favor patience, persistence, or impulse control and may be signatures of primates and other social mammals given conditions in which local competition occurs for limited resources (e.g., queuing for mates, taking turns at water holes). A possible extension of these studies is that selection for persistence, patience, or impulse control may have facilitated selection for large body size since small animals may not be energetically capable of waiting for critical food or water resources to become available. Where persistence, patience, or impulse control increases the likelihood of morbidity (e.g., desiccation) or mortality, these studies can be linked to life history evolution and adaptations to minimize associated costs. Further analyses of the fine-grained relationships between primates and their plant prey are warranted.

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GETTING THE HANG OF IT: AGE DIFFERENCES IN TAIL-USE BY MANTLED HOWLING MONKEYS (*ALOUATTA PALLIATA*)

Samantha M. Russak

Introduction

Among primates, only the five genera of the family Atelidae (*Alouatta*, *Lagothrix*, *Oreonax, Brachyteles* and *Ateles*) have fully prehensile tails. Numerous studies (e.g., Mendel, 1976; Gebo, 1992; Bergeson, 1998; Lawler and Stamps, 2002) have shown that prehensile tails aid in locomotion, help to maintain balance while resting or sleeping, especially on smaller branches, and improve the efficiency of foraging by enlarging the monkey's feeding sphere.

Howling monkeys use their fully prehensile tails from birth, and infants often wrap their tails around the base of their mothers' tails for extra security, especially while traveling (Baldwin and Baldwin, 1978). Prehensile tail-use continues in older, more independent infants and juveniles, particularly during play and environmental exploration. Adult howlers also use their tails in most activities, especially foraging and traveling. However, activity budgets differ greatly between adults and immatures, with the latter being much more active.

This study addresses the age-related differences in tail-use by mantled howling monkeys (*Alouatta palliata*). Many previous studies have focused on the positional and postural behavior of howling monkeys (e.g., Bicca-Marques and Calegaro-Marques, 1993; Estrada *et al.*, 1999; Gebo, 1992; Lawler and Stamps, 2002), but none has focused on age as an independent variable, and only one article (Wheeler and Ungar, 2001) addressed sex differences. Many of these studies have used the same independent variables, such as the size and type of substrate, the monkeys' location in the trees, and general activity, but the dependent variables differ greatly across reports.

Methods

The study was carried out at the Ometepe Biological Field Station, Isla de Ometepe, Nicaragua (11°24'N, 85°50'W) at the beginning of the wet season, 4–22 July 2004. This tropical, semideciduous, dry forest has many groups of mantled howling monkeys, *Alouatta palliata*, at three main sites: Beach Forest, Spider Forest, and Volcano Forest. The latter two are fragmented and crosscut by agricultural fields or trails, while Beach Forest is an isolated fragment (about 1 ha) bounded by Lake Nicaragua and the main road on the island. Howlers come to the ground to cross this road, but were not seen doing so during this study. For more details of the study site, see Garber *et al.* (1999) and Winkler *et al.* (2004).

The study had two parts: an extensive nine-day period in which six groups (five in Spider Forest, one in Volcano

Forest) were observed, and an intensive six-day period in which the single group in Beach Forest was observed. This yielded 10 data-collection days with over 53 contact hours and over 22 hours of data. Seventy samples (700 minutes of data) and 65 samples (650 minutes of data) were collected in the first and second periods, respectively. The groups varied in their composition but generally had 2–4 adult males, 3–6 adult females, 1–4 juveniles, and 0–2 infants.

Instantaneous, focal-subject sampling at 15-second intervals was used over 10-minute sampling periods. Individuals were chosen at random, so that no subject was the focus of two samples in a row. Data were collected on adults and immatures, but only adults could be sexed. If the focal-subject was lost from view for over a minute, the sample was dropped; if the monkey was out of sight for less than a minute, it was noted on the data sheet, and the behavior recorded for that period was the last seen behavior for that subject. All observations occurred when the monkeys were in the trees, usually at 10–20 m; binoculars were occasionally used.

For each sample, I recorded the starting time, one of the four general behavioral contexts (Table 1), size of substrate, and location in the canopy. Travel for dependant infants was recorded when the mother carried them them dorsally or ventrally while traveling herself. Data were analyzed as rates (the frequency of scans per sample) for both immatures and adults. These numbers were then compared using a binomial test (two-tailed, $\alpha = 0.05$).

Results

Adults used their tails most while feeding on terminal branches and resting, and in both contexts used their tails more than immatures did (Table 2). Immature howlers used their tails most when playing, followed by resting and feeding. Adults were not recorded playing.

Sixteen of 20 combinations of context and tail-use showed differences between adults and immatures; of these, immatures had greater rates than adults for 12 categories ($n = 16$, $x = 4$, $p = 0.038$). Rates of tail-use for immatures did not differ from adult rates for four of 20 combinations. