American Journal of Primatology 11:125–132 (1986)

Census and Preliminary Observations on the Ecology of the Black-Faced Black Spider Monkey (*Ateles paniscus chamek*) in Manu National Park, Peru

FRANCES WHITE
Department of Ecology and Evolution, State University of New York, Stony Brook, New York

The black-faced black spider monkey, *Ateles paniscus chamek*, was studied at Cocha Cashu, Manu National Park, Peru, from June to August 1982. The density of independently locomoting individuals was found to be 31/km^2, and the average party size was 3.15. Data on age and sex compositions of parties, activity patterns, and diet composition are presented. The spider monkeys spend approximately 30% of observed time feeding, 44% resting, and 25% moving. They ate 80% fruit and 17% new leaves. Spider monkeys appear to be important seed dispersers. The best dispersal observed was for fruits with few, relatively large seeds. A rough day-range of 2,400 m was estimated from measured travel times and distances. The social system of *Ateles* is discussed.

Key words: population density, activity patterns, diet, seed dispersal, social organization

INTRODUCTION

Ateles is a genus of New World monkey that has long interested primatologists because of its large size, highly frugivorous diet, unusual social organization, and similarities to apes [Erikson, 1963]. Studies on *Ateles* have been carried out in a variety of locations, but extensive studies are rare [Cant, 1977; Klein, 1972, 1974; Klein & Klein, 1975, 1976, 1977; van Roosmalen, 1980; Mittermeier & van Roosmalen, 1981; Fleagle & Mittermeier, 1980]. This paper reports observations on a previously unstudied subspecies, *Ateles paniscus chamek*, and compares them with results from other *Ateles* studies.

A. p. chamek weighs about 7 kg and has a long, glossy, black pelage. The face varies from black to dusky pink in color. It is found throughout western Matto Grosso, eastern Bolivia, and northeastern Peru, extending into Brazil as far as the Rio Jura, a southern tributary of the Rio Amazonas [Kellogg & Goodman, 1944].

METHODS

This study was conducted at Cocha Cashu in Manu National Park at about 11.8°S latitude and 71.4°W longitude. Manu National Park lies mostly within the Departamento de Madre de Dios, the most sparsely populated departamento in Peru.

Received February 15, 1983; revision accepted April 17, 1986.

Address reprint requests to Dr. Frances White, Department of Ecology and Evolution, State University of New York at Stony Brook, New York 11794.

Between June 23 and August 20, 1982, during the dry season when fruit is relatively scarce [Terborgh, 1983], 49 strip censuses were conducted on foot along established trails. All contacts with *Ateles* were recorded following the methods recommended by Emlen [1971] and Robinette et al [1974]. The density of *Ateles* in the study area was calculated using the length of the transects and the effective detection distance from the trail, as described by Cant [1978]. Only those groups contacted during census walks were included in the density calculation; each group contacted was followed briefly until at least an accurate count was obtained. The number of independent individuals in each grouping was recorded; the number of females carrying infants was also noted. Whenever possible, the age and sex of each member of a party were recorded.

Individuals were classed as adult, juvenile, or infant. A sub-adult class was not included. As Cant [1978] observed, this is a biologically dubious age category for females; the distinction between adult and sub-adult males is also difficult to make and could not be reliably established during the brief period of this study. The division between juvenile and infant is clearer; infants move independently only during short periods whereas juveniles are rarely or never carried by an adult.

During the early part of the study (June to early July), time was spent habituating the animals and practicing sample methods. During the latter part (July 10 to August 20), groups were followed for long periods, and activity data were recorded using two-minute sampling of focal animals [Altmann, 1974]. Activity was classified into three basic categories: *feeding*, when the animal was actively collecting and/or consuming food; *moving*, when the animal was travelling both within and between trees; and *resting*, when the monkey was stationary. This last category, therefore, included grooming, sleeping, and other quiescent activities.

Specimens of all food items were collected for identification whenever possible, and the time spent feeding on each item was recorded during activity data collection. Specimens of the ripe fruits eaten by *Ateles* were collected, measured, and weighed, and the seeds were removed, counted, measured, and weighed.

The exact location relative to the trail system was recorded as often as possible while a group was being followed. These timed routes were then transferred to a scaled map of the trails, and the patterns of movement were measured to the nearest 25 m. Social behavior was recorded opportunistically as observed.

RESULTS

The 60 parties of *A. p. chamek* contacted during the census part of this study contained a total of 192 independent individuals. The effective detection distance [Cant, 1978] was found to be 30 m, which yielded a strip width of 60 m. With sightings outside this distance excluded, the estimated population density was 31 independent individuals per square kilometer.

The average number of adults and juveniles together in a party was 3.15. Table I shows the party size frequency together with the party composition where known. The party most frequently encountered and identified consisted of an adult female and a juvenile. Parties consisting of females and offspring accounted for 56% of those parties fully identified. All male parties accounted for 20%, and mixed sex parties accounted for 24%. Table II shows the relative frequencies of each age and sex class together with those frequencies found by Cant [1978] for *Ateles geoffroyi*. Frequencies were calculated for those counts in which all individuals in a party were identified to age and sex, while the ratio of adult females with and without infants was based on total sightings.

In the second month of this study, parties of *A. p. chamek* were observed for a total of 53 hours. The results of activity data collection and the relative proportions of each of the food categories in the diet are shown in Tables III and IV respectively.

TABLE I. Party Composition

Party size	Total contacts	Adult		Juveniles	Unidentified individuals	Contacts
		Males	Females			
1	14	0	1	0	0	1
		1	0	0	0	3
		0	0	0	1	10
2	15	0	2	0	0	1
		0	1	0	1	1
		2	0	0	0	1
		0	0	0	2	7
3	8	0	2	1	0	2
		1	1	1	0	2
		3	0	0	0	1
		0	0	0	3	3
4	10	0	2	2	0	3
		0	2	1	1	1
		2	2	0	0	1
		0	0	0	4	5
5	3	0	3	2	0	1
		1	3	1	0	1
		0	4	0	1	1
6	6	0	3	3	0	1
		0	1	2	3	1
		1	3	2	0	1
		1	4	1	0	1
		3	2	0	1	1
		0	0	0	6	1
7	1	0	0	0	7	1
8	2	1	1	1	5	1
		0	0	0	8	1
9	1	0	0	0	9	1

TABLE II. Age and Sex Composition

	Present study (*Ateles paniscus chamek*)	Cant [1978] (*Ateles geoffroyi*)
Adult females	0.72	0.64
Adult males	0.28	0.36
Adults	0.59	0.50
Juveniles	0.28	0.37
Infants	0.13	0.12
"Reproductive rate"[a]	0.350	0.375

[a]Ratio of females with infants to females without infants.

Table V shows the parts of the fruits that were eaten or dropped, as well as the seed weight and number for each fruit.

The maximum time a party was followed in 1 day was 8 hours. This group consisted of three adult females, two juveniles, and one infant. The group travelled a total of 200 m in the 18 minutes devoted to travel time. This was an exceptionally short day-range, as distances measured were more often in the 400 to 800 m range before the animals were lost. Female parties, i.e., parties containing adult females

TABLE III. Activity Data

	Percentage of total time observed				
				Roosmalen [1980]	
Activity	This study	Klein [1978]	Richard [1970]	Wet	Dry
Feeding	31.28	22.0	11	43	28
Resting	43.55	63.0	61	24	59
Moving	24.82	14.0	28	33	13

TABLE IV. Diet Composition

Part eaten	This study	Klein [1978]	Cant [1977]	Mittermeier & Roosmalen [1981]
Fruits	80.53	83.0	60.0	88.5
Leaves	16.63	8.0	14.0	5.5
Flowers	2.03	<0.1	0.0	4.4
Petioles	0.81	—	0.0	0.0
Seeds	0.00	0.0	19.0	0.0
Miscellaneous	0.00	10.0	0.0	1.6

and their offspring, took a mean time of 7.5 minutes to travel 100 m. On the one occasion on which a party containing only adult males was followed, the males were involved in an inter-group dispute. This party of three males travelled a total of 1050 m in 38 minutes; that is, on average they covered 100 m in 3.5 minutes and thus moved more than twice as fast as female parties. Lone adult males were also observed to travel faster than lone adult females, although both were difficult to follow over significant distances.

DISCUSSION

Census

The density of 31 independent individuals per square kilometer is slightly higher than the 28 spider monkeys per kilometer found by Cant [1978] in his study of *A. geoffroyi* at Tikal, Guatemala, using a comparable census technique. Since Cant included infants in his count of individuals, the difference between these two results is greater than it first appears. *A. p. chamek*, like all the primates at Cocha Cashu, has never been intensively hunted, and the high density of monkeys at this study site draws much comment from visitors.

Party Size

The mean party size of 3.15 independent individuals is similar to the results of Klein and Klein's [1977] study of *Ateles belzebuth* in Colombia. The Kleins found a median party size of 3.5; they also excluded infants from their counts. Klein and Klein's distribution of party sizes also appears comparable to that found in this study, as both have a majority of parties in the 1 to 4 range. The Kleins' results differ in that they found a higher proportion of very large parties (greater than eight individuals). This difference may be due to the longer study period. The present study was conducted in the dry season when sizes of foraging parties at Cocha Cashu are reportedly smaller than in other seasons [S. Robinson and A. Wilson, personal communication].

TABLE V. Part of Fruit Utilized

Fruit species[a]	Part of fruit		Seed	
	Ingested	Dropped	Weight	No.
Brosimum rubescens	Fruit	—	0.05	1
Ficus insipida	Fruit	—	[b]	400+[c]
Dipreryx micrantha	Mesocarp	Seed	18.00	1
Crematosperma species	Fruit	—	<0.05	1
Inga marginata	Seed + mesocarp	Empty pod	0.50	11
Leonia glycicarpa	Seed + mesocarp	Exocarp	0.75	22
Unidentified species	mesocarp	Seed	2.80	1
Ficus perforata	Fruit	—	[b]	40+[c]
Unidentified species	mesocarp	Seed	2.90	1
Unidentified species	Fruit	—	2.40	1
Tapura peruviana	Fruit	—	1.50	1
Ficus pertusa	Fruit	—	[b]	60+[c]
Diospyros species	Seed + mesocarp	Exocarp	0.50	4
Paullinia species	Seed + mesocarp	Exocarp	0.01	1
Ficus ypsilaphlebla	Fruit	—	[b]	400+[c]
Brosimum alicastrum	Fruit	—	0.25	1
Celtis iguanea	Seed + mesocarp	Exocarp	0.30	1
Swartzia species	Seed + mesocarp	Exocarp	1.90	1
Anomospermum species	Fruit	—	0.60	1
Unidentified species	Seed + mesocarp	Exocarp	3.20	1

[a]Fruits are listed in decreasing frequency of occurrence in diet.
[b]Seed weight negligible.
[c]Seed number approximation.

Age and Sex Composition

Data on age-sex composition from the present study and from Cant's [1978] study are largely similar. In both studies approximately half the individuals contacted were adults; in the present study, however, more females per males (2.53:1 as compared with 1.76:1) were found. The relative proportions of infants were equivalent, although Cant found a slightly higher proportion of juveniles. These differences suggest that the higher density at Cocha Cashu results from more adult females with infants.

Activity Data

Less time was devoted to resting (Table IV) than that reported by Klein and Klein [1977] for *A. belzebuth*, but this may result from the different methods of data collection employed in the two studies. In this study, activity records were not weighted by the number of participating individuals in the group as was done by Klein & Klein [1977]. Their method may overemphasize the more visible activities such as resting. Data from other studies [Richard, 1970; van Roosmalen, 1980] show that activity patterns in *Ateles* are variable (Table IV).

Diet

In this study, as in those by Hladik [1975], Klein and Klein [1977], and Mittermeier and van Roosmalen [1981], about 80% of the feeding records of spider monkey diets consisted of fruit (Table V). Cant [1977], however, found that in Guatemala, 60% of the diet of *A. geoffroyi* consisted of fruit, and 19% consisted of seeds. The species list of foods eaten during this study is shown in Table VI. The higher proportion of new leaves and leaf buds eaten during this study may be a product of the reduced availability of fruit and of the comparative abundance of new leaves in

the dry season. Mittermeier and van Roosmalen [1981] found that *A. p. paniscus* in Surinam ate more leaves during the dry season than during the wet season.

The diet composition found at Cocha Cashu was comparable to that reported by Cant [1977] for *A. geoffroyi* in that both show a predominance of one plant species. In Cant's study, the dominant species was *Brosimum alicastrum*, which is present at Tikal in high densities and accounted for 56% of the total diet. The density of the dominant species in the diet of *A. p. chamek* in Manu, *Brosimum rubescens*, did not appear to be exceptionally high, but the trees were especially favored by the spider monkeys who fed in them for long periods and returned to the same trees repeatedly. One tree was revisited almost daily for nearly 3 weeks.

A major difference between the diets found in this and the Kleins' [1977] study is that *Ateles paniscus chamek* did not eat the abundant palm fruits present at Cocha Cashu, although these are extensively used by *Cebus apella* and *Cebus Alibfrons*, especially during times of low food availability [i.e., the dry season; Terborgh, 1983]. The Kleins, however, found that several types of palm fruits were important in the diet of *A. belzebuth*.

Seed Dispersal

The importance of spider monkeys as seed dispersers has been noted before [Boucher, 1981; Hladik, 1975; Hladik & Hladik, 1969; Mittermeier & van Roosmalen, 1981; Muskin & Fishgrund, 1981]. Cant [1977], in contrast, found that spider monkeys in Guatemala destroyed a large proportion of the seeds they ate. *A. p. chamek* in Manu were seen to excrete the entire, undamaged seeds of many of the fruits they ate.

In this study, a total of 20 fruit species were observed being eaten. In 17 species, the entire fruit was ingested, and the undamaged seeds of several of the fruit species were observed in the feces. If these seeds remained viable after passage through the gut, they were being endozoochorially dispersed by the spider monkeys. The seeds of the remaining three fruit species were dropped undamaged during feeding. The fruits that were ingested whole characteristically had a very sticky and difficult to remove mesocarp, whereas the other fruits had a mesocarp that was easier to bite off. At least one of the fruits in this second category, *Diptreryx micrantha*, is known to be bat dispersed [L. Emmons, personal communication].

The fruits with many small seeds were produced in large numbers, and the spider monkeys remained resting and feeding in these trees for long periods of time and excreted seeds so that they fell under the parent tree. The passage time in *Ateles* is just over 4 hours for first appearance, and the bulk of the meal is passed within 8 hours [Milton, 1980]. The spider monkeys at Cocha Cashu were frequently observed to spend the major part of the day in the close vicinity of heavily fruiting figs, so that the bulk, if not all, of the seeds were dropped close to the parent tree. The quality of dispersal was obviously better for fruits with a small number of large seeds. As only a small number of these were ripe or produced at one time, the spider monkeys would leave the tree after a brief feeding bout, and the seeds were then carried greater distances before being excreted.

Fruit dispersal strategies are often classed into generalist-frugivore-adapted or specialist-frugivore-adapted depending on the morphology and phenology of the fruit and on the disperser they attract [McKey, 1975; Pilji, 1972]. Fruits in the first category frequently contain many small seeds and are produced in large quantities over a short space of time. Those in the second contain a small number of relatively large seeds and are produced in small quantities over a longer period of time. The spider monkeys in Manu ate fruits from both categories, but appeared to provide better dispersal for the specialist-frugivore-adapted fruits.

Ranging Behavior

Parties of spider monkeys moved an average of 100 m in 7.5 minutes. As a party spends approximately 25% of a 12-hour day moving, an estimate of the daily range is 2400 m. Although this is obviously a very crude method of estimating daily range, the result is comparable to ranges found by van Roosmalen [1980]—500 m to 5,000 m—and by Klein [1972], who gives a minimal distance of 500 m to 1,800 m and estimates an upper limit of approximately 4,000 m.

Social Organization

The results of this study support previous interpretations of the social organization of *Ateles* [Cant, 1977; Klein, 1972; 1974; Klein & Klein, 1975, 1976, 1977, van Roosmalen, 1980]. The spider monkeys in Manu lived in large social groups that used the same area and usually interacted peacefully with one another. Only the males behaved territorially, and they cooperated to defend quite clear-cut boundaries. Females usually stayed within the boundaries of a group's range, but van Roosmalen [1980] has observed female emigration from groups. Members of the spider monkey group associated in temporary parties of changing composition and variable size. The compositions of these parties were relatively stable from day to day, as certain recognizable individuals were found together in the same general area on sequential days. Over a period of weeks, however, compositions of parties altered as animals joined or left. Other studies [Klein & Klein, 1977; van Roosmalen, 1980] have found that party size is dependent on seasonal food availability, and thus parties are larger in the wet than in the dry season. Although no evidence was found in this study of spider monkeys congregating to sleep at night, van Roosmalen [1980] found that party sizes at night of spider monkeys in Surinam were larger than party sizes during the day for 2 months of the year.

The only social grooming observed during this study was between adult females and their offspring. Roosmalen [1980] found that the only long-term bond between individuals was between female and offspring. Brief associations of one adult male and female away from other party members were observed prior to copulations. Roosmalen [1980] reports that courtship behavior occurs before a pair leaves the party. Spider monkey social organization is unusual among non-human primates but shows similarities with that of the chimpanzee, *Pan troglodytes* [Wrangham, 1975; 1979].

CONCLUSIONS

1. Spider monkeys are present in Manu at comparatively high densities.
2. Individuals associate in small parties of mixed age and sex classes.
3. *A. p. chamek* is highly frugivorous and disperses many of the seeds of the fruits that it eats.
4. The social organization of *A. p. chamek* appears similar to that of other *Ateles* species.

ACKNOWLEDGMENTS

I would like to thank Ann Wilson, Meg McFarland, John Terborgh, and other researchers at Cocha Cashu for their assistance in the field. Special thanks go to John Fleagle for his valuable advice and guidance and for reading and suggesting improvements to the manuscript. This work was funded in part by a grant from the World Wildlife Fund Project Number 1613, and BNS 8210949. It is contribution number 457 from the Department of Ecology and Evolution, State University of New York at Stony Brook.

REFERENCES

Altmann, J. Observational study of behaviour: Sampling methods. BEHAVIOUR, 49:227–267, 1980.

Boucher, D.H. The "real" disperser of *Swartzia cubensis*. BIOTROPICA (SUPPLEMENT: REPRODUCTIVE BOTANY) 13:77–78, 1981.

Cant, J.G.H. Ecology, locomotion and social organization of spider monkeys (*Ateles geoffroyi*). UNPUBLISHED DOCTORAL DISSERTATION, University of California, Davis, 1977.

Cant, J.G.H. Population survey of the spider monkey *Ateles geoffroyi* at Tikal, Guatemala. PRIMATES 19:525–535, 1978.

Emlen, J.T. Population densities of birds derived from transect counts. THE AUK 88:323–342, 1971.

Erikson, G.E. Brachiation in New World monkeys and in anthropoid apes. SYMPOSIA OF THE ZOOLOGICAL SOCIETY OF LONDON 10:135–163, 1963.

Fleagle, J.G.; Mittermeier, R.A. Locomotor behavior, body size and comparative ecology of seven Surinam monkeys. AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY, 52:301–314, 1980.

Hladik, C.M. Ecology, diet and social pattern in Old and New World primates. Pp. 3–35 in SOCIOECOLOGY AND PSYCHOLOGY OF PRIMATES. R. H. Tuttle, ed. The Hague, Mouton, 1975.

Hladik, A.; Hladik, C.M. Rapports entre vegetation et primates dans la foret de Barro Colorado (Panama). LA TERRE ET LA VIE, 23:25–117, 1969.

Kellogg, R.; Goodman, E.A. Review of the spider monkeys. PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM, 96:1–45, 1944.

Klein, L.L. The ecology and social organization of the spider-monkey, *Ateles belzebuth*. UNPUBLISHED DOCTORAL DISSERTATION, University of California, Berkeley, 1972.

Klein, L.L. Agonistic behavior in neotropical primates. Pp. 77–122 in PRIMATE AGGRESSION, TERRITORIALITY AND XENOPHOBIA. R. L. Holloway, ed. New York, Academic Press, 1974.

Klein, L.L.; Klein, D.J. Social and ecological contrasts between four taxa of neotropical primates. Pp. 59–85 in SOCIOECOLOGY AND PSYCHOLOGY OF PRIMATES. R. H. Tuttle, ed. The Hague, Mouton, 1975.

Klein, J.L.; Klein, D.J. Neotropical primates aspects of habitat usage, population density, and regional distribution in La Macarena, Colombia. Pp. 70–78 in NEOTROPICAL PRIMATES: FIELD STUDIES AND CONSERVATION. R.W. Thorington; P.G. Heltne, eds. Washington DC, National Academy of Sciences, 1976.

Klein, L.L.; Klein, D.J. Feeding behavior of the Colombian spider monkey, *Ateles belzebuth*. Pp. 153–181 in PRIMATE ECOLOGY: STUDIES OF FEEDING AND RANGING BEHAVIOR IN LEMURS, MONKEYS AND APES. T. H. Clutton-Brock, ed. New York, Academic Press, 1977.

McKey, D. The ecology of coevolved seed dispersal systems. Pp. 151–191 in COEVOLUTION OF ANIMALS AND PLANTS. L.E. Gilbert and P. H. Raven, eds. Austin, Texas, University of Texas Press, 1975.

Milton, K. Food choice and digestive strategies of two sympatric primate species. THE AMERICAN NATURALIST. 177:496–505, 1980.

Mittermeier, R.A. Distribution, synecology and conservation of Surinam monkeys. UNPUBLISHED DOCTORAL DISSERTATION, Harvard University, Cambridge, 1977.

Mittermeier, R.A.; van Roosmalen, M.G.M. Preliminary observations on habitat utilization and diet in eight Surinam monkeys. FOLIA PRIMATOLOGICA 36:1–39, 1981.

Musking A.; Fishgrund, A.J. Seed dispersal of *Stemmadenia* (Apocynaceae) and sexually dimorphic feeding strategies by *Ateles* in Tikal, Guatemala. BIOTROPICA (SUPPLEMENT: REPRODUCTIVE BOTANY) 13:78–80, 1981.

Pilji, L. van der PRINCIPLES OF DISPERSAL IN HIGHER PLANTS. New York, Springer-Verlag, 1972.

Richard, A. A comparative study of the activity patterns and behavior of *Alouatta villosa* and *Ateles geoffroyi*. FOLIA PRIMATOLOGICA 12:241–263, 1970.

Robinette, W.L.; Loveless, C.M.; Jones, D.A. Field tests of strip census methods. JOURNAL OF WILDLIFE MANAGEMENT 38:81–96, 1974.

Terborgh, J. FIVE NEW WORLD PRIMATES, A STUDY IN COMPARATIVE ECOLOGY. Princeton, New Jersey, Princeton University Press, 1983.

van Roosmalen, M.G.M. Habitat preferences, diet, feeding strategy and social organization of the black spider monkey (*Ateles paniscus paniscus* Linnaeus 1758) in Surinam. UNPUBLISHED DOCTORAL DISSERTATION, Agricultural University of Wageningen, 1980.

Wrangham, R.W. The behavioural ecology of chimpanzees in Gombe National Park, Tanzania. UNBUBLISHED DOCTORAL DISSERTATION, Cambridge University, Cambridge, 1975.

Wrangham, R.W. On the evolution of ape social systems. SOCIAL SCIENCE INFORMATION 18:353–368, 1979.