

1 *Introduction*

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For those outside of the primatological community, it may seem surprising that this is the first volume about spider monkeys (genus *Ateles*). However, while they are often seen as the “typical monkey,” mischievously hanging from their tails, swinging through the trees and eating fruit, spider monkeys are relatively unstudied in the wild compared with many species of Old World monkey, and other New World genera such as capuchin monkeys (*Cebus* spp.) and howler monkeys (*Alouatta* spp.). Indeed there are more data concerning most aspects of the social lives of the highly endangered muriqui (*Brachyteles* spp.), thanks largely to the long-term studies of Karen Strier, than the more common and much more widely distributed spider monkey.

Spider monkeys are fast moving, wide ranging and high canopy animals whose social system often means that only a few community members can be followed at any one time. Such features make the study of wild spider monkeys notoriously difficult, and are almost certainly the reasons behind the historical dearth of long-term studies of the genus. That said, the number of field studies of spider monkeys has exploded over the last decade (Table 1.1). Studies have been, or are being, carried out by researchers at all levels in academia, and perhaps most importantly there has been an increase in the number of students carrying out their Ph.D. research at various sites throughout the spider monkey range. Although natural history studies are still being carried out, especially on those species and populations we know less about, hypothesis-driven research focusing on many aspects of spider monkey ecology, behavior, physiology, morphology and evolution has increased dramatically.

Given the difficulties in studying spider monkeys in a natural setting, one might postulate that studies carried out on captive animals would be more common as many of the difficulties in studying them in the wild are negated. Unfortunately this does not appear to be the case, as scientific publications on captive spider monkeys are surprisingly rare (Eisenberg and Kuehn, 1966; Klein, 1971; Klein and Klein, 1971; Eisenberg, 1976; Rondinelli and Klein, 1976; Chapman and Chapman, 1990; McDaniel *et al.*, 1993; Watt, 1994; Laska

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Table 1.1 *Information on field study sites for Ateles spp.*

Species	Study site	Country	Type of research	Primary researchers (> 3 months)	Publications
<i>Ateles geoffroyi</i>	Los Tuxtlas Biological Research Station	Mexico	Population density, conservation	Alejandro Estrada	Estrada and Coates-Estrada (1996)
	Otoc Ma'ax Yetel Koh Reserve (Punta Laguna)	Mexico	Communication, social behavior, development, habitat use	Filippo Aureli, Gabriel Ramos-Fernández, Colleen Schaffner, Kathryn Slater, Alejandra Valero, Laura Vick	Ramos-Fernández (2005); Ramos-Fernández and Ayala-Orozco (2002); Ramos-Fernández <i>et al.</i> (2003); Campbell <i>et al.</i> (2005) Aureli <i>et al.</i> (2006); Valero <i>et al.</i> (2006); Aureli and Schaffner (2007); Slater <i>et al.</i> (2007)
	Parque de la Flora y Fauna Silvestre Tropical	Mexico	Conservation, translocation, ecology, social behavior, sexual behavior, diet, sensory physiology	Laura Hernandez Salazar, Matthias Laska	Laska <i>et al.</i> (2007a)
	Tikal	Guatemala	Locomotion, behavioral ecology	Margaret Baxter, John Cant ^a	Coelho <i>et al.</i> (1976); Cant (1977, 1978, 1990); Fedigan and Baxter (1984)
	Parque Nacional Pico Bonito	Honduras	Ecology, diet	Justin Hines ^a	Hines (2002, 2004a, b, c, 2005)
	El Zota Biological Research Station	Costa Rica	Behavioral ecology, social behavior, conservation, cognition	Stacey Lindshield, Michelle Rodrigues	Luckett <i>et al.</i> (2004); Lindshield (2006); Rodrigues and Lindshield (2007)
	Hacienda Los Inocentes	Costa Rica	Ecology, social behavior	Patricia McDaniel ^a	McDaniel (1994)
	La Selva Biological Station	Costa Rica	Diet, ecology, social behavior, ranging patterns, activity cycles	Aimee Campbell ^c	Campbell and Sussman (1994); Wentz <i>et al.</i> (2003)
	Osa National Wildlife Refuge	Costa Rica	Behavior, conservation	K. Nicole Gibson	None to date
	Punta Rio Claro Wildlife Refuge	Costa Rica	Color vision, diet preference	Pablo Riba-Hernandez	Riba-Hernandez <i>et al.</i> (2004)

Santa Rosa National Park	Costa Rica	Ecology, seed dispersal, social behavior, color vision	Filippo Aureli, Colin Chapman, Chihiro Hiramatsu, Colleen Schaffner, Patricia Teixidor ^a	Chapman (1987, 1988, 1990a, b); Chapman <i>et al.</i> (1989); Campbell <i>et al.</i> (2005); Hiramatsu <i>et al.</i> (2005)
	Costa Rica	Ecology, behavior, population survey	Susan Boinski, Martha Pineros, Jennifer Weghorst ^b	Piñeros (1994); Weghorst (2007)
	Panama	Ecology, diet, demography, social behavior, reproduction	Christina Campbell, Ronald Dare, Katharine Milton	Eisenberg and Kuehn (1966); Richard (1970); Dare (1974); Milton (1981, 1993); Ahumada (1992); Milton and Hopkins (2005); Campbell (2000, 2003, 2004, 2006a, b); Campbell <i>et al.</i> (2001, 2005); Russo <i>et al.</i> (2005)
<i>Ateles hybridus</i>	Venezuela Colombia	Population density Behavioral ecology, social behavior	Diana Liz Duque Sandoval Andres Link	None to date None to date
<i>Ateles belzebuth</i> <i>belzebuth</i>	Colombia	Behavioral ecology	Lewis Klein ^a	Klein (1971, 1972); Klein and Klein (1977)
	Colombia	Ecology, social behavior, social structure, demography, communication	Jorge Ahumada, Gisel Didier L., Luisa Fernanda, Agumi Inaba, Kosei Izawa, Andres Link, Kohei Matsushita, Akisato Nishimura, Nelson Pinilla, Juan C. Pizarro, Marcela Quiñones, Yukiko Shimooka ^a Andrea Nunes	Ahumada (1989); Izawa and Mizuno (1990); Izawa (1993, 2000); Izawa <i>et al.</i> (1997); Stevenson <i>et al.</i> (2000); Shimooka (2003, 2005); Russo <i>et al.</i> (2005), Link <i>et al.</i> (2006); Matsuda and Izawa (2007)
Maracá Ecological Station	Brazil	Diet, ecology		Nunes (1995, 1998); Nunes and Chapman (1997)
Tawadu Forest	Venezuela	Feeding behavior, ecology	Hernán Castellanos ^a	Castellanos (1995); Castellanos and Chanin (1996) (<i>cont.</i>)

Table 1.1 (cont.)

Species	Study site	Country	Type of research	Primary researchers (> 3 months)	Publications
<i>Ateles belzebuth</i> <i>chamek</i>	Yasuní	Ecuador	Demography, diet, seed dispersal, cognition, communication, genetics, locomotion, social behavior	John Cant, J. Larry Dew, Anthony Di Fiore, Andres Link, Wilmer Pozo-Rivera, Stephanie Spehar, Scott Suarez, Dionisios Youlatos	Dew (2001, 2005); Suarez (2003, 2006); Spehar (2006); Cant <i>et al.</i> (2001, 2003); Pozo Rivera (2004); Russo <i>et al.</i> (2005); Link and Di Fiore (2006)
	Cocha Cashu, Manu National Park	Peru	Seed dispersal, behavioral ecology, demography, male social relationships, habitat use	K. Nicole Gibson, Sabrina Russo, Margaret Symington	Symington (1987a,b, 1988a,b); Russo (2003, 2005); Russo and Augspurger (2004); Russo <i>et al.</i> (2006); Campbell <i>et al.</i> (2005)
<i>Ateles paniscus</i>	Lago Caiman, Parque Nacional Noel Kempff Mercado	Bolivia	Diet, behavioral ecology, population density	Robert Wallace ^a	Wallace (1998, 2001, 2005, 2006); Wallace <i>et al.</i> (1998); Karesh <i>et al.</i> (1998); Rocha (1999)
	Estacion Biologica del Beni	Bolivia	Population density, ecology	P. Fabiana Mendez, Luis Pacheco ^a	Méndez (1999); Pacheco (1997); Pacheco and Simonetti (1998, 2000)
	Tunquini, Parque Nacional Cotapata	Bolivia	Population density, behavioral ecology	Amira Apaza	Apaza (2002)
	La Chonta, Concesion Forestal	Bolivia	Diet, behavioral ecology, conservation ecology	Annika Felton ^b	None to date
	Oquiriquia, Concesion Forestal	Bolivia	Diet, population density	Lila Sainz	Sainz (1997)
	Ralleighvallen National Park	Surinam	Diet, ecology	Marc van Roosmalen ^a	van Roosmalen (1985)
	Station des Nouargues	French Guiana	Locomotion, diet, population density	Bruno Simmen, Dionisios Youlatos	Simmen and Sabatier (1996); Simmen <i>et al.</i> (1998); Youlatos (2002)

^aCompleted Ph.D. research.
^bPh.D. thesis in progress.
^cUncompleted Ph.D. thesis.

1996, 1998; Laska *et al.*, 1996, 1998, 1999, 2000a, 2000b, 2003, 2006, 2007b; Matisoo-Smith *et al.*, 1997; Hernández-López *et al.*, 1998, 2002; Pastor-Nieto, 2000, 2001; Hernandez-Salazar *et al.*, 2003; Davis *et al.*, 2005; Schaffner and Aureli, 2005; Joshi *et al.*, 2006). While spider monkeys are common in zoological parks they are conspicuously absent from primate research centers, and this may account for the apparent discrepancy. Although the chapters in this book focus on field research, we certainly acknowledge the importance of captive research and urge scientists to look to captive groups for many avenues of research that may be difficult to carry out in the wild.

In bringing together the various chapters in this volume, I had several goals in mind. First and foremost I wanted to provide a single comprehensive source for readers interested in any aspect of spider monkey behavior, ecology and evolution. Second, I wanted to showcase the expansion in research being carried out on this genus in the past decade. The authors who have contributed to this volume are numerous; however, the list does not include many who have contributed greatly to our knowledge of spider monkey behavioral ecology in the past, but who no longer study them today. Additionally absent are many graduate students currently gathering data and whose work will almost certainly broaden our knowledge even further.

The first section of this book deals with the morphology, evolution, phylogeny and taxonomy of spider monkeys. Spider monkeys are often compared to the Hominoidea because of their ability to brachiate, and the morphological features that allow them to do so. Rosenberger and colleagues provide a detailed overview of the cranial, dental and postcranial morphology of spider monkeys. They put this information into an evolutionary context by examining the evolutionary history of *Ateles* and the other members of the tribe, Atelini (*Brachyteles* and *Lagothrix*) using both morphological and genetic data sets. Reference is also made to howler monkeys, *Alouatta* spp., who, along with the atelins, constitute the subfamily Atelinae.

The taxonomy of the various species of *Ateles* has changed multiple times over the years and continues to be debated today. In Chapter 3 Collins covers the history of this taxonomic debate and discusses issues that relate to taxonomic inconsistencies today. The major issue I was confronted with in editing the chapters for this volume is the designation of the Bolivian and Peruvian black spider monkeys (*Ateles belzebuth chamek* versus *Ateles chamek*). I have chosen in this volume to be consistent throughout the chapters and to follow Collins by using *Ateles belzebuth chamek*. Adding to the confusion of this taxon is the fact that the spider monkeys at Cocha Cashu National Park, Peru, have been widely published under the incorrect name of *A. paniscus* (Symington, 1987a, 1987b, 1988a, 1988b). Genetic evidence clearly shows, however, that the morphological similarities they share with *A. paniscus* in Surinam and the

Guianan Shield (i.e. black coat and pink faces) are superficial and they should either be *A. belzebuth chamek*, or *A. chamek* (see Collins, this volume).

The second section of the book deals with the ecological challenges spider monkeys face and the ways they have adapted to these various pressures. Di Fiore and colleagues examine possibly the most well studied aspect of spider monkey life – their diet. After reviewing the different kinds of foods eaten by spider monkeys and the varying proportions of the diet that these food types contribute, they go on to investigate the similarities – or lack thereof – in the fruit genera consumed in 13 different studies. Spider monkeys appear to be quite plastic in the fruits that they consume and adjust well to each environment in which they are found.

In Chapter 5, Wallace investigates the myriad factors that influence spider monkey ranging patterns. While concluding that the availability of ripe fruit is the most important factor, he cautions that most studies investigating ranging patterns have not truly investigated all the possible contributing factors, and calls for a unified method of measuring ranging patterns. He also challenges the idea that female spider monkeys have core home ranges in all populations, and shows that these animals can be quite plastic in their use of varying habitat types.

In Chapter 6, Dew reviews the evidence showing that spider monkeys play an important role as seed dispersers in the forests they inhabit and backs up this review with primary data from his research at Yasuní National Park in Ecuador. Comparing spider monkeys (*Ateles belzebuth belzebuth*) with the closely related and sympatric woolly monkey (*Lagothrix lagothricha poeppigii*), he shows that spider monkeys are highly effective dispersers at this site. They disperse seeds of a wide variety of sizes (including large seeds that woolly monkeys do not disperse), they show low levels of seed predation, they disperse seeds far away from the parent tree and they do not damage the seed by ingesting it. The conservation implications of the importance of spider monkeys for forest renewal and maintenance are clear.

The third section investigates the behavior of spider monkeys. Youlatos provides a detailed explanation of spider monkey locomotion and posture. He begins by outlining the various modes of locomotion and posture, calling for a unified and standard set of definitions so that comparative studies can be more fruitful. With the initial provision that methods are not standardized in the data sets currently available, he provides a comparative investigation of the ways in which spider monkeys run, walk, sit, stand, swing and leap (to name a few), elucidating possible specific-level differences. A major avenue for future research is highlighted in this chapter – the need for fine-scale analyses of environmental features that may help explain why spider monkeys at different sites differ in these locomotor and postural attributes.

In Chapter 8, Ramos-Fernández reviews what is currently known about spider monkey communication, and then focuses on the most intensely studied call, the whinny. He reviews the various hypotheses to explain the function of the call and the evidence supporting and refuting each of these hypotheses. The one aspect of the whinny that does seem to be clear is that it contains information about the individual identity of the caller. He cautions that call “function” may not be easy to tease out as there may be multiple functions, depending on whether the intended recipient is a single individual, all individuals within a subgroup, or anyone that can hear the call.

Aureli and Schaffner examine the social structure and social relationships of spider monkeys. They provide an in-depth comparative discussion of fission–fusion societies and then provide a theoretical framework in which they house the rest of their chapter. They go on to review in great detail what is known about female–female, male–male, and female–male relationships. Perhaps the striking feature of this chapter is how the picture has changed over the last few years with the discovery that male–male relationships in spider monkeys are more complex than we once assumed, and how strikingly similar to common chimpanzees (*Pan troglodytes*) spider monkeys are in their social behavior.

Campbell and Gibson examine the reproductive biology and sexual behavior of spider monkeys, drawing largely on information from their two study sites, Barro Colorado Island, Panama, and Cocha Cashu, Manu National Park, Peru. They examine and discuss possible functions of the unique reproductive morphologies of both female and male spider monkeys – the hypertrophied pendulous clitoris of females and the large, baculum-free penis of males. Additionally they provide detailed descriptions of sexual behavior in the genus, highlighting the secluded and prolonged nature of the spider monkey copulation.

In her chapter on immature spider monkeys, Vick provides a seminal piece of work examining the challenging world that immature spider monkeys face. It would appear that the life of the immature male spider monkey, in particular, is filled with many perils that may cause their death prior to adulthood. Of particular interest in her chapter is the clear indication that spider monkey juveniles show many of the differences in behavior that adult male and female spider monkeys show.

In Chapter 12 Shimooka and colleagues present the first comprehensive review of spider monkey demographic factors such as interbirth interval, age at dispersal, community size and sex composition. They provide evidence for what appear to be interspecific differences, but caution that even with this data set, the sample size may be too small to truly know if the differences are real. As is echoed in many of the volume’s chapters, a call for continued long-term research is called for as the kind of data presented in this chapter can only be garnered from such studies.

In the final section of the volume, two chapters investigate interactions between humans and spider monkeys. Ramos-Fernández and Wallace tackle what is possibly one of the most urgent issues facing many researchers of spider monkeys today – their conservation. They review the current status of the various taxa and then go on to illuminate and discuss the variety of factors that are contributing to the current decline in populations. Although a few taxa require immediate action to ensure their survival, the picture is not totally bleak for all spider monkeys and many populations appear to be sustainable if efficient management of protected areas is guaranteed.

Finally, Cormier and Urbani discuss the interaction of spider monkeys with that ever-present primate species – *Homo sapiens*. We can never forget that the lives of spider monkeys, in much of their range, is intricately entwined with the lives of our species. The presence of spider monkeys in archaeological data such as faunal assemblages and iconography is reviewed and discussed. The authors also review data concerning the importance of spider monkeys to modern-day peoples – largely in the Amazonian region. Spider monkeys are often considered one of the tastiest primate species and as such hunting can play an important role in the survival of various populations.

It is my hope that the various chapters in this volume will be exciting, informative, and useful to those who read them. It is clear that although spider monkeys are difficult to study in the field, there are many researchers who are willing to face those difficulties head on in order to gain further insight into the lives of these fascinating primates. I hope that the increase in research being carried out on wild populations of spider monkeys will continue in future years.

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