen for each of the phytogeographic regions. They were selected focusing on the sampling areas in each region around known field study sites where the primates are known to live. Mean values for the climatic variables were then calculated for each of the phytogeographic regions.

Many of the primates occur in more than one phytogeographic region. These regions of overlap were considered as discrete sub-regions. Those species in the overlapping sub-regions were considered to be at the limits of their distribution, and therefore assumed to be in the most ecologically constrained part of their range. In support of this approach, it has been suggested (Strier, 1992), that one way to further distinguish between the effects of seasonality on dietary strategies (and by inference body size), is to examine data on sympatric taxa. The same climatic variables were recorded for the regions of overlap.

The following climatic variables were recorded from each of the weather stations; mean annual temperature ($^{\circ}\text{C}$); mean annual rainfall (mm), number of months with less than 50 mm ($mo < 50$); the number of months where mean monthly rainfall (mm) was greater than twice the mean monthly temperature ($^{\circ}\text{C}$); and ($P > 2t$). Two indices of rainfall diversity were calculated. The first index was Z (Simpson's index of rainfall diversity). Simpson's is an index of the proportional distribution of total rainfall across the 12 months of the year, and varies from $Z = 0$ (completely uneven) to $Z = 1$ (completely even). Simpson's index of diversity (Peet, 1974), which is derived from the species diversity literature (Magurran, 1988), has been questioned (Bronikowski and Webb, 1996; but see Williamson and Dunbar, in press), since it does not take dry months into account. There is as yet no single climatic index applicable across all habitat types. Some indices provide insufficient variance between values of the

seasonality index for statistical tests; for example, when rainfall is very low or even. We used, therefore, the index of the temporal distribution (RDV) of rainfall (Williamson, 1997). RDV is calculated by finding the difference between all possible pair-wise comparisons of the 12 mean monthly rainfall values, then finding the mean of these differences. This statistic is based on the exact randomization test (Sokal and Rohlf, 1981; p.788). RDV records the opposite of Z, a high value indicates a more seasonal environment, a low value a less seasonal environment. The climate data for the regions and overlapping regions is shown in Table 2.

Body weight categories

We divided the platyrrhines into body weight categories that would reflect finer-grained dietary adaptations, since body size and dietary quality are related (Fleagle, 1988; Anapol and Lee, 1994). To test whether rainfall seasonality has an effect on the geographic distribution of platyrrhines, the smallest species was chosen for each of the seven body weight categories, for each of Gentry's regions (Table 3). The smallest species were selected since they would be expected to be more constrained in their distribution, and because small species they are less able to buffer themselves against unpredictable food availability in fluctuating environments.

Results

Initial diagnostic Spearman rank correlations showed RDV to be the only climatic variable significantly correlated with body weight, so only those results will be presented here.

Table 4. Genera inhabiting each phytogeographic region, and those occupying regions overlapping phytogeographic regions. MA = Middle America; NA = Northern Andes; NVC = Northern Venezuela-Colombia; SA = Southern Andes; AM = Amazonia; AF = Atlantic Forest; CCCH = Cerrado/Caatinga/Chaco.

Phytogeographic region	Genera
MA	<i>Saguinus, Aotus, Saimiri, Cebus, Alouatta, Ateles</i>
NA	<i>Saguinus, Aotus, Callicebus, Cebus, Alouatta, Ateles, Lagothrix</i>
NVC	<i>Saguinus, Aotus, Callicebus, Saimiri, Cebus, Alouatta, Lagothrix</i>
SA	<i>Aotus, Callicebus, Cebus, Alouatta, Lagothrix</i>
AM	<i>Cebuella, Callithrix, Saguinus, Aotus, Callicebus, Saimiri, Cebus, Pithecia, Chiropotes, Cacajao, Alouatta, Ateles, Lagothrix</i>
AF	<i>Callithrix, Leontopithecus, Callicebus, Cebus, Alouatta, Brachyteles</i>
CCCH	<i>Callithrix, Aotus, Callicebus, Cebus, Alouatta</i>
Overlapping regions	
CCCH/AF	<i>Callithrix, Callicebus, Cebus, Alouatta</i>
CCCH/AM	<i>Callithrix, Aotus, Callicebus, Cebus, Alouatta</i>
AF/AM	<i>Callithrix, Callicebus, Cebus, Alouatta</i>
AM/NA	<i>Saguinus, Aotus, Callicebus, Saimiri, Cebus, Alouatta, Ateles</i>
AM/SA	<i>Aotus, Callicebus, Cebus, Alouatta, Lagothrix</i>
AM/NVC	<i>Saguinus, Aotus, Saimiri, Cebus, Alouatta, Ateles</i>
NA/MA	<i>Saguinus, Aotus, Cebus, Alouatta</i>
NA/NVC	<i>Saguinus, Aotus, Callicebus, Cebus, Alouatta, Ateles</i>
NA/NVC	<i>Saguinus, Aotus, Saimiri, Cebus, Alouatta, Ateles</i>

Body weight relationships with climate

The body weight of the smallest species in each of the seven phytogeographic regions was positively correlated with RDV ($r^2 = 0.70$, $F = 2.19$, $p = 0.01$), (Fig. 2). The regions containing the smallest species had the most even spread of rainfall (low RDV, or non-seasonal environments).

Body weight categories were regressed against RDV (Table 3, Fig. 3). As body weight increases, the significance level of the regression slope decreases (Table 3), being non-significant from the 2300 g category and upwards (Figs. 3: D, E. and F.). The most highly significant regression is that for the category <500g ($r^2 = 0.87$, $p = 0.001$). This corresponds to "Kay's threshold" (Kay, 1975) which defines the boundary between insectivorous (<500g) and folivorous primates (>500g).

Discussion

This study suggests that rainfall seasonality acts as a selective force on the distribution of body weights in Neotropical primates. The results of this study summarize what has already been suggested by other authors (for example, Cristoffer, 1987; Ross, 1992; Kinzey, 1994), that the adaptive morphological changes in body size are affected by environmental factors. In this paper we have analyzed in detail how environmental factors characterize rainfall seasonality and hence habitat productivity in each of Gentry's phytogeographic regions.

The most important result presented in this paper is the very significant effect that rainfall seasonality has on the geographic boundaries of the smallest species and how, in very seasonal habitats, only larger platyrrhines are found. Species' with body weights of less than 500g can only be distributed in the Amazonian region, which has a tendency to be less seasonal, favoring year-round food availability.

The smallest body weight category plotted against rainfall seasonality (RDV) (Fig. 3: A; Table 3), has the most highly significant regression slope of all the body weight categories ($r^2 = 0.87$, $p = 0.001$). This result corresponds to "Kay's threshold" (Kay 1975, 1984), and applies to the entire Order Primates. Smaller animals require a higher protein content in their diet, and therefore have a higher

Table 5. Mean body weights for each of the platyrrhine genera.

Genus	Mean weight (g)
<i>Alouatta</i>	6500.92
<i>Aotus</i>	942.75
<i>Ateles</i>	7820.75
<i>Brachyteles</i>	10787.5
<i>Cacajao</i>	3165
<i>Callicebus</i>	1086.58
<i>Callimico</i>	585
<i>Callithrix</i>	279.88
<i>Cebuella</i>	128
<i>Cebus</i>	2704
<i>Chiropotes</i>	2807.5
<i>Lagothrix</i>	7042.5
<i>Leontopithecus</i>	585.17

basal metabolic rate (BMR), and consequently higher energetic needs (reviewed in Ford and Davis, 1992). Kay (1984) stated that no primarily insectivorous primates (>30-40% of their diet composed of insects) would weigh more than 700g. Significantly, this body weight threshold also correlates with twinning and monogamy (Dunbar, 1995a, 1995b), features only found in callitrichids. On the other hand, for the middle-sized and larger platyrrhines (>1 kg), troop fragmentation appears to be a facultative adjustment to food scarcity (Kinzey and Cunningham, 1984).

Rosenberger (1992) suggested that small and large platyrrhines have overcome the problem of seasonality in two different ways:

1. Smaller species, which require a high energy diet, will shift to alternative food resources (e.g., gums or insects)

in the dry season when fruit is scarce. For example, *Saguinus fuscicollis* switches from fruit to predominantly nectar in the dry season (Terborgh and Stern, 1987), and thus avoids competition with larger primates by feeding on specialized resources (Garber, 1992). Alternatively Peres (1989) suggests, that small species switch to different feeding locations, where insects are more likely to be concentrated in the dry season, such as gumlicks and knot-holes. We need to be cautious, therefore, in suggesting that resources for the smaller primates are fewer in the dry season.

2. Larger platyrrhine primates have solved the problem of seasonality with folivory. Leaves are available year-round, although they are a low-quality food resource that requires special adaptations to overcome the problems of its digestion (Rosenberger, 1992). Large body size, an adaptation

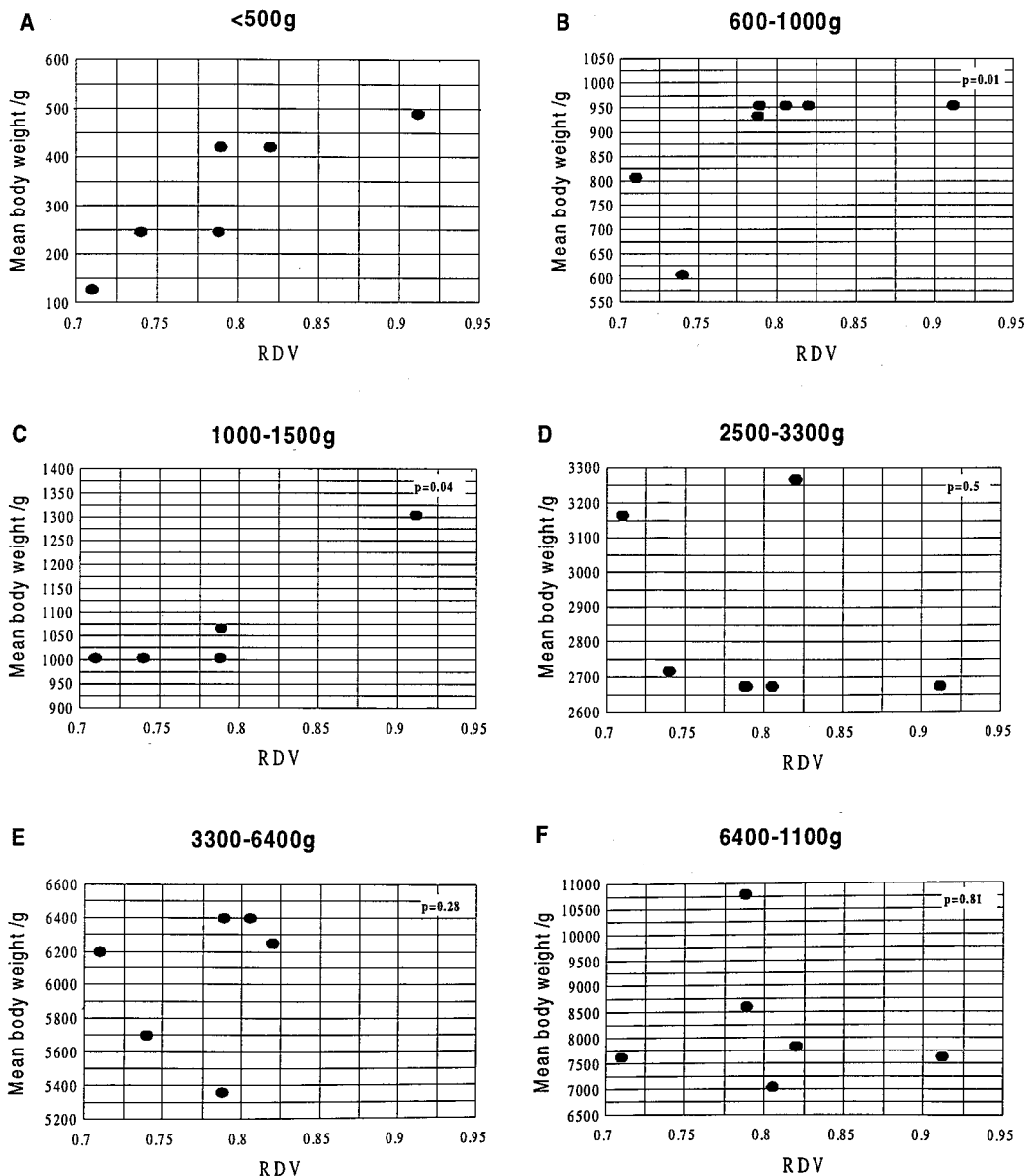


Figure 3. The smallest platyrrhine primate in each of the body weight categories (see Table 3) in each phylogeographic region against rainfall diversity (RDV). A. less than 500 g (dotted line indicates Kay's threshold); B. 600-1000 g; C. 1000-1500 g; D. 2500-3300 g; E. 3300-6400 g; F. 6400-11000 g.

to folivory, buffers against harsh seasonal habitats. This is supported by recent discoveries of giant extinct pitheciines (Hartwig, 1995; Hartwig and Cartelle, 1996), weighing as much as 25 kg. Their extreme large size may be an adaptation to competition for resources in a harsh habitat, brought on by climate changes in the Pleistocene.

Low rainfall seasonality habitats evidently permit the survival of a wider variety of primate species, but there is a need to understand better the environmental factors that underlie the biogeographic distribution of species if we are to devise effective conservation strategies.

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THE SQUIRREL MONKEY BREEDING COLONY OF THE PASTEUR INSTITUTE, CAYENNE, FRENCH GUIANA

Benoît de Thoisy
Hugues Contamin

Introduction

Squirrel monkeys, especially *Saimiri sciureus* and *S. boliviensis*, are animal models widely used in biomedical research; mainly in pharmacology, toxicology, cancerology, nutrition, cardiovascular diseases and neurology (Mittermeier *et al.*, 1994). Numerous captive breeding colonies have been established in different parts of the world. However, reproduction of captive squirrel monkeys is often inconsistent, giving rise to disappointing breeding results. The aim of this article is to briefly present the 15-year-old colony of the Pasteur Institute of French Guiana, emphasizing efforts to ensure the well-being of the monkeys and, being a biomedical research institution, the results obtained using this non-human primate model.

In 1978, The Pasteur Institute of French Guiana, belonging to a network of international Pasteur Institutes, decided to initiate a long-term research program on human malaria. Although not the natural host of either *Plasmodium vivax* or *P. falciparum*, *Saimiri sciureus* was chosen as a model because it is sensitive to experimental infection (Gysin, 1991). Moreover, squirrel monkeys naturally

occur in French Guiana, and a captive colony maintained under natural climate conditions appeared to have better chances of obtaining good reproductive rates.

Establishment of the Colony

Three phenotypes, belonging to two squirrel monkey species (Hershkovitz, 1984), were acquired for the establishment of the colony: two phenotypes of *Saimiri s. sciureus* (Gothic type), one from Guianas and the other from Brazil, and the Bolivian squirrel monkey, *Saimiri boliviensis* (Roman type). Most of them were wild caught from Guyana, Surinam, French Guiana and northeastern Brazil, although a few were bought in the USA.

The colony is organized into three areas in two distinct locations: inside the confines of the Pasteur Institute in Cayenne, where the main captive breeding colony is maintained, and on the "Ilet-La-Mère", a 56-ha, wooded island just offshore from Cayenne. On the island, a part of the monkey population is held in captivity in a supplementary breeding colony, whilst the rest are free-ranging. Three factors determined the use of the island. The "Ilet-La-Mère" permitted the establishment of a semi-wild colony, where animals for experimentation or reproduction needs could be obtained by trapping. The isolation from wild monkey populations and animal dealers is today considered to be fundamental, both for conservation and health reasons. The island should also give the opportunity to release into a controlled environment post-experiment monkeys and old breeders. This isolated colony could also represent a reserve in case of a dramatic epidemic in Cayenne, and would permit the re-establishment of the captive colony within a few years without recourse to the capture of wild monkeys and a consequent long-term disruption of research programs.

Current Situation

At the end of 1996, the entire colony was comprised of 1,060 squirrel monkeys: 770 and 110 in the Cayenne and island colonies, respectively, and 180 free-ranging. Today all captive monkeys are *S. s. sciureus* from the Guianas due to their much better breeding performance, and the two other types of squirrel monkeys have been progressively released onto the island. The infrastructure at Cayenne consists of large outside cages where breeding mothers and young are kept. There are indoor cages for monkeys destined for experimental purposes, and monkeys used in the various malaria protocols are maintained in individual cages in a separate room. Three airtight rooms are reserved for HTLV and Hepatitis C-infected monkeys. On

Table 1. Main characteristics of the captive population of the captive squirrel monkey colony of the Pasteur Institute in Cayenne, French Guiana.

	n	Male:Female	Young ¹ :Adult	Captive-born	Mortality
1986	475	2:3	4.5:10	17%	75 (16%)
1991 ²	701	1:2	4.1:10	29%	91 (13%)
1996 ³	879	1:1	4.2:10	87%	49 (5.52%)

¹ < 3 year-old.

² 60 wild monkeys were introduced in the colony in 1987.

³ 60 monkeys were sold and left the colony in 1992.

the island, the infrastructure is restricted to large outside cages for breeders and young.

The Breeding Colony

The French Guianan colony of *S. sciureus* is today probably one of the largest in the world. The colony was established 18 years ago, and records from 1986, 1991 and 1996 highlight its growth and the overall improvement in breeding (Tables 1 and 2). Most of the monkeys are now captive-born, 65% of births in 1996 produced F2 infants (born from captive-born parents, parents of which were caught in the wild), and for the first time a small number (3%) of F3 births. Interestingly, a birth peak (observed in free-ranging squirrel monkeys) was noticeable during the first ten years of the Cayenne colony, but has gradually disappeared. In 1991, a birth peak was still evident (Moisson and Gysin, 1992), but has not been observed in recent years. Seasonality is recorded, however, in the captive squirrel monkeys on the island, and is the only difference in the breeding performances of the two captive colonies (Cayenne and Ilet). In general, there has been an overall decrease in mortality, with a change in the causes of death. Infection-related deaths decreased from 22% in 1991 to 4% in 1996. In 1991, 11% of deaths were related to experimentation, whereas by 1996 this proportion had increased to 18%. It should be noted that this slight increase reflects a better control of other causes of mortality, mainly infections, rather than an increase in death related to experimentation. At present, infant mortality (new-born, <1 week old), is the major contributor to the mortality statistics (40%). Deaths are otherwise the results of accidental injuries, reproductive pathologies and old age.

The Wild Population on the "Ilet-La-Mère"

This island was colonized during XVIIIth and XIXth centuries by Jesuits, and later was the site of the famous French Guianan convict prison. Jesuits deforested most of the island and introduced fruit trees, such as *Spondias mombin* (Anacardiaceae), mangos (*Mangifera indica*, Anacardiaceae), and guavas (*Psidium goyava*, Myrtaceae). Today with the exception of two small *Schizachyrium* savanna areas, the vegetation is characterized by a mixed community of non-deciduous trees with a high floristic diversity (Alexandre, 1983), thus providing fruits year-round. Since 1981, the island has been legally protected by local decrees prohibiting hunting and restricting access. Initially there were no mammals on the island. Some rodents, rats, agoutis (*Dasyprocta agouti*) and acouchis (*Myoprocta acouchi*) were introduced and have since thrived. The primate population includes mostly squirrel monkeys together with some pairs of night monkeys (*Aotus*

Table 2. Breeding results of the captive squirrel monkey colony.

	Reproductive females	Viable births	Fecundity	Fertility	Young still alive at weaning
1986	164	46	28%	32%	65%
1991	266	125	47%	53%	93%
1996	272	149	55%	61%	87%

trivirgatus) released by the Pasteur Institute in the early 1980s. Observations of the night monkey groups are infrequent, but they are estimated to number less than 20 or 30 individuals, including young. There is an absence of competitors of the squirrel monkeys. A total of 170 were introduced in 1981 and more than 150 were released during the following years. From this population, 60 animals were captured and taken back to Cayenne. A recent survey (Louguet *et al.*, 1997) indicated that 180 squirrel monkeys currently inhabit the island. This is not a single population, however. It is divided into two distinct sub-populations which interact very infrequently. Half of the squirrel monkeys, although free-ranging are not wild. They are completely dependent on the provision of artificial dietary supplements twice a day, and their home range is restricted to 2-3 ha around the site of the captive colony. The other monkeys live in four groups occupying the forested area. Most of the adult females are breeding and we believe that the population may now have reached a numerical threshold due to limited food resources. The population density is, however, comparable to those observed in natural habitats on the continent. The main eco-ethological patterns of the free-ranging population are comparable to those observed in secondary forests elsewhere (Louguet *et al.*, 1997).

The Role of *Saimiri sciureus* at the Pasteur Institute of French Guiana

Research

The aim of the colony is to maintain squirrel monkeys for biomedical research, especially as a model for human malaria. In general, the females are kept for reproduction, and it is mostly the four-year-old males which are used in the research programs. Sixty to 70 naive monkeys are available for experimentation each year. Ninety-five percent of the monkeys are involved in the various human malaria research protocols, and are not sacrificed. Anti-*Plasmodium* treatments, when required, are efficient, and as a consequence the monkeys recover fully. After varying periods of experimental use, the monkeys are re-integrated into the colonies as breeders. Programs studying the physiology and physiopathology of squirrel monkeys are receiving increasing importance (Contamin *et al.*, submitted). Some other research programs have also been initiated recently. They include the use of the squirrel monkeys as a model for HTLV (Kazanji *et al.*, 1997) and Hepatitis-C. Scientific collaboration in vaccinology, pathology, parasitology, genetic and cytogenetic studies are ongoing or planned with other Pasteur Institutes and biomedical research institutions.

Education

Once or twice a year, the Pasteur Institute opens its doors for public visitation, including even part of the island. This represents a valuable means by which the Pasteur Institute can explain its various biomedical research programs to the local people, many of whom are strongly

concerned with the problems of malaria in French Guiana. Lectures are given about the colony, squirrel monkey biology, and the importance of biomedical research.

Conclusion

It is important to emphasize some of the difficulties in maintaining the colonies. The large, outdoor colony reduces cost, but renders difficult the strict application of recommendations and guidelines proposed for the keeping of monkeys for biomedical research. Nevertheless, the success of this colony is shown by its good breeding record, its importance internationally in its contributions to research on malaria, and the increasing role of squirrel monkeys as a primate model for retroviral studies.

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The preliminary results on the performance of the Pasteur Institute breeding colony could not have been highlighted without the important work carried out by the successive veterinarians who have contributed so much to the well-being of the monkeys and the improvement of their living conditions, most especially: J. Gysin, J.-M. Postal, P. Moisson, J.-C. Vié, and B. Bonnemains. We also thank Gordon Langsley for help with the English version of this text.

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FIRST DETAILED FIELD DATA ON *CHIROPOTES SATANAS UTAHICKI* HERSHKOVITZ, 1985

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The Xingu-Tocantins interfluvium has been the principal focus of development in eastern Amazonia over the past three decades, with the building of the TransAmazon highway, the Carajás mining project, construction of the Tucuruí hydroelectric dam, and the establishment of cattle ranching in its southern half, currently the principal location of land conflicts in Brazilian Amazonia. Endemic to this interfluvium (Hershkovitz, 1985), Uta Hick's bearded saki, *Chiropotes satanas utahicki*, was assigned the MaceLande category of 'vulnerable' by Rylands *et al.* (1996), based on criterion A1(c): a decline in area of occupancy, extent of occurrence and/or quality of habitat. This clearly reflects the overall situation within this primate's distribution, but, with the exception of a small number of more general surveys (see Ferrari and Lopes, 1996), there are no specific data on the status of wild populations.

With this in mind, *C. s. utahicki* was the focus of a study at two locations, the Ferreira Penna Scientific Station (ECFPn) (01°42'S, 51°28'W) in the Caxiuanã National Forest, and the Fazenda Arataú (03°50'S, 50°20'W) (Fig. 1). They were chosen in order to assess the effects of human colonisation on *C. s. utahicki* populations. Surveys were carried out at these sites between January and October, 1996. While primary *terra firme* forest predominates at both, the 33,000 ha ECFPn is contiguous with the remaining 300,000 ha of the Caxiuanã National Forest, a protected area that suffers only very low levels of human encroachment, while in contrast the 7,000 ha forest reserve on the Fazenda Arataú has not only been isolated from surrounding forest for some twenty years, but has

also been selectively logged.

Data were collected using standard line-transect survey methods (Brockelman and Ali, 1986). A total of 532.9 km were surveyed at the ECFPn, covering both rainy (January to April) and dry seasons (September and October), whereas 101.3 km were surveyed at the Fazenda Arataú during the late wet/early dry season (May to August).

The two surveys revealed some surprising contrasts between the two study sites (Table 1) which, in many respects, were the opposite of the pattern that would be expected according to the ecological characteristics of each species. Black-handed tamarins (*S. m. niger*) normally prefer disturbed and/or secondary forest, for example (Oliveira, 1996), even at Caxiuanã (Ferrari and Lopes, 1996), but they were nevertheless sighted more than twice as frequently at ECFPn than at the Fazenda Arataú. While bearded sakis are thought to be highly intolerant of habitat disturbance (Johns and Ayres, 1987), on the other hand, the sighting rate for *C. s. utahicki* at the Fazenda Arataú was almost twenty times higher than that at Caxiuanã.

C. s. utahicki groups were slightly larger at the ECFPn (mean size 9.3 individuals, $n = 7$ sightings) in comparison with the Fazenda Arataú (mean size 6.9 individuals, $n = 24$), but both values fall within the range for *Chiropotes* recorded in previous studies (Ayres, 1981; Branch, 1983; Lopes, 1993), and there is little to suggest any significant tendency with regard to this variable, especially given the sample size.

The ECFPn survey not only covered the longest total distance of any carried out so far in an area inhabited by bearded sakis, but also encompassed a range of different months. It thus seems reasonable to conclude that the number of sightings recorded is a reliable indication of an enigmatically low density of *C. s. utahicki* at this site. While the survey at the Fazenda Arataú was much shorter, a similar study carried out in January 1996 also indicated that bearded sakis were relatively abundant there (A. F. P. Nunes, pers. comm.).

The reasons for such a striking difference in the apparent abundance of *C. s. utahicki* at the two sites remain unclear, but one factor may be the high density of babaçu (*Orbignya martiana*) palms at the Fazenda Arataú, the fruits of which were regularly eaten by the sakis. Although the forest at the ECFPn may be among the most floristically diverse of eastern Amazonia (Almeida *et al.*, 1983),

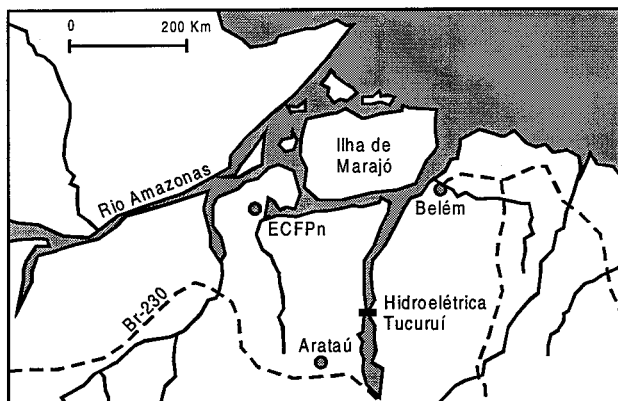


Figure 1. Study sites mentioned in the text. The Ferreira Penna Scientific Station (ECFPn) in the Caxiuanã National Forest, municipality of Melgaço, and the Fazenda Arataú, municipality of Novo Repartimento, Pará, Brazil.

Table 1. Sightings of primates at the two study sites.

Species	Sightings (per 10 km) at	
	ECFPn ¹	Fazenda Arataú ²
<i>Alouatta belzebul belzebul</i>	111 (2.08)	10 (1.00)
<i>Cebus apella apella</i>	25 (0.47)	18 (1.78)
<i>Chiropotes satanas utahicki</i>	6 (0.11)	21 (2.07)
<i>Saguinus midas niger</i>	59 (1.11)	5 (0.50)
<i>Saimiri sciureus sciureus</i>	-	4 (0.40)
Total	201 (3.77)	58 (5.73)

¹Total transect length = 532.9 km;

²Total transect length = 101.3 km.

certain characteristics of the Arataú forest may be more beneficial specifically to *C. s. utahicki* (and perhaps also to other taxa). Thus, while the Caxiuaná National Forest may be the most important protected area in the region, effective conservation of *C. s. utahicki* - and possibly other fauna - may depend on the establishment of further reserves, and the development of effective alternative measures in other areas of the Xingu-Tocantins interfluvium.

Acknowledgments: This study was supported by the Goeldi Museum/ECFPn and the Grupo Queiroz Galvão, and by grants from WWF-US and the Brazilian Higher Education Authority - CAPES. We would also like to thank Olavo Galvão, Luciano Tavares and Andréa Nunes.

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PRIMATES OF THE SERRA DO BRIGADEIRO STATE PARK, MINAS GERAIS, BRAZIL

Bráz A. P. Cosenza
Fabiano R. de Melo

Aguirre (1971) pointed to the Serra do Brigadeiro, in the south-east of the state of Minas Gerais, as one of the few localities where the mureki, *Brachyteles arachnoides*, still survives. Aguirre (1971) had suggested the existence of 50-60 individuals of *B. arachnoides* in a 2,400 ha forest at Araçonga. The exact localities proved impossible to identify, and it was only in the last decade, that its continued occurrence in the region was confirmed, when a female juvenile was captured during surveys by the Centro de Estudos Ecológicos e Educação Ambiental (CECO), based at Carangola, Minas Gerais.

The Serra do Brigadeiro State Park (PESB), 13,210 ha, was created by the State Government of Minas Gerais, through the State Forestry Institute (IEF) on 27 September, 1996 (Fig. 1). The park covers part of the municipalities of Ervália, Fervedouro, Sericita, Araçonga, Miradouro,

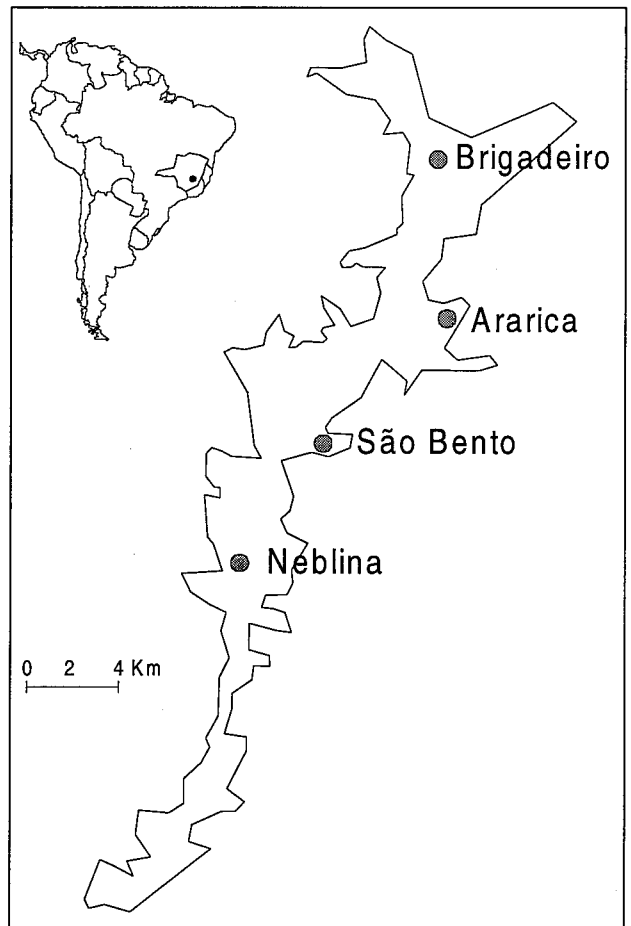


Figure 1: Location and limits (approximately between 42°22'S and 42°32'S, and between 20°34'W and 20°53'W) of the Serra do Brigadeiro State Park, Zona da Mata, Minas Gerais, southeast Brazil. Note the four sampling areas.

Pedra Bonita, Muriaé and Divino. The predominant vegetation in the past was tropical forest, part of the Atlantic forest of Brazil. Today only fragments remain. In the 1960s, the Belgo-Mineira mining company cut the majority of the forests of the region to produce charcoal, and today only 10% of the primary forests remain, the majority of which is composed of secondary vegetation.

Faunal surveys were carried out in 1996/1997, involving six expeditions and 25 days in the field. Censuses were carried out along specific trails in four sampling areas (Table 1). For three species, playback was used in order to increase the chance of locating the groups. Tape recordings of the vocalizations of *Callithrix geoffroyi*, *Callicebus personatus* and *Brachyteles arachnoides* were used at regular intervals (Sony Walkman and audio amplifiers).

Four primate species were observed which had already been recorded for the area (*Callicebus personatus*, *Cebus apella nigrinus*, *Alouatta fusca*, and *Brachyteles arachnoides*), along with the first sightings of *Callithrix aurita*. *C. aurita* had already been recorded in the vicinity of the park in the municipality of Araçuaia (Cosenza, 1994; Fonseca *et al.*, 1994). Two small groups (5 and 4 individuals, respectively) were seen in primary and secondary forest within the Fazenda Neblina. Both observations were made using playback, with the groups approaching the observer, allowing accurate identification and group counts. Population densities of the primates were estimated from a single census in the Fazenda Neblina (Table 2).

C. aurita was found to be rare, as was *B. arachnoides* the most vulnerable species in the park. The low densities of muriquis are undoubtedly associated with the widespread deforestation and hunting pressure during the 1960s and 1970s. Annual visits to the Park since 1987 have allowed us to identify two separate groups of muriquis, one with 27 individuals (no infants seen) in the Fazenda Brigadeiro (Andrade, pers. comm.) and another with 15 individuals in the Fazenda Neblina (Cosenza, 1993).

Callicebus personatus groups occur throughout the remaining forest patches, both primary and secondary, in the Park. Group size varied from 2 to 5 and the titis are evidently the species least affected by forest fragmentation and degradation. They are occasionally captured for pets by local people. Two females have been sent to the Rio de Janeiro Primate Center (CPRJ/FEEMA). The brown

Table 1: Species of primates, their occurrence at the different survey areas and in different vegetation types in the Serra do Brigadeiro State Park, Minas Gerais.

Species	Census Areas ¹	Vegetation Types ²
<i>Callithrix aurita</i>	1	SF-PF
<i>Callicebus personatus</i>	1-2-3-4	S-SF-PF
<i>Cebus apella nigrinus</i>	1-2-4	SF-PF
<i>Alouatta fusca</i>	1-2-3-4	SF-PF
<i>Brachyteles arachnoides</i>	1-2	SF-PF

¹ Census areas: (1) Fazenda Neblina, (2) Fazenda Brigadeiro, (3) Ararica, (4) São Bento.

² Vegetation types: (S) Scrub, (PF) Primary forest, (SF) Secondary forest.

Table 2 - Estimated densities of primates in the Fazenda Neblina forest of 320 ha, Serra do Brigadeiro State Park, Minas Gerais.

Species	Density (ind./ha)
<i>Callithrix aurita</i>	0.028
<i>Callicebus personatus</i>	0.103
<i>Cebus apella nigrinus</i>	0.009
<i>Alouatta fusca</i>	0.075
<i>Brachyteles arachnoides</i>	0.018

howling monkey, *Alouatta fusca*, was also observed with some frequency, even though, after *B. arachnoides*, it is the species suffering the highest hunting pressure. Although *Cebus apella nigrinus* was rarely seen during the censuses, capuchin monkeys were the species most often mentioned in interviews with local people.

The number of primate species in the Serra do Brigadeiro State Park is very high when compared to other protected areas in the Atlantic forest of Minas Gerais. Including, as it does, four species (*C. aurita*, *C. personatus*, *A. fusca* and *B. arachnoides*) listed as threatened in the IUCN Red List of Threatened Animals (IUCN, 1996), as well as the threatened species lists of Brazil (Fonseca *et al.*, 1994) and of the state of Minas Gerais (Lins *et al.*, 1997), the importance of the Serra do Brigadeiro State Park is unquestionable.

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REACTION OF WILD EMPEROR TAMARINS TO THE PRESENCE OF A SNAKE

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 Júlio César Bicca-Marques
 Karin Schacht
 Alice C. de Alencar Araripe



Predation on callitrichines is rarely observed in the wild. Reports of predation by snakes include, for example, those by Heymann (1987) and Correa and Coutinho (1997). Other predators include raptors, tayras, and ocelots (see Caine, 1993; Ferrari and Lopes Ferrari, 1990). Since predation on these primates is not commonly witnessed by researchers in the wild, anecdotal accounts may be useful to evaluate its role in callitrichine social evolution (see Caine, 1993) as well as its impact on population density. In this paper we report on the reaction of a black-chinned emperor tamarin (*Saguinus imperator imperator*) group on the proximity of a snake.

The incident (observed by the first author, C.A.N.) occurred on 24 September, 1997, during a study on the cognitive aspects of foraging decisions in *S. i. imperator*, *S. fuscicollis weddelli*, and *Callicebus cupreus cupreus* at the Zoobotanical Park of the Federal University of Acre (UFAC), Brazil (9°56'30"-9°57'19"S, 67°52'08"-67°53'00"; 100 ha), Rio Branco, state of Acre, Brazil. At 1209 h, an emperor tamarin group composed of four individuals (one adult male - AMA, one adult female - PNK, and two immature males - BRA and LAR) arrived at feeding station A. Each feeding station (totalling four) was composed of eight visually identical feeding platforms (FP) distributed in a circular arrangement. At 1214 h, following BRA and PNK, respectively, AMA and LAR were feeding on bananas at FP1 and FP7 when a snake (probably a *Bothrops* sp. measuring approximately 1.2 m) climbed up FP2 and remained curled on the top. FP2 was approximately 4.6 m distant from FP1, and 10.7 m distant from FP7 (Fig. 1). At 1216 h, AMA saw the snake from FP1 and left the platform, emitted an alarm call from an adjoining tree, and abandoned the feeding station, followed by all other group members. LAR could not see the snake from FP7 because there were two trees between it and FP 2 (Fig. 1). About one minute after the tamarins had left the feeding station, the snake went to the ground and disappeared into the vegetation.

This single observation of an interaction between a potential predator and the tamarins was made during approximately 4,000 hours of daily monitoring of the feeding stations from September 1997 through January 1998.

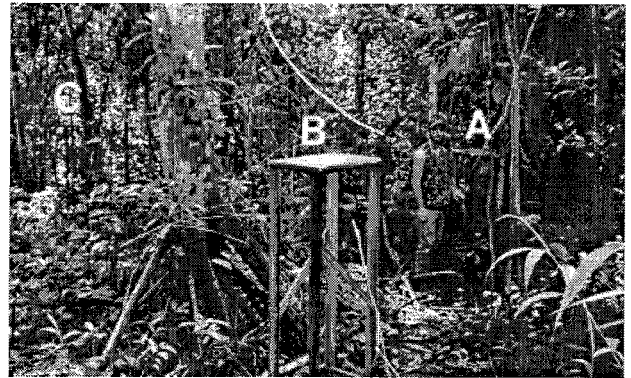


Figure 1. Partial view of the feeding station showing the first author close to the platform 1 (A). Feeding platforms 2 (B) and 7 (C) are also shown.

During this time two stable social groups and several solitary emperor tamarins visited the feeding stations 986 times, involving more than 145 hours of observations. Whether this case represents a predation attempt or not, is impossible to affirm. However, the reaction of the tamarins would indicate it was.

