

Estimates of Reproductive Parameters for Free-ranging *Ateles geoffroyi*

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ABSTRACT. Six and a half years of data collected on the reproductive parameters of a population of free-ranging *Ateles geoffroyi* show the following characteristics: seasonality of births; interbirth interval of ca. 32 months; nursing by infants for more than 2 years; and reproductive life span of females continuing beyond 20 years of age. These characteristics appear to reflect adaptations to a primary resource base, ripe fruit, that is very low in protein and patchily distributed in space and time in tropical forests.

INTRODUCTION

Data on reproductive parameters of wild primate populations are scant at best (KLEIN, 1971; ALTMANN et al., 1977; GLANDER, 1980). Yet without this type of information, it is difficult to understand the population dynamics of particular primate species and, ultimately, the community ecology characteristic of particular areas. Spider monkeys (*Ateles*) are one of the largest of the Neotropical primates (adult body weight 7-9 kg), with a geographical range extending from southern Mexico through much of Central and South America. Data on reproductive parameters of *Ateles* are derived primarily from captive animals studied in the temperate zone or relatively short-term field studies (EISENBERG & KUEHN, 1966; DARE, 1975; KLEIN, 1971; EISENBERG, 1973, 1976). Data presented below were collected for 6.5 years on reproductive parameters of a free-ranging population of *Ateles geoffroyi* (black-handed spider monkey) living in lowland tropical forest on Barro Colorado Island in central Panama.

THE STUDY POPULATION

Black-handed spider monkeys are indigenous to forested regions of central Panama. However, in 1923 when Barro Colorado Island was declared a nature preserve, spider monkeys were already eliminated from the area by hunters. In 1959-1961 various immature spider monkeys, purchased in the open-air market in Panama City, were released onto Barro Colorado. Five of these introduced animals survived (one male and four females) and formed the breeding nucleus for the present population (EISENBERG & KUEHN, 1966; EISENBERG, 1976). Though initially provisioned, supplementary foods have not been offered for many years. Spider monkeys on Barro Colorado forage for wild foods in the forest in the same manner as described for undisturbed populations of *Ateles* in other habitats (CARPENTER, 1935; KLEIN & KLEIN, 1978) and can be regarded as nutritionally self-sufficient.

SOURCES OF DEMOGRAPHIC DATA

Records of births and deaths in the *Ateles* population were kept sporadically during the 1960's and early 1970's. In 1974, when I began my observations, there was a total population of 12 monkeys living in one troop. I recorded births, deaths and other relevant information on this population from March 1975 through August 1980. In addition, I went through record books, photographs and earlier accounts of the population and examined information on births, deaths and genealogies. Fortunately, during my period of observation, four spider monkeys gave birth to a total of eight infants offering an unusual opportunity to obtain accurate information on seasonality of births, interbirth intervals, durations of lactation and gestation and age at first parturition.

REPRODUCTIVE PARAMETERS

BIRTH SEASON

Most accounts in the literature suggest that *Ateles* do not show a discrete birth season. Neither CARPENTER (1935) working with free-ranging *A. geoffroyi* nor KLEIN (1971) working with free-ranging *A. belzebuth* and captive *A. geoffroyi* found evidence for seasonality in births. However, a colony of captive *A. fusciceps* in Washington, D.C. exhibited a strong birth peak in April–June and a lesser birth peak in November–December (EISENBERG, 1973).

Eighteen births were recorded for the Barro Colorado *Ateles* from January 1968 through August 1980 (births occurring between 1966–1968 could not be included in calculations due

Table 1. *Ateles* births on Barro Colorado Island, 1968–1980.*

Estimated birth date (by month)	Sex of infant	Source of observation
January 11, 1970	Male	DARE (1975)
June 24, 1972	Male	DARE (1975)
July 30, 1972	Female	DARE (1975)
July 18, 1975	Female	MILTON (1980)
July 22, 1977	Male	MILTON (1980)
August 1968	Male	OPPENHEIMER ^{1,2}
August 19, 1977	Male	MILTON (1980)
August 26, 1979	Female	MILTON (1980)
August 20, 1980	Female	MILTON (1980)
September 3, 1969	Male	DARE (1975)
September 1974	Male	MILTON (1980)
October 4, 1969	Male	DARE (1975)
October 17, 1971	Male	DARE (1975)
October 25, 1973	?	? ²⁾
November 1974	Female	MILTON (1980)
December 25, 1969	?	EISENBERG (1966)
December 5, 1972	Female	DARE (1975)
December 1979	?	MILTON (1980)

*Other births noted in the literature or in the Barro Colorado Island record book could not be used in calculations due to gaps in data collection or unreliability. For example, EISENBERG and KUEHN (1966) recorded three births in the spring of 1966. If these had been the only other possible births between 1966–1980, they could have been used in the calculations (but would not have altered the significant trend toward births in the latter half of the year). Since it is probable, however, that some other births took place between 1966 and the earliest continuous set of births I could confidently verify (beginning August 1968), I could only test the complete natality material compiled between 1968–1980. 1) Noted in BCI record book; 2) noted in BCI record book but no name signed to entry.

to discontinuity in the data). Of these, 2 occurred in the first half of the calendar year and 16 in the latter half (Table 1). Assuming that the probability of a female giving birth is equal for both halves of the year, the exact binomial probability of an observed distribution of births this extreme or more so is equal to 0.002. The Barro Colorado *Ateles* population therefore appears to show seasonality in the distribution of births.

Spider monkeys are strongly dependent on ripe fruit in the diet (HLADIK & HLADIK, 1969; KLEIN & KLEIN, 1978; MILTON, 1981). Ripe fruits are generally very low in protein content (MILTON, 1981). Data show that such fruits are very patchily distributed in space and time in the Barro Colorado forest (MILTON, 1980). The clustering of births during the mid- to latter portion of the year may be related to the maximal availability of ripe fruit. Data show that during much of the rainy season on Barro Colorado (April–May to October–November), more tree species are producing the soft-pulped fruits and arils favored as foods by spider monkeys than is the case during the transition and dry season months (late November–December into March) (FOSTER, 1973). Maximal availability of high energy foods may be especially important for pregnant or lactating females or their newly weaned infants.

INTERBIRTH INTERVAL

Accounts in the literature suggest a range of interbirth intervals for *Ateles* of 22 to 36 months with a mean of 33 months (EISENBERG, 1973, 1976). Interbirth intervals for the Barro Colorado *Ateles* were investigated for females that successfully weaned one infant and then gave birth to another. Precise records exist for seven births among three females between January 1969 and August 1980 (Table 2). The mean interbirth interval for these seven births is 31.9 ± 3.0 months which accords well with the mean suggested by EISENBERG (1976). Interbirth intervals ranged from a low of 28 months ($N = 2$) to a high of 36 months ($N = 1$). In no case was a new infant born before the preceding infant had attained an age of greater than 2 years.

DURATION OF LACTATION

It has been suggested that captive *Ateles fusciceps* are strongly milk-dependent for 10 months and suckle for 18–20 months (EISENBERG, 1973). A similar pattern also was noted for wild *A. belzebuth* (KLEIN, 1971). My field observations, based on the swollen appearance of the mammaries of females and regular suckling activities of infants (infant approaches mother, positions itself for suckling and remains in position for some minutes, voluntarily terminating the activity) indicate that Barro Colorado *Ateles* provide milk for their young for at least 26 months after birth ($N = 2$). One female suckled her infant for at least 28 months

Table 2. Interbirth intervals for *Ateles*.

Female A	Female B	Female C
January 11, 1970 ¹⁾	October 4, 1969	October 17, 1971 ¹⁾
December 5, 1972	July 30, 1972	September 1974
July 18, 1975	November 1974	July 22, 1977
	August 18, 1977	December 1979 ²⁾
	August 20, 1980	

1) Mother uncertain. Therefore there are seven reliable interbirth intervals and two probable interbirth intervals listed above. Only the seven reliable intervals were used to calculate mean interbirth interval; 2) Infant dies, February 1980—only documented case of infant mortality (MITTERMEIER, pers. comm.). Other deaths appear to have occurred in juvenile/young adult or very old adult stage. Current population is 15 animals (August 1980).

after birth. I would suggest that free-ranging *Ateles* are probably strongly milk-dependent for at least 2 years. The fact that in no case was a new infant born until the prior infant had attained an age of at least 28 months strengthens this assumption.

GESTATION PERIOD

Based on data from captive *Ateles fusciceps*, EISENBERG (1973) estimated a gestation period of 7–7.5 months. In May 1979, I observed probable precopulatory behavior between one female *Ateles* and an adult male. The male was observed intently following the female and sniffing the substrate wherever she paused. This behavior has been termed “place-sniffing” by KLEIN (1971), who noted it in free-ranging *A. belzebuth*. Additionally, the male reacted aggressively to the 5-year-old son of this female when it attempted to approach its mother. This female gave birth to an infant in December 1979. If fertilization occurred in May–early June 1979, this places the gestation period at ca. 200 days or ca. 7 months, in general agreement with EISENBERG’s (1973) estimate for captive animals.

SEXUAL MATURITY

Accurate information exists for time of first parturition for one *Ateles* female in the Barro Colorado population. This female was born July 31, 1972 and produced her first infant in August 1979, suggesting that sexual maturity occurs ca. 6.5 years. This is considerably longer than the estimate of 5 years for captive *Ateles* (EISENBERG, 1973). The estimate for free-ranging *Ateles* is strengthened by the fact that two other juvenile females in the Barro Colorado population, ages 7.6 years and 5.7 years, have yet to produce their first infants. At this time (August 1980), the 7.6-year-old female is expecting an infant; the 5.7-year-old shows no signs of pregnancy.

There are no precise data for time of sexual maturity for wild male *Ateles*. A captive *A. fusciceps* male is known to have sired an infant at 4.75 years of age (EISENBERG, 1976). One young male in the Barro Colorado population, born September 1974, began associating strongly with adult males in mid-1978 and by 1979 associated almost exclusively with them rather than with females and immatures. This suggests that young males in the wild show some behavioral correlates of sexual maturity between the 4th and 5th year of age. Currently (August 1980) two other young males, approximately 3 years old, are still in strong association with their mothers.

REPRODUCTIVE LONGEVITY

Two adult females, introduced onto Barro Colorado at an estimated age of 1.5 years are still alive (August 1980), and both have recently produced infants. The two females, which are now at least 22 years old, appear in excellent health and show no evidence of senescence. This suggests that wild females routinely live for more than 20 years and at such age are still reproductively active members of the population.

Reproductive longevity for wild males is difficult to determine since paternity cannot be established in most cases. The founder male *Ateles* was introduced onto the island at an estimated age of 4 years. This male must have fathered all infants born between 1966 (the time of the first recorded births in the population) and 1971, when the first island-born male infants matured. Adult male spider monkeys show a dominance hierarchy and there is a decided possibility that this same male fathered most or all infants until his death. In September 1978, this animal had to be put to sleep. At that time he had lost many fingers and toes, showed

facial paralysis, and was covered with large open sores suggestive of renal failure. A veterinarian stated that the deteriorated condition of the animal was the result of old age. Thus, by age 24, this male showed considerable evidence of senescence and imminent death.

REPRODUCTIVE PARAMETERS AND *Ateles* ECOLOGY

Ateles troops both in Panama and in Colombia have supplying areas in excess of 800 ha (KLEIN & KLEIN, 1978; MILTON, 1981). This extensive home range size is apparently due to the very patchy spatial and temporal distribution patterns of ripe fruit in Neotropical lowland forests (MILTON, 1980, 1981). Ripe fruit, as noted above, is the preferred food of spider monkeys and a large area of forest is required to supply an *Ateles* troop (some 15–22 individuals) with fruit over all parts of an annual cycle.

The reproductive parameters discussed above appear to reflect adaptations to a resource base that requires the prolonged nurturing of selected individuals over a considerable period of time rather than a relatively rapid input of new individuals into the population. With respect to the conservation needs of this species it should be noted that in the wild, animals apparently do not begin to reproduce until they have attained an age greater than 5 years and females produce new infants only around every 2 and 1.5 years. Therefore, once decimated in numbers or reintroduced into a suitable habitat, spider monkeys apparently require many years to repopulate an area.

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