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News

THREE CALLITRICHID SPECIMENS RECOVERED IN THE MUSEU NACIONAL, RIO DE JANEIRO

During a recent reorganization of the fluid collection of the Museu Nacional, Universidade Federal do Rio de Janeiro, Brazil, I found a recipient with three callitrichid specimens, two identified as *Callithrix chrysoleuca* (MNRJ-43078, 43080) and a third as *Saguinus labiatus labiatus* (MNRJ-43079). The labels did not have the name(s) of the collector(s), but indicated only that all specimens were obtained at the locality named "Mata do Acará, State of Amazonas, Brazil". This area is located on the right bank of the middle/lower Rio Madeira, a few kilometers below the mouth of the Igarapé Acará (= Igarapé Auará), 03°56'S, 59°38'W (Fig. 1). Theoretically, only *C. chrysoleuca* should occur in this region, which is near to Borba, the type locality of the species. *S. labiatus labiatus* is known only from the Madeira-Purus interfluvium.

Due to the proximity of this area with the Rio Madeira it is probable that the collector(s) travelled to some point on the left bank of that river, in a stretch of non-flooded forest, to obtain the tamarin. Alternatively it was purchased or otherwise obtained on the right bank from somebody keeping it as a pet, but originated from the left bank. It would seem improbable that this record represents an enclave population of *S. labiatus* in the geographical distribution of *C. chrysoleuca*, and if it does it is unlikely that it is syntopic; the moustached tamarins and the marmosets being so similar ecologically.

Acknowledgments: To João Alves de Oliveira and Maria Alexandra Ramos Bezerra who gave me access to these *Saguinus* and *Callithrix* specimens in the Museu Nacional, Rio de Janeiro. To Andrea Portela Nunes and Diego Astúa de Moraes for reviewing the text.

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ASSOCIAÇÃO MICO-LEÃO-DOURADO - CORREDORES

O Programa de Conservação para o Mico-Leão-Dourado, *Leontopithecus rosalia*, iniciou em dezembro a implantação de corredores agroflorestais em fazendas particulares, com o intuito de aumentar a área florestal disponível para os micos-leões reintroduzidos e também, de diversificar a produção em tais áreas. Este projeto, coordenado pela Associação Mico-Leão-Dourado, vem sendo financiado pelo PD/A - o Programa Demonstrativo - Categoria "A" do Programa Piloto para Proteção das Florestas Tropicais do Brasil (um programa com financiamento externo criado pelo Ministério do Meio Ambiente, principalmente para a Amazônia mas incluindo uma parcela para a Mata Atlântica) desde agosto de 1996, quando foram implantados corredores experimentais dentro da Reserva Biológica de Poço das Antas. O modelo, cujos resultados tem sido positivos, está sendo usado como parcela demonstrativa para incentivar os proprietários particulares a adotarem o mesmo sistema. O primeiro corredor, com cerca de 300 metros de comprimento, passará por uma área de pastagem ligando dois fragmentos de matas que já tem grupos de micos, sendo um na Fazenda Santa Helena e outro na Fazenda Vale dos Cedros, ambas de antigos colaboradores do Programa de Reintrodução que estão, inclusive, nos fornecendo a mão-de-obra para implantação destes corredores. O Coordenador deste projeto é o agrônomo Alexandre José Vieira, da Associação Mico-Leão-Dourado, Caixa Postal 109.968, Casimiro de Abreu, Rio de Janeiro, Brasil, e-mail: micoleao@ax.apc.org.

Denise Marçal Rambaldi, Associação Mico-Leão Dourado, Caixa Postal 109.968, 28860-970 Casimiro de Abreu, Rio de Janeiro, Brasil.

PROBLEMAS DE AMOSTRAGEM NO DESENVOLVIMENTO DA SISTEMÁTICA E BIOGEOGRAFIA DE PRIMATAS NEOTROPICAIS

O seguinte é um resumo de uma palestra apresentada no VIII Congresso Brasileiro de Primatologia e V Reunião Latino-Americana de Primatologia, João Pessoa, Paraíba, Brasil, 10-15 de agosto de 1997.

O avanço dos estudos em sistemática e biogeografia envolvendo primatas neotropicais, especialmente os táxons que ocorrem na Região Amazônica, ainda está seriamente comprometido pela deficiência de dados básicos. O esclarecimento das relações de parentesco entre os membros da maioria dos grupos ainda esbarra na falta de compreensão global da diversidade, com táxons permanecendo por serem descritos e variações geográficas por serem acuradamente interpretadas. Além do mais, em sua maioria, as distribuições geográficas potenciais são mal delineadas, ignorando-se como grupos aparentados

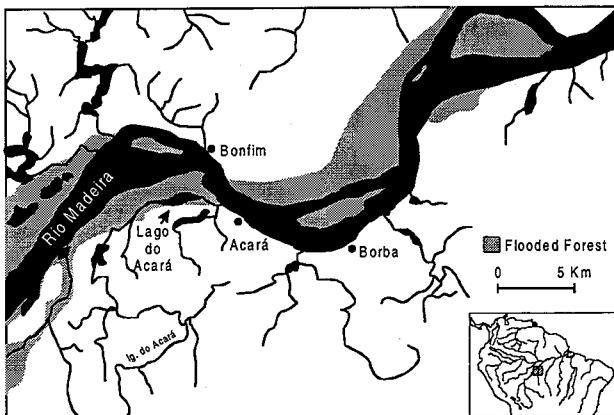


Figure 1. The collecting locality of *Saguinus labiatus labiatus* and *Callithrix chrysoleuca* recorded in the Museu Nacional, Rio de Janeiro.

se comportam, em termos de relações mútuas, nas bordas de suas áreas de ocorrência. Apesar de haver um conhecimento relativo do papel desempenhado pelos rios e descontinuidades de paisagem na determinação de limites de distribuições geográficas e dos mecanismos envolvidos nos processos de especiação a isto associados, esta é uma área do conhecimento que ainda carece de um corpo de dados mais consistente. Isto tem se refletido nas dificuldades de se determinar áreas de endemismo, que deveriam funcionar como unidades geográficas operantes em biogeografia histórica e como fonte de orientação para estratégias de conservação. Estas dificuldades têm frequentemente levado à tomada de decisões com base em ausência de provas. Coleções de amostras quantitativas ainda são necessárias para a maioria dos táxons. Contudo, os principais problemas se referem ao estabelecimento de amostras qualitativas, que deverão ser coligidas a partir da determinação de áreas geográficas prioritárias para a condução de novas investigações.

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EEP STUDBOOK FOR THE COTTON-TOP TAMARIN, *SAGUINUS OEDIPUS*

The third edition of the European Endangered Species Programme (EEP) studbook for the cotton top tamarin, *Saguinus oedipus*, was published in September 1997. It was compiled by Michael Schröpel, Vice Director of Magdeburg Zoo and EEP Coordinator for the species. The first two editions (1995, 1996) gave both a historical and current survey of the captive populations. The third (1997) edition gives only the demographic changes (births, deaths and transfers) during the period 1 January 1996 to 31 December 1996. Although some collections did not contribute to this studbook, it contains data on 1980 cotton-tops. On 31 December 1996, there were 534 live tamarins registered (243.225.66), with a sex ratio of 1:0.9, in 82 European zoos and institutions which contributed. The population has been increasing since 1990, although the growth rate is slowing and has been very low in the past few years. Over the last 10 years, changes in the population have been largely due to births and deaths, with imports and exports being infrequent. The oldest living cotton top is a male of 20 years. The mortality rate of neonates is high and the net reproductive rate has decreased from 3.1 for males and females in 1987-1991 to 2.3 for males and 2.0 for females in 1992-1996. Analyses in the studbook provide information on the total captive population as from 1965, population growth trends (λ values), the crude demography (deaths, births and transfers), age pyramid, mortality, generation structure and number, inbreeding coefficients, fecundity and birth seasonality.

The studbook also includes a full list of participants in the programme.

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Reference

Schröpel, M. 1997. *EEP Studbook for Cotton-top Tamarin* (*Saguinus oedipus*). 3rd edition (changes during 1996). September 1997. Zoologischer Garten Magdeburg, Magdeburg.

CENTRO NACIONAL DE PRIMATAS, BELÉM, BRASIL

O Centro Nacional de Primatas (CENP), Belém, Pará, foi criado em 15 de março de 1978, através da Portaria Ministerial nº 115 para atender convênio celebrado entre o Ministério da Saúde, Ministério da Agricultura, Organização Panamericana da Saúde e a Organização Mundial da Saúde, com o objetivo principal de criar e reproduzir primatas não humanos, sob condições controladas, para apoiar investigações biomédicas desenvolvidas no Brasil e no exterior e assegurar a preservação das espécies. Ao CENP compete: I) planejar e executar política de desenvolvimento de pesquisas científicas voltadas para as populações de primatas não humanos do Brasil; II) proporcionar o suprimento necessário às pesquisas no campo das ciências da saúde, III) assegurar a preservação das espécies; IV) estudar os aspectos relacionados com a ecologia, biologia e patologia das espécies de primatas, com ênfase nos seguintes pontos; a) realizar pesquisas de campo para determinar o estado atual das populações de primatas e sua dinâmica; b) pesquisa de campo para determinar as áreas geográficas mais susceptíveis à captura, protegendo esses habitats, sem que as populações corram risco de extermínio; c) avaliar os efeitos do impacto das situações ecológicas sobre os habitats dos primatas; d) realizar estudos para determinação e implantação das colônias de primatas para a reprodução em cativeiro e sua utilização em pesquisas científicas; e) capacitação de recursos humanos nas áreas de biologia, patologia, bacteriologia, parasitologia e outras relacionadas ao campo da primatologia, f) proporcionar condições para realização de pesquisas nacionais e estrangeiras que envolvam primatas não humanos, g) promover intercâmbio com centros similares no exterior e h) criar subcentros regionais no país, com as mesmas finalidades, indicadas anteriormente.

As pesquisas desenvolvidas no Centro Nacional de Primatas incluem: estudo de filarioses de macacos; elaboração de dieta para macacos mantidos em cativeiro; avaliação reprodutiva das espécies; estudo comportamental em cativeiro; e a avaliação clínico-laboratorial (parasitológico-bacteriológico). As instituições que desenvolvem pesquisas que utilizam material e/ou animais do CENP: a) Instituto Evandro Chagas, Belém (malária, arboviroses, sarampo, schistosomose, leishmanioses, viroses e outras), b) Universidade Federal do Pará, Belém

(genética de primatas não humanos, estudo do sistema nervoso central, estudo da visão), c) Instituto Reneé Rachoux, Pernambuco, d) Instituto Aggeu Magalhães, Minas Gerais, e) Instituto Osvaldo Cruz, Rio de Janeiro, e f) National Institutes of Health, EUA.

Atualmente o Centro Nacional de Primatas possui um plantel de aproximadamente 300 animais, pertencentes as seguintes espécies: *Aotus azarai*, *Callithrix humeralifera*, *C. argentata*, *C. jacchus*, *Callithrix aff. emiliae*, *C. penicillata*, *Callicebus moloch*, *C. torquatus*, *Saguinus midas midas*, *S. m. niger*, *S. imperator*, *S. fuscicollis weddelli*, *Alouatta belzebul belzebul*, *Cebus apella*, *C. olivaceus*, *C. albifrons*, *Cercopithecus aethiops*, *Saimiri ustus*, *S. sciureus*, *Chiropotes satanas utahicki*, *Pithecia irrorata*, e *Ateles chamek*.

Centro Nacional de Primatas, BR 316 - Km 7, Caixa Postal 44, 67030-000 Ananindeua, Pará, Brasil, Tel: (091) 255-1720, Fax (091) 255-0248.

MARGOT MARSH BIODIVERSITY FOUNDATION - 1997 PROJECTS



The Margot Marsh Biodiversity Foundation, a charitable institution dedicated exclusively to primate conservation, was created in 1996. The mission of the fund is "to contribute to global biodiversity conservation by providing strategically targeted, catalytic support for the conservation of endangered nonhuman primates and their natural habitats".

In 1997, the Primate Action Fund provided support for 25 projects promoting action for the conservation of primates, as well as the IUCN/SSC Primate Specialist Group newsletters.

- Primate segments of environmental radio broadcasts - Sharon Matola, (Belize Zoo and Tropical Education Center, Belize)
- Study of the Assamese macaque in Makalu-Barun Conservation Area, Nepal - Mukesh Kumar Chalise (Natural History Society of Nepal, Kathmandu)
- Spider and howler monkey rescue - Joseph Vieira (Chalalan Project, San José de Uchupiamanas and Madidi National Park, Bolivia)
- Community-based conservation program for the golden langur in Assam, India - (Community Conservation Consultants, Gays Mill, Wisconsin)
- Primate census along the Rio Tapiche, Peru (Detroit Zoological Institute, Detroit, Michigan)
- Second Lion Tamarin Population and Habitat Viability Analysis Workshop - Fundação Biodiversitas (Belo Horizonte, Brazil)
- Genetic characterization of new types of mouse lemur from the west coast of Madagascar - Rodin

Rasoloarison (Laboratoire de Primatologie et de Biologie Evolutive Antananarivo, Madagascar), Jörg Ganzhorn (Deutsches Primatenzentrum Göttingen, Germany) and Anne Yoder (Northwestern University Medical School, Chicago, Illinois, US)

- Primate distributions in Pando, northern Bolivia - Scott Hardie (University of Abertay, Dundee, Scotland), Hannah Buchanan-Smith and Mark Prescott (University of Stirling, Scotland)
- Indonesian Gibbon Conference - Alan Mootnick (International Center for Gibbon Studies, Santa Clarita, California) and Jatna Supriatna (Conservation International - Indonesia, Jakarta, Indonesia)
- Sustainable development in a riverine wildlife sanctuary, Belize - Ed Johnson (Eco-Communications International, Ojai, California)
- Population dynamics of the brown howler monkey - Sérgio Mendes (Museu de Biologia Mello Leitão, Santa Teresa, Espírito Santo, Brazil)
- Behavior and breeding of the buffy tufted-ear marmoset - Sérgio Mendes (Museu de Biologia Mello Leitão, Santa Teresa, Espírito Santo, Brazil)
- Conservation of capuchin and howler monkeys in Trinidad - Kimberly A. Phillips (Hiram College, Hiram, Ohio)
- Behavior and diet of the diademed sifaka and indri - Joyce Powzyk (Duke University, Durham, North Carolina)
- Search for Tattersall's and Perrier's sifaka in northern Madagascar - Serge Rajaobelina (Fanamby, Antananarivo, Madagascar)
- Chimpanzee Conservation Budongo Forest Project - Vernon Reynolds (Oxford University, Oxford, UK, and Kampala, Uganda)
- Primate conservation in Yasuni National Park, Ecuador (Peter Rodman, University of California, Davis, California), John Cant (University of Puerto Rico, Puerto Rico) and Laura Acros (Catholic University, Quito, Ecuador)
- Ecology and behavior of the golden langur in Assam, India - Barry Rosenbaum (University of Colorado, Boulder, Colorado)
- Conservation of endangered monkeys in southeastern Ivory Coast - Scott MacGraw and Randall Susman (State University of New York, Stony Brook, New York), Isaac Mona (Centre suisse de Recherche Scientifique, Abidjan, Ivory Coast) and Michael Abedi-Lartey (Ghanian Forestry Department, Accra, Ghana)
- Ecology of the Niger Delta red colobus monkey - J. Lodewijk Werre (Niger Delta Wetlands Foundation, Port Harcourt, Nigeria)

- Assessment of cyclone damage in southeastern Madagascar - Patricia Wright (State University of New York, Stony Brook, New York)
- *African Primates* Newsletter - Tom Butynski (Zoo Atlanta, Nairobi, Kenya)
- *Neotropical Primates* Newsletter - Anthony Rylands (Conservation International do Brasil, Belo Horizonte, Brazil)
- Golden-headed lion tamarin conservation - James Dietz (University of Maryland, College Park, Maryland)
- Translocation of golden lion tamarins - Maria Cecília Martins Kierulff (Golden Lion Tamarin Conservation Program, Rio de Janeiro, Brazil).

Project proposal guidelines were outlined in *Neotropical Primates* 4(2):66, June 1996. For further information about the Margot Marsh Biodiversity Foundation, please contact: William R. Konstant, Conservation International, 2501 M Street NW, Suite 200, Washington D. C. 20037, USA. Fax: (215) 402-0469.

REGIONAL PLAN FOR THE CONSERVATION AND MANAGEMENT OF MESOAMERICAN PRIMATES

A workshop for a regional CAMP for Mesoamerican primates was held from 23-29 June, 1997 at the Zoológico Nacional Simon Bolivar, San José, Costa Rica. It was organized by the IUCN/SSC Primate Specialist Group - Neotropical Section, AZA New World Primate Taxon Advisory Group, AZA Mesoamerican Fauna Interest Group, Asociación Mesoamericana y del Caribe de Zoológicos, Universidad Nacional (Costa Rica), Fundación pro Zoológicos, Brookfield Zoo, Houston Zoo, and Burnet Park Zoo, in collaboration with the Conservation Breeding Specialist Group (CBSG), and was sponsored by the IUDZG/World Zoo Organization, St. Louis Zoo, and the New World Taxon Advisory Group. Sixty-three participants from 28 institutions analyzed the conservation problems of Mesoamerican primates. A CAMP process guided the evaluation of the status of the primate species and subspecies present in each country. The participants recommended the conservation actions to be taken immediately and in the long-term. Yolanda Matamoros, Mesoamerican and Caribbean Zoo and Aquarium Association (AMAZOO). Published in *CBSG News*, 8(2):12, 1997.

NETHERLANDS' ORDER OF GOLDEN ARK AWARDED TO PSG MEMBER MARC VAN ROOSMALEN

The Dutch primatologist, Dr. Marc G. M. van Roosmalen, naturalized Brazilian, working at the National Institute for Amazon Research (INPA) in Manaus, received the Order of the Golden Ark from His Royal Highness Prince Bernhard of the Netherlands, in a ceremony at the

Soestdijk Palace on November 29, 1997.

As he bestowed the honor of Officer in the Order of the Golden Ark, Prince Bernhard cited Dr. Van Roosmalen for "his conservation efforts to identify areas of highest priority by conducting surveys of fruits and primates in the Brazilian Amazon, and the discovery of at least ten primates new for science, a new dwarf porcupine, and a number of new tree species, including a new species of *Lecythis* from the Rio Aripuanã".

The Order of the Golden Ark was established by Prince Bernhard in 1971 to recognize people committed to international nature conservation. It is recognized as an official order of the Dutch government, and is the highest conservation award of the Netherlands. Since 1971, some 300 people have received The Order of the Golden Ark, including Dr. Richard Leakey, Sir David Attenborough, Tanzania's former President Nyerere, Maurice Strong, Dillon Ripley and, in 1995, Dr. Russell A. Mittermeier, President of Conservation International, and Chairman of the IUCN/SSC Primate Specialist Group.

THE WISCONSIN REGIONAL PRIMATE RESEARCH CENTER (WRPRC) AUDIOVISUAL ARCHIVE CONTRIBUTION POLICY

If you have videotape materials or slides related to non-human primates and would consider contributing copies to the WRPRC archive, please contact the Wisconsin Regional Primate Research Center Audiovisual Archive staff. Please do not prejudice your material as inappropriate for the archive. Image clarity is the minimum criterion. Finished pieces as well as data tapes should be preserved. We would like to have 50 or more slides for EACH species to have good taxonomic, behavioral and other descriptive documentation. Please keep in mind that people who have been a part of the growing history of the discipline should also be photodocumented. We gratefully acknowledge the more than 475 contributions received to date. A sample of the 6,000 slides in the Archive is available on Primate Info Net at <<http://www.primate.wisc.edu/pin/images/index.html>>.

WRPRC Archival materials are loaned internationally for educational and research purposes. Any requests to republish photographic materials from the archive must be approved by the photographer. If you have materials available or are planning laboratory or field work which involves videotaping or photography, please send us a note at <library@primate.wisc.edu>. A catalog of videotapes available from the WRPRC Audiovisual Archive is available at: <<http://www.primate.wisc.edu/pin/vidlib.html>>. To borrow items from the Archive, contact Special Collections Librarian, Ray Hamel at: <hamel@primate.wisc.edu>.

Larry Jacobsen, The Library, Wisconsin Regional Primate Research Center, University of Wisconsin, 1220 Capitol Court, Madison, Wisconsin, 53715-1299, USA.

FAUNA AND FLORA INTERNATIONAL - THE 100% FUND



Fauna and Flora International's 100% Fund offers a unique approach to the funding of small-scale conservation projects focused on the protection of endangered species throughout the world. It is one of the very few sources of grants for this purpose, especially for applicants from developing countries. It was set up in 1971 to provide sums of money very quickly for urgent conservation action. Since then the Fund has supported more than 570 projects in over 120 countries. It provides grants to a wide diversity of projects ranging from population surveys of endangered animals and plants to education campaigns, and covering a wide range of species, from paratid snails to gorillas.

The Fund is unique in that 100% of all donations pass directly to conservation projects, with no deductions for administration. Applications are assessed by a committee of international conservationists. Projects are selected on the basis of conservation importance, sound scientific principles, cost effectiveness and local involvement. Reports are submitted after six months and at the end of the project.

Outcomes of the 100% Fund: Conservation and research activities that enhance the chances of survival for some of the world's most endangered species; implementation of small-scale projects for which funding is generally not available from any other source, especially for people applying from developing countries; the collection of information essential to the development of species action plans and IUCN listings; local people benefit through involvement in the projects, and from training opportunities provided; many 100% Fund projects involve an educational component, generating environmental awareness in local communities; grant recipients benefit from personal development and skill-sharing provided by working alongside local people; the 100% fund is also an important mechanism for training young conservationists, many early recipients have since risen to prominent positions in the conservation world.

For donations to the fund or applications for grants, contact: Fauna and Flora International, Great Eastern House, Tenison Road, Cambridge CB1 2DT, UK, Tel: +44 (0)1223 571000, Fax: +44 (0)1223 461481, e-mail: <info@ffint.org>. Web site: <http://www.wcmc.org.uk/ffi>.

DIRECTORY OF GRADUATE PROGRAMS IN PRIMATOLOGY AND PRIMATE RESEARCH

The *Laboratory Primates Newsletter* is published quarterly by the Schrier Research Laboratory, Psychology Department, Brown University, Rhode Island, and edited by Judith E. Schrier. Pages 31 to 38 of volume 37(1) provide a list and details of graduate programs in primatology and primate research in: the USA, Arizona (Arizona State

University, Tempe; Primate Foundation of Arizona, Mesa), California (California State University, San Marcos; University of California, Davis), Florida (University of Florida, Gainesville), Georgia (Emory University, Yerkes Regional Primate Research Center and University of Georgia, Atlanta), Illinois (Northwestern University Medical School and University of Chicago, Chicago), Massachusetts (Boston University School of Medicine, Boston), Minnesota (University of Minnesota, St. Paul), New Mexico (University of New Mexico, Albuquerque), North Carolina (Duke University, Durham), Ohio (Kent State University, Kent, Miami University, Oxford), Oregon (Oregon Regional Primate Research Center, Beaverton), Pennsylvania (University of Pennsylvania, Philadelphia; University of Pittsburgh, Pittsburgh), Tennessee (Vanderbilt University, Nashville), Texas (University of Texas, Austin), Washington (Central Washington University, Ellensburg; University of Washington, Seattle), Wisconsin (University of Wisconsin, Milwaukee; Wisconsin Regional Primate Research Center and University of Wisconsin, Madison), Australia (Australian National University, Canberra), Canada (University of Calgary, Calgary; and University of Alberta, Edmonton, Alberta), England (University of Liverpool, Liverpool) and India (Jai Narayan Vyas University of Jodhpur, Rajasthan).

CENTER FOR ENVIRONMENTAL RESEARCH AND CONSERVATION - COLUMBIA UNIVERSITY

The Center for Environmental Research and Conservation (CERC) is a consortium of five education and research institutions: The American Museum of Natural History (AMNH), The New York Botanical Garden (NYBG), the Wildlife Conservation Society (WCS), and Wildlife Preservation Trust International (WPTI), besides the University of Columbia, New York, where it is based. The New York-based United Nations Development Program is also linked to the CERC through its governing council. The CERC combines the expertise of these institutions for conservation-related research and training for scientists, planners and managers from around the world. It currently offers the Ph.D. in ecology and evolutionary biology (EEB). The Center's faculty includes numerous areas of expertise (25), including such as: *Behavioral Ecology* (Marina Cords, Columbia; John Glendinning, Columbia, Barnard College; Hilary Morland, WCS; James Wetterer, Columbia); *Biogeography* (Joel Cracraft, AMNH; Darrel Frost, AMNH; Bill Hahn, Columbia; Alan Harvey, AMNH; Ross McPhee, AMNH; Christopher Raxworthy, Columbia); *Captive Breeding* (Ellen Dierenfeld, WCS; Anna Marie Lyles, WCS; Danny Wharton, WCS); *Ecology/Tropical Ecology* (Joel Cohen, Columbia; Alejandro Graal, WCS; Paul Hertz, Columbia, Barnard College; Scott Mori, NYBG; Paul Olsen, Columbia; Charles Peters, NYBG; Christopher Raxworthy, Columbia; James Wetterer, Columbia; Helen Young; Columbia, Barnard College); *Mammalogy and*

Systematics (Fred Koontz, WCS; Ross MacPhee, AMNH; Juan Carlos Morales, Columbia; Michael Novacek, AMNH); and *Primate* (Marina Cords, Columbia; Don Melnick, Columbia; Hilary Morland, WCS; Mary Pearl, WCS; John Robinson, WCS). Applications are available electronically from the CERC Web site or the Columbia University application page: <<http://www.columbia.edu/cu/bulletin/apply.html>>.

The CERC also offers a two-semester training course "The Morningside Institute Program in Conservation Biology" in the science, techniques and policy of conservation biology. It provides a solid overview of the theoretical bases as well as practice in the tools of conservation science. It is designed for those needing additional background in conservation science in anticipation of a career change. Participants take the courses at the CERC on Columbia's Morningside campus. Themes for the 1st semester are 'Conservation Biology' and 'People in the Landscape', and for the 2nd Semester are 'Techniques in Conservation Biology' and 'Issues in Environmental Policy'. The application deadline is 31 July. Financial support for participation in the program is available. Contact: Dr. Mary C. Pearl, Associate Director, CERC- Morningside Institute, Tel: 212 854 8186, Fax: 212 854 8188, e-mail: <mcp14@columbia.edu>.

For more information about CERC, write to: CERC Graduate Program MC 5557, 10th Floor Schermerhorn Extension, Columbia University, 1200 Amsterdam Avenue at 119th Street, New York, NY 10027, USA, Tel: 212 854 8186, Fax: 212 854 8188, e-mail: <cerc@columbia.edu>. World Wide Web: <<http://www.columbia.edu/cu/cerc>>.

Primate Societies

AMERICAN SOCIETY OF PRIMATOLOGISTS AWARDS - 1998



The American Society of Primatologists is soliciting nominations for two awards via the Awards and Recognition Committee:

1) *The Distinguished Primatologist Award*: This award honors a primatologist who has had an outstanding career and made significant contributions to the field. Previous awards have honored Dr. William Mason, Dr. Philip Hershkovitz, Dr. Charles Southwick, and Dr. Orville Smith. Nominations should be made in writing and must include a narrative that describes the nature and extent of the nominee's contribution to primatology. Nominators must also see that two additional letters of support be submitted on behalf of the nominee. 2) *The Distinguished Service Award*: This award is not presented on any scheduled basis but is presented to deserving individuals who have contributed long-time service to the ASP and to primatology in general. Former awardees are Dr. Richard Harrison, Historian for the ASP, Dr. Leo Whitehair, for

long-time accomplishments on behalf of primatology, Judith Schrier, Editor of the *Laboratory Primate Newsletter*, and Larry Jacobsen, Head of Library Services at the Wisconsin Regional Primate Research Center, Madison. A nominating letter in support must be included at submission. If you would like to nominate individuals for either of these special awards (Deadline for receipt is May 15, 1998) send pertinent information to: Gerry Ruppenthal, Chair, Awards and Recognition Committee, Box 357920, University of Washington, Seattle, WA 98195, USA, Fax: (206) 616-9774, e-mail: <gerry@u.washington.edu>.

PRIMATE SOCIETY OF GREAT BRITAIN - NAPIER MEDAL 1997



The 1997 Napier Medal was awarded to Nicola Koyama of Liverpool University for her Ph.D. thesis on reconciliation behaviour in wild Japanese macaques at Arashiyama in Japan. Alan Dixson (Subdepartment of Animal Behaviour, Madingley, Cambridge) awarded the medal. He not only congratulated Nicola on her fine thesis, but so ably remembered the unique and enduring contribution of both John Napier - PSGB founding President in whose honour and memory the medal has been given - and his wife Prue, also a distinguished primatologist.

Hilary O. Box, PSGB President, Department of Psychology, University of Reading, Reading RG6 2AL, England, UK.

AMERICAN SOCIETY OF PRIMATOLOGISTS' CONSERVATION AWARD NOMINATIONS AND GRANT APPLICATIONS



Nominations for Conservation Awards and Grants are now being sought by the American Society of Primatologists (ASP). These awards and grants, funded from the ASP Conservation Fund, are a mechanism to recognize deserving colleagues and students, including those from primate habitat countries for whom the prestige of an ASP award or grant can be a valuable aid to the recipient's conservation efforts. An award nomination is basically a letter of recommendation. A grant proposal should consist of a concise narrative (a few pages) plus a budget page. **Subscription Award**: This award provides the *American Journal of Primatology* to worthy individuals in habitat countries who otherwise would have little access to the scientific literature on nonhuman primates. Preference is given to individuals who will make the journal available for use by students and colleagues. The award is normally the journal. A nominating letter should describe the nominee's credential, his/her primate-related activities, and should explain why the nominee deserves to receive high priority consideration. **Conservation Award** (\$500): This award provides recognition and financial support for students and young investigators from habitat countries who dem-

onstrate potential for making significant and continuing contributions to primate conservation. Those eligible include students, researchers, and educators from primate habitat countries for whom no more than five years have elapsed since receipt of their terminal degree. Nominators should provide the name, title and full mailing address of their nominee, along with a statement about the nominee's qualifications for the award, focusing on past and potential contributions to primate conservation. A copy of the nominee's CV is encouraged. Supporting letters from other individuals acquainted with the nominee's work may be submitted. Past awards have been presented by U.S. Ambassadors or other senior officials, thereby obtaining favorable publicity for the award, its recipient, and primate conservation in the recipient's country. **Senior Biology and Conservation** (\$500 Honorarium): This award is one of ASP's highest honors. It is given to recognize an individual without an advanced degree who has made substantial contributions over many years to promote primate conservation either through direct action or via enhancement of biological knowledge of the well-being of primates. Such contributions could arise from work done in the field, laboratory, or zoo settings. Nominees might work directly with primates or be engaged in activities supporting those who work with primates. Examples include, park rangers, census takers, animal caretakers, research technicians, assistants or facilitators, and individuals involved in primate enterprise benefitting primate conservation. Nominating letters should detail the nominee's qualifications, contributions to primate biology and conservation, period of service, and full mailing address. A copy of the nominee's CV is encouraged. Supporting letters from other individuals acquainted with the nominee's work may be submitted. This award is typically presented at a public ceremony by senior officials. **Conservation Small Grants** (up to \$1500, but usually \$500): Grant proposals are solicited for conservation research or related projects, including conservation education. ASP and IPS members working in habitat countries are especially urged to apply to help someone from a habitat country submit a meaningful project which can be a portion of a larger effort. Grant proposals must be typed in English, should not exceed 2000 words, and should include a brief budget page. Recipients of grants must agree that a brief progress report, in a form suitable for publication in the *ASP Bulletin*, will be made within 12 months of the award. **Evaluation and Application procedure:** With the exception of requests for emergency support, which can be considered at any time for immediate action, the Conservation Committee will make its recommendations for awards and grants to the ASP Executive Committee at its annual meeting. Successful nominees and applicants will be informed following the meeting and their names will be published in the *ASP Bulletin*. The **1998 deadline** for submission of nominations and grant proposals is **22 May 1998**. They should be sent to, Chair, ASP Conservation Committee at the address below.

Dr. Randall C. Kyes, Regional Primate Research Center, University of Washington, Box 357330, Seattle, WA 98195.

NUEVA MESA DIRECTIVA DE LA ASOCIACIÓN MEXICANA DE PRIMATOLOGÍA (AMP)

Durante la celebración del pasado Simposio Nacional de la Asociación Mexicana de Primatología (AMP), se eligió la nueva mesa directiva que presidirá durante el Bienio 1997-1999. Los cargos se distribuyeron de la siguiente forma: *Presidente* - **Dr. Jorge Martínez-Contreras** (Universidad Autónoma Metropolitana, Iztapalapa); *Secretario* - **Dra. Ana María Santillán-Doherty** (Instituto Mexicano de Psiquiatría); y *Tesorero* - **Jorge Ocampo Carapia** (Universidad Autónoma Metropolitana, Iztapalapa). La dirección de e-mail de la Asociación para este periodo será la siguiente: <jmc@xanum.uam.mx>.

Recent Publications

A JOURNAL ON PHENOLOGY AND SEASONALITY

The journal *Phenology and Seasonality* is published by SBP Academic Publishing, Amsterdam and New York. The first issue came out in the fall of 1996. The Editor-in-Chief is Helmut Lieth, University of Osnabrueck, the Executive Editor is Frank-M. Chmielewski, Humboldt University of Berlin. The Editorial Board has the following members: Elisabeth B. Beaubien, University of Alberta; Koen Kramer, Agricultural University of Wageningen; Mark D. Schwartz, University of Wisconsin - Milwaukee; and D. Klaveness, University of Oslo. It is published quarterly. The purpose of *Phenology and Seasonality*, the first international journal on this discipline, is to provide a worldwide basis for communication among scientists who deal with phenological observations. Topics covered include: National and international activities in the area of phenology and seasonality; annual cycles in the atmosphere, hydrosphere, and in the soil; investigations of impacts of climatological or other factors on phenological events; impact of climate variations and climatic changes on seasonal events; annual growth patterns of plants and development patterns of animals; seasonal and diurnal behaviour of animals; periodicity of pests and diseases; linkage of remotely-sensed information to phenological data; and development of seasonally-forced models (statistical and process-based models). Annual subscriptions: Institutional - DFL120,00 or US\$159,00; Individual - DFL120,00 or US\$75,00. For more information: SPB Academic Publishing, P. O. Box 11188, 1001 GD Amsterdam, The Netherlands, Fax: +31 20 638 0524, e-mail: <kugler@pi.net>, or c/o Demos Vernande, Order Department, 386 Park Avenue South, Suite 201, New York, NY 10016, USA, Fax: +1 212 6830118. *Information kindly provided by PSG member Eckhard W. Heymann of the Deutsches Primatenzentrum, Göttingen, Germany.*

BOOKS

A Primatologia no Brasil - 6, edited by Maria Bernadete Cordeiro de Sousa and Alexandre A. de L. Menezes, 1997, 292pp. Editora da Universidade Federal do Rio Grande do Norte, Sociedade Brasileira de Primatologia, Natal. ISBN 85 7273 059 1. Price: Brazil R\$20.00 (+R\$2.00 postage), elsewhere US\$20.00 (+US\$5.00 postage). The proceedings of the VII Congresso Brasileiro de Primatologia, held in Natal, 23-28 July, 1995. Contents: *Seção I - Ecologia*. Habitat analysis for the metapopulation conservation of black lion tamarins (*Leontopithecus chrysopygus*, Mikan, 1823) - Cláudio Valladares-Padua, pp.13-26; Fatores ecológicos e comportamentais implicados na seleção e uso dos locais de pernoite de grupos de *Callithrix jacchus* em ambiente natural - Fátima L. M. Camarotti & Maria Adélia O. Monteiro da Cruz, pp.27-42; Composição química de exsudados explorados por *Callithrix jacchus* e sua relação com a marcação de cheiro - Leonardo C. de O. Melo, Maria Adélia O. Monteiro da Cruz & Zelita F. Fernandes, pp.43-59. *Seção II - Comportamento*. Elements of common marmoset (*Callithrix jacchus*) complex vocal sequences - Dwain P. Santee & Beatriz O. Stumpf, pp.61-73; Vocal development in monkeys - Charles T. Snowdon, pp.75-90; Resposta reprodutiva de fêmeas de *Callithrix jacchus* a pareamentos sucessivos: repensando o "mate guarding" e o "pair-bond" - Maria Bernadete C. de Sousa, Hélderes P. A. da Silva, Ana C. S. R. Albuquerque, Ian C. D. Teixeira, Francisco C. Raulino & André Luiz de Oliveira, pp.91-108; O comportamento agonista intersexos em função do acesso ao alimento em pares de sagüis (*Callithrix jacchus*) - Maria de Fátima C. Cirne & Héliida M. Bezerra, pp.109-122; Relação tamanho do grupo x cuidado infantil em *Callithrix jacchus* no ambiente natural - Edinilza M. dos Santos & Maria Adélia O. Monteiro da Cruz, pp.123-137; Socialização de filhotes de *Callithrix jacchus* em ambiente natural - Fabíola da S. Albuquerque & Maria de F. Arruda, pp.139-153; Variação diurna em comportamentos sócio-sexuais do sagüi, *Callithrix jacchus* - Maria Bernadete C. de Sousa & Janete de B. Moisés, pp.155-170; Estudo da distribuição do comportamento de catação em grupos sociais cativos de sagüis (*Callithrix jacchus*, Primates: Callitrichidae) a partir de parâmetros cronobiológicos - Carolina V. M. de Azevedo, José W. Queiroz, Alexandre A. de L. Menezes & Lúcio F. de S. Moreira, pp.171-192. *Seção III - Patologia*. Helmintos de sauás, *Callicebus personatus nigrifons* (Spix, 1823, Primates: Cebidae), coletados em resgate faunístico durante a construção da Usina Hidrelétrica Nova Ponte - MG - Alan L. de Melo, Fernanda M. Neri & Maria B. Ferreira, pp.193-198; Presença de *Escherichia coli* pertencente ao sorogrupo das EIEC (*Escherichia coli* enteroinvasora) em fezes diarréias do *Callithrix jacchus* (sagüi comum) - Maria J. B. C. Fernandes, Dulce Almeida; Maria E. A. Seixas; Antônio P. Rocha & Lígia M. R. Melo, pp.205-216; Estudo bacteriológico de órgãos de *Callithrix jacchus* (Primates: Callitrichidae) que foram ao óbito no Núcleo de

Primatologia da UFRN - Maria José B. C. Fernandes, Dulce Almeida, Maria E. A. Seixas, Elzeneide D. Duarte & Lígia M. R. Melo, pp.217-230; Actinomicose cervico-facial de caráter disseminado em *Leontopithecus chrysopygus* (Mikan, 1823) Primates: Callitrichidae - Waldo M. Gonçalves, Helena Magalhães, Carlos H. C. Costa, Mário A. Ronconi, João B. da Cruz & Alcides Pissinatti, pp.231-240; Osteodistrofia fibrosa em híbridos de *Callithrix* (Erxleben, 1777) Primates: Callitrichidae - Relato de dois casos - João B. da Cruz, Alcides Pissinatti, Marcílio D. do Nascimento & Carlos H. C. Costa, pp.241-248; Parasitismo por helmintos e protozoários no sagüi comum (*Callithrix jacchus*) - Maria de F. F. de M. Ximenes, pp.249-256. *Seção IV - Geral*. Medidas morfométricas de *Saguinus imperator imperator* e *Saguinus fuscicollis weddelli* (Callitrichidae: Primates) em ambiente natural - Júlio C. Bicca-Marques, Cláudia Calegari-Marques, Elvira M. P. de Farias, Maria A. de O. Azevedo & Francisco G. de A. Santos, pp.257-267; Methods and use of fecal steroid analyses for monitoring reproductive functioning in marmosets and tamarins - Toni E. Ziegler, Guenther Scheffler & Anne A. Carlson, pp.269-280; *A Primatologia no Brasil: 10 anos de Current Primates References* - Ivana T. D. Jarreta, Kátia C.P.S. Santos & M. Emília Yamamoto, pp.281-292. Available from: Maria Bernadete Cordeira de Sousa, Departamento de Fisiologia, Universidade Federal do Rio Grande do Norte, 59072-970 Natal, Rio Grande do Norte, Brazil, Fax: +55 (0)84 211-9206, e-mail: <mdesousa@cb.ufrn.br>.

Behavioral Approaches to Conservation in the Wild, edited by Janine R. Clevmons and Richard Buchholz, 1997, 400pp. Cambridge University Press, Cambridge, UK. Hardback ISBN 0 521 58054 4. Price: £55.00 (+p&p), Paperback ISBN 0 521 58960 6. Price: £19.95 (+p&p). This book is unique in emphasizing conservation of wild populations as opposed to captive and reintroduced, where behavioral research has concentrated in the past. The variety of expertise in this volume demonstrates that the complete ethological framework, not just behavioural ecology, provides valuable techniques and knowledge for conserving biodiversity. Issues addressed include: the limits and potentials of behavioral research to conservation; the importance of behavioral variation as a component of biodiversity, and the use of animal behavior to solve conservation problems and provide specific direction for research and management practices. Contents: Part I: Problems and issues; Part II: Conservation and the four levels of behavioral study; Part III: Examples and case studies. Available from: Customer Services Department, Cambridge University Press, The Edinburgh Building, Cambridge CB2 1BR, UK, Fax: +44 (0)1223 325152, e-mail: <directcustserve@cup.cam.ac.uk>.

Phylogenies and the Comparative Method in Animal Behavior, edited by Emília P. Martins, 1996. Oxford University Press, New York. ISBN 0 19 509210 4. Based on papers from a symposium organized for the Animal Behavior Society in Seattle, July 1994. Available from: Ox-

ford University Press, Order Department, 2001 Evans Road, Cary, NC 27513, USA, or Oxford University Press, Science Publications, Walton Street, Oxford OX2 6DP, UK, Fax: +44 (0)1865 56646.

The Enchanted Amazon Rain Forest: Stories from a Vanishing World, by Nigel J. H. Smith, 1996, 208pp. ISBN 0 8130 1577 1. Price US\$29.95. University Press of Florida, Gainesville. Compiled during Nigel Smith's quarter-century of fieldwork in the Amazon, the stories reflect the resilient culture of millions of small farmers, hunters and fisherfolk along the region's waterways and pioneer roads. Their lore is an intriguing blend of indigenous European and African religious beliefs spanning all aspects of daily life and including a wide assortment of ghosts, monsters and enchanted places. As a backdrop to the tales, Smith provides information on the flora and fauna of the area, on the geographical and historical setting, and in particular on the problems of rain forest conservation. With its intimate photographs, also by Nigel Smith, this book will appeal to the general public as well as to ecologists, anthropologists, botanists, natural historians, and all others working in the Amazon basin. Available from: University Press of Florida, 15 NW 15th Street, Gainesville, Florida 32611-2079, USA. Tel: (352) 392-1351. Tel: (toll free): 1 800 226 3822.

Ecology of an African Rain Forest: Logging in Kibale and the Conflict Between Conservation and Exploitation, by Thomas T. Struhsaker, 1997, 456pp., 103 figures, 43 tables, index, references. University Press of Florida, Gainesville. ISBN 0 8130-1490 5. Price: Cloth US\$39.95 (with p+p, US\$3.50 in the USA, US\$4.00 elsewhere). Highly recommended. This book examines some of the most important aspects of the conservation biology of tropical forests. Thomas Struhsaker summarizes 20 years of research in the Kibale forest in Uganda, one of the most important centers for the study of tropical rain forests in Africa. Among the longest ongoing projects in rain forest ecology anywhere, Struhsaker's book differs from the great majority of logging studies by emphasizing the fauna rather than looking only at the commercially valuable timber species. By providing long-term data on a variety of plants and animals, it offers the first truly in-depth synthesis of the consequences of selective logging in the tropics. The main body of the book demonstrates the adverse effects of logging, even 25 years after the event, on community structure and numerous other aspects of forest ecology. Although much has been claimed for the possibilities of sustainable logging in tropical rain forests, few data support these claims. Struhsaker demonstrates that future logging must be done at far lower intensities than is currently practiced if intact ecosystems are to be maintained. He also offers detailed recommendations for harvest plans compatible with the conservation of biodiversity and ecological integrity. The long-term data he has summarized on the population dynamics of rain forest trees, primates, rodents, duikers, and elephants

are unrivaled and will be widely cited, as will the data on seasonality, tree phrenology, gap dynamics, rainfall, and temperature. Struhsaker addresses the underlying causes of tropical deforestation and concludes that although there are numerous proximate factors, the ultimate causes are rapidly increasing human populations and rates of consumption per capita. He draws comparisons with relevant studies elsewhere in the tropics and offers specific recommendations to address the problems. "A much-needed volume that will be of interest to a wide audience, written by a leader in the field, and one with an international reputation. The current rosy advocacy for 'sustainable development' needs a wake-up call, and this is it. This volume combines some of the hottest topics in conservation science today into a cohesive whole that looks clear-eyed into the face of modern conservation in the tropics and finds it frighteningly lacking in scientific underpinning, rational consideration, and effective implementation". - Truman Young, University of California at Davis. *Contents*: Introduction: Objectives and Historical Overview; Ecological overview of Kibale; Biological Seasonality and El Niño Effects; Effects of Logging on the Tree Community; The Impact of Logging on Forest Gap and Edge Dynamics; Primates; Rodents; Duikers; Elephants; Tropical Rain Forest Management Policy and Practice; Causal Factors of Tropical Deforestation and Recommendations; Appendices. Thomas T. Struhsaker has conducted field research in Africa over a period of 34 years. From 1970 through 1987 he established, developed, and directed the field research station in Kibale, Uganda. He maintains an active role in Kibale today and is a research scientist in the Department of Biological Anthropology and Anatomy at Duke University. Available from: University Press of Florida, 15 NW 15th Street, Gainesville, Florida 32611-2079, USA. Tel: (352) 392-1351.

Brazilian Perspectives on Sustainable Development of the Amazon Region, edited by Miguel Clüser-Godt and Ignacy Sachs, 1995, 330pp. ISBN 1 85070 576 3. Hardcover. Price: £45.00/US\$68.00. Vol. 15. Man and the Biosphere Series (editor J. N. R. Jeffers). The Parthenon Publishing Group, Carnforth, UK, and UNESCO, Paris. A high level scientific reference text on Amazonian ecology, resource use and development. *Contents*: Introduction; Climatic and hydrological conditions as key factors for eco-development strategies; Development and management plans for the Amazon region; The Amazon - an urbanized forest; Sociodiversity and biodiversity; Agroforestry in Brazil's Amazonian development policy; Rehabilitation of capoeiras; Degraded pastures and mining sites; The Amazon and extracting activities; Development of commercial fisheries in the Amazon basin and consequences for fish stocks and subsistence fishing; Mining without destruction; Organizing research for the development of the Amazon region; Possibilities for sustainable agriculture development in the Brazilian Amazon; Elements for a strategy for territorial settlement and eco-development in the Amazon. Available from: The

Parthenon Publishing Group, UK Office, Casterton Hall, Carnforth, Lancs LA6 2LA, UK, Tel: +44 (0)15242 72084, Fax: +44 (0) 15242 71587; USA Office, One Blue Hill Plaza, P.O.Box 1564, Pearl River, New York 10965, USA, Tel: +1 914 73 9363, Fax: +1 (914) 735 1385. Web site: <<http://www.parthpub.com>>.

Congresso Brasileiro de Unidades de Conservação. Anais. Vol. I - Conferências e Palestras. Vol. II - Trabalhos Técnicos, edited by Miguel S. Milano, 1997. Vol. I - 414pp., Vol. II - 803pp. The proceedings of a major congress on Brazilian protected areas held in Curitiba, Paraná, 15-23 November 1997. In Portuguese with English abstracts. The Congress was organized by the Universidade Livre do Meio Ambiente, the Rede Nacional Pró Unidades de Conservação, and the Instituto Ambiental do Paraná, and promoted by the Fundação O Boticário de Proteção à Natureza, the Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos do Paraná, and the Instituto Ambiental do Paraná. Volume I contains the 30 major lectures given during the congress, and Volume II contains 75 talks, presentations, and workshop results divided into the following themes: Policy and legislation; Planning and administration; Public use; Biodiversity, research and monitoring; and Management. A remarkable and most valuable compendium. Available from: Miguel S. Milano, Diretor Técnico, Fundação O Boticário de Proteção à Natureza, Avenida Rui Barbosa 3450, 83065-260 São José dos Pinhais, Paraná, Brazil, e-mail: <fundacao@fbpn.org.br>. Web site: <<http://www.fbpn.org.br>>.

Biodiversidade, População e Economia, organizado por João Antônio de Paula, 1997, 672pp., Centro de Desenvolvimento e Planejamento Regional (CEDEPLAR) e Programa de Pós-Graduação em Ecologia, Conservação de Vida Silvestre (ECMVS), Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brasil. Preço: R\$30,00 (não incluindo postagem). Esse volume é resultado de trabalho coletivo de vários pesquisadores da Universidade Federal de Minas Gerais em torno do programa "Biodiversidade, População e Economia: Uma Região da Mata Atlântica", vinculado ao Programa de Apoio ao Desenvolvimento Científico e Tecnológico - Núcleo de Ciências Ambientais (PADCT/CIAMB), do Ministério de Ciência e Tecnologia. É um relatório-síntese de estudos interdisciplinares desde 1990. O programa estudou privilegiadamente a bacia do médio Rio Doce em Minas Gerais, em particular a sub-bacia do Rio Piracicaba. Inclui os seguintes capítulos: Dinâmica Capitalista, Divisão Internacional do Trabalho e Meio Ambiente - João Antônio de Paula et al.; A Ocupação do Território e a Devastação da Mata Atlântica - Fausto R. A. Brito, Ana Maria H. C. de Oliveira & André C. Junqueira; Ocupação do Território e Estrutura Urbana - Roberto L. de M. Monte-Mór et al.; Estrutura Econômica Regional e Meio Ambiente - Alisson F. Barbieri et al.; Fundamentos Históricos e Metodológicas da Questão Ambiental - João

Antônio de Paula, Fausto R. A. Brito & Maria Regina Nabuco; A Bacia Hidrográfica como Unidade de Análise e Realidade de Integração Disciplinar - Francisco A. R. Barbosa, João Antônio de Paula & Roberto L. de M. Monte-Mór; Atividades Antrópicas e Impactos Ambientais - Alisson F. Barbieri et al.; Impactos Antrópicos e Biodiversidade Aquática - Francisco A. R. Barbosa et al.; Impactos Antrópicos e Biodiversidade Terrestre - Gustavo A. B. da Fonseca; Sociedade, Poder e Meio Ambiente - Tânia M. Braga & Vanja A. Ferreira; Programa de Educação Ambiental - Cláudio B. Guerra et al.; Análise Integrada dos Resultados - Roberto L. de M. Monte-Mór et al.; Propostas de Intervenção - Heloísa M. Costa et al.; Uma Proposta Metodológica Interdisciplinar - João Antônio de Paula et al. Para maiores informações: Editora UFMG, Biblioteca Central, 4º andar, Universidade Federal de Minas Gerais (UFMG), Avenida Antônio Carlos 6627, 30161-970 Belo Horizonte, Minas Gerais, Brazil.

Etología: Bases Biológicas de la Conducta Animal y Humana, editado por Fernando Peláez del Hierro, Universidad Autónoma de Madrid, and Joaquim Veà Barro, Universidad Central de Barcelona, 1997. Ediciones Pirámide, S. A., Madrid. ISBN 84 368 1076. Preço: 3.000 Pts. Contenido: Presentación; Jordi Sabater Pi: semblanza de un naturalista - Joaquim V. Barró & Fernando P. del Hierro; 1. Los métodos observacionistas en la Etología - Vicenc Quera Jordana; 2. Aproximación al significado de los períodos sensibles en el desarrollo del comportamiento - Juan M. Serrano Rodríguez & Jaime Iglesias Dorado; 3. El pensamiento animal a la luz de la comunicación - Carles Riba i Campos; 4. Conducta cultural - Montserrat Colell Mimó & Maria D. Segarra Castells; 5. Agresión - Dietmar Zinner; 6. Comportamiento sexual y reproductor: modelos evolutivos y conductuales - Fernando P. del Hierro, Susana S. Rodríguez & Carlos Gil-Burman; 7. Factores ecológicos y sistemas sociales de los primates - Carlos Gil-Burmann, Fernando P. del Hierro & Susana S. Rodríguez; 8. Modelos primatológicos de la evolución conductual humana: la caza en los chimpancés - Joaquim V. Baró; 9. La importancia de la mano y de la manipulación en la adaptación de los primates - Mateo Escobar Aliaga & Carmen Garcia González. Disponible: José Maria Elola Gómez, Delegado de Ventas, Comercial Grupo Araya, c/ Iriarte 4, E-28028 Madrid, España.

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ABSTRACTS

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Meetings

Workshop sobre a Biodiversidade de Mamíferos do Brasil (Sistemática, Biogeografia e Conservação): Discussão de um Programa Nacional de Inventário, Monitoramento e Informatização das Principais Coleções do País, 6 a 8 de maio de 1998, Sociedade Brasileira de Mastozoologia, Museu Nacional e Universidade Federal do Rio de Janeiro (UFRJ). Comissão organizadora: Dr. Leandro O. Salles e Dr. Luiz Flamarion B. de Oliveira, Setor de Mastozoologia, Departamento de Vertebrados, Museu Nacional, Quinta da Boa Vista, 20.940-040 Rio de Janeiro, Rio de Janeiro, e Dr. Rui Cerqueira, Laboratório de Vertebrados, Departamento de Ecologia, Universidade Federal do Rio de Janeiro (UFRJ), Caixa Postal 68020, 21941 Rio de Janeiro, Rio de Janeiro, Brasil. E-mail: Leandro Salles <salles@omega.lncc.br>.

21st Annual Meeting of the American Society of Primatologists, 28 June - 1 July, 1998, Southwestern University, Georgetown, Texas. Co-hosted by the Southwestern University and The University of Texas M. D. Anderson Cancer Center, Science Park, Bastrop, Texas. For further information: Steven Schapiro, University of Texas M.D Anderson Cancer Center, Department of Veterinary Research, Rte 2, Box 151-B1, Bastrop, Texas 78602, USA., Tel: 512 321 3991, Fax: 512 322 5208, or Evan Zucker, Chair - ASP Program Committee, Department of Psychology, Loyola University, New Orleans, LA 70118, USA, Tel: 504 865-3255, e-mail: <zucker@loyno.edu>. Web site: <<http://www.asp.org>>.

Human Behavior and Evolution Society - 10th Annual Meeting, 8-12 July, 1998, University of California, Davis. Papers on non-human primates that have relevance to human behavior are welcomed. Contact: Peter Richardson (Division of Environmental Studies) or Monique Borgerhoff Mulder (Department of Anthropology), University of California, Davis, CA 95616, USA. <www.des.ucdavis.edu>.

1998 Meeting of the Society for Conservation Biology, 13-16 July, 1998, Macquarie University, Sydney, Australia. For more information; Dr R. Frankham, School of Biological Sciences, Macquarie University, Sydney, NSW 2109, Australia, Tel: +61 2 850 8186, Fax: +61 2 850

8245.

Animal Behavior Society Annual Meeting, 18-22 July, 1998, Southern Illinois University, Carbondale, Illinois. For further information: Dr Lee Drickamer, Department of Zoology, Southern Illinois University, Carbondale, IL 62901, USA. Web site: <<http://www.clarku.edu/~rking/abs.html>>.

VII International Congress of Ecology, New Tasks for Ecologists after Rio 92, 19-25 July 1998, Centro Affari & Palazzo Internazionale Congressi, Florence, Italy. Organized by the International Association for Ecology (INTECOL) in conjunction with the Italian Ecological Society (SItE). Themes include: Perspectives in global ecology; Perspectives for the ecological management of natural resources; Problems and perspectives in Mediterranean ecosystems; Diversity concepts at different scales; Perspectives in ecological theory and modeling; Key issues in aquatic ecosystems; Perspectives in landscape ecology; Perspectives in sustainable land use; Key issues in microbial ecology; Patterns and interactions in populations and communities; Perspectives in environmental chemistry and ecotoxicology; Integrating ecology into economic and social development; Ecological engineering; Progresses in ecological education. Contact: Almo Farina, Vice-President INTECOL, Secretariat VII International Congress of Ecology, Lunigiana Museum of Natural History, Fortezza della Brunella, 54011 Aulla, Italy, Tel: +39 187 400252, Fax: +39 187 420727, e-mail: afarina@tamnet.it, web site: <http://www.tamnet.it/intecol.98>.

Euro-American Mammal Congress, 20-24 July, 1998, University of Santiago de Compostela, Galicia, Spain. Organized under the auspices of the American Society of Mammalogists (ASM), Societas Europea Mammalogica (SEM) and the Sociedad Española para la Conservación y el Estudio de los Mamíferos (SECEM). Also participating: University of Santiago de Compostela (USC) through its Colleges of Sciences and Pharmacy as well as the Consejería de Agricultura, Ganadería, y Montes of the local government (Xunta de Galicia) through the intermediacy of its Dirección General de Montes y Medio Ambiente Natural. The meeting will emphasize the cutting edge and little known aspects of scientific knowledge of mammalian species, and communities and ecosystems of the Holarctic. However, contributions of interest relating to mammals from other regions will also be welcomed. Contributions will be grouped in sessions that will cover general subjects, symposia or workshops. General matters currently projected: Behavioral Ecology, Biogeography, Community Ecology, Conservation, Development, Molecular Systematics, Morphology and Morphometrics, Natural History, Paleontology, Parasites and Diseases, Physiology, Population Dynamics, Population Genetics, Systematics and Evolution, and Wildlife Management. Those interested in organizing a symposium should contact a member of the Steering Committee. Deadlines for

proposals 11 March 1997. The organizers request that electronic mail be used for contact whenever possible. For more information, all queries and requests: galemys@pinar1.csic.es. Circulars will also be sent by electronic mail, and distributed through a variety of distribution lists and list servers. Postal address: Euro-American Mammal Congress, Laboratorio de Parasitología, Facultad de Farmacia, Universidad de Santiago de Compostela, 15706 Santiago de Compostela, Spain, Fax: (34) 81 593316.

7th International Behavioral Ecology Congress, 27 July - 1 August, 1998, Asilomar Conference Center, Monterey Peninsula, California, USA. For further information contact: Walt Koenig, e-mail: <wicker@uclink.berkeley.edu>, or Janis Dickinson, e-mail: <sialia@uclink2.berkeley.edu>. International Society for Behavioral Ecology web site: <<http://socrates.berkeley.edu/~isbe98/>>.

XVII Congress of the International Primatological Society, 9-14 August, 1998, University of Antananarivo, Antananarivo, Madagascar. The theme of the Congress is: "Taking Responsibility for our Future through Conserving Biological Diversity such as Primates". Deadline for registration and free communications abstracts is 1 February 1998. Materials must be received by this date. Deadline for abstracts for symposia, workshops and roundtable discussions: 31 October 1997. Registration fees are US\$300 for regular IPS members, US\$100 for IPS student members, US\$350 for non-members, and US\$100 for accompanying persons. Registration includes the opening and closing receptions, as well as the program and abstract booklets, lunches and shuttles. After 1 February 1998, all rates will increase by US\$50. On site registration will be more. The official languages will be French and English. Two plenary lectures will be given on topics relevant to human responsibilities for World Survival and to the significance of primate conservation. Contact: Secretariat XVII IPS Congress, Madame Berthe Rakotosamimanana, Faculte des Sciences, Batement P, Porte 207, BP 906, Antananarivo 101 Madagascar. Tel: 261 2 26991 ext.24, e-mail: <ralaiari@syfed.refer.mg>. Development Committee: Marlene Rakotomalala, Tel: 261 2 26991 ext.13, Scientific Committee: Hantanirina Rasamimanana, e-mail: <hramasim@syfed.refer.mg>. Coordinator and for information: Soava Rakotoarisoa, Tel: 261 2 26991 ext.24. Common fax: 261 2 31398.

Measuring Behavior '98, 2nd International Conference on Methods and Techniques in Behavioral Research, 18-21 August, 1998, Center for Biological Sciences, University of Groningen, Haren, The Netherlands. The Conference host is Prof. Dr. J.M. Koolhaas. The program will consist of oral papers, poster sessions, demonstrations, training sessions, user meetings, scientific tours, post-conference excursions, and a pleasant social program. All presentations will deal with innovative methods and techniques in behavioral research. Validation of a new technique is an acceptable subject for a paper or poster. How-

ever, papers discussing applications of proven techniques do not belong at Measuring Behavior '98. Presentations on physiological techniques are welcome, as long as there is a clear link with behavior. Contributions are welcome on the following topics: Behavioral Recording, Behavior and Physiology, Behavioral Analysis, and Behavioral Models. "Measuring Behavior '98" will devote special attention to the integration of advanced behavioral research with physiological measurements. Deadline for submission of abstracts: 1 April 1998. Notification of acceptance of abstracts: 1 June 1998. Deadline for early registration (reduced fee): 15 June 1998. For further information: The Conference Secretariat, Measuring Behavior '98, Attn: Rosan Nikkelen, P.O. Box 268, 6700 AG Wageningen, The Netherlands, Tel: +31 (0)317 497677, Fax: +31 (0)317 424496, e-mail: <mb98@noldus.nl>. Web: <http://www.noldus.com/events/mb98/mb98.htm>.

Association for the Study of Animal Behaviour - Intraspecific Variation in Behaviour, 2-4 September, 1998, University of Urbino, Italy. Organized in conjunction with the Societa Italiana di Ethologia, by Giorgio Malacame and Tim Roper. Plenary lectures will address four main themes: the role of social learning and culture in producing intraspecific variation in behaviour; intraspecific variation in social and mating behaviour in vertebrates as a function of population density and other variables; alternative strategies; and individual differences in behaviour. Offers of talks or posters relevant to these or other aspects are invited. Posters on any other aspect of animal behaviour are also welcomed. For more information: Prof. Giorgio Malacame, Department of Sciences and Advanced Technologies, Borsalino 54, 15100 Alessandria, Italy, e-mail: <malacam@venere.unial.it>, or Dr Tim Roper, School of Biological Sciences, University of Sussex, Brighton BN1 9QG, UK, e-mail: <t.j.roper@sussex.ac.uk>.

Conservation Breeding Specialist Group (CBSG) Annual Meeting 1998, 8-11 October, 1998, Pacifico Yokohama Conference Center, Yokohama, Japan. Organized by the CBSG, Zoological Gardens of the City of Yokohama, and the Japanese Association of Zoological Gardens and Aquariums. For further information: Secretariat of the 1998 CBSG Annual Meeting, c/o ΑΣΤΕΙΟΝ Co., Ltd., Room #401, Toranomon Sangyo Bldg., 1-2-29 Toranomon, Minato-ku, Tokyo, 105-0001 Japan, Tel:+81 3 3593 2565, Fax: +81 3 3593 1088, e-mail: <atky@tky2.3web.ne.jp>.

Primate Society of Great Britain (PSGB) Winter Meeting - Current Contributions of Zoos to Primate Conservation and Biology, 2 December, 1998, Zoological Society of London, London, U.K. Organized by Dr Miranda Stevenson and Dr Bryan Carroll. Contact: Dr Miranda Stevenson, Marwell Zoological Park, Colden Common, Winchester, Hants SO21 1JH, England, U.K. Tel: 01962 777407, Fax: 01962 777511, e-mail: <mirandast@email.msn.com>.

Association for the Study of Animal Behaviour - The Genetic Analysis of Behaviour, 3-4 December, 1998, Zoological Society of London, London. Organized by Mike Ritchie and Bambos Kyriacou. For more information: Dr M. G. Ritchie, Environmental & Evolutionary Biology, Bute Medical Building, University of St. Andrews, Fife KY16 9TS, UK, Fax: +44 (0)1334 463600, e-mail: <mgr@st-andrews.ac.uk>, or Dr Bambos Kyriacou, Department of Genetics, Adrian Building, University of Leicester, Leicester LE1 7RH, UK, Fax: +44 (0)1162 523378, e-mail: <cpk@leicester.co.uk>.

Contributions

We would be most grateful if you could send us information on projects, research groups, events (congresses, symposia, and workshops), recent publications, activities of primatological societies and NGOs, news items or opinions of recent events and suchlike. Manuscripts should be double-spaced and accompanied by the text in diskette for PC compatible text-editors (MS-Word, Wordperfect, Wordstar). Articles, not exceeding six pages, can include small black-and-white photographs, high quality figures, and high quality maps, tables and references, but please keep them to a minimum.

Please send contributions to: **ANTHONY RYLANDS**, c/o Conservation International do Brasil, Avenida Antônio Abrahão Caram 820/302, 31275-000 Belo Horizonte, Minas Gerais, Brazil, Tel/Fax: +55 (31) 441 17 95 or **ERNESTO RODRÍGUEZ-LUNA**, Parque de La Flora y Fauna Silvestre Tropical, Instituto de Neuroetología, Universidad Veracruzana, Apartado Postal 566, Xalapa, Veracruz 91000, México, Fax: 52 (28) 12-5748.

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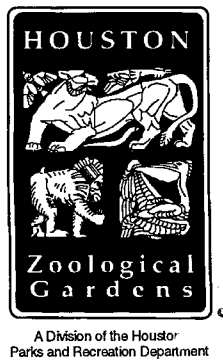
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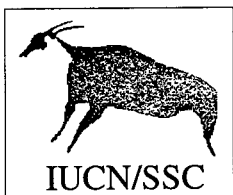
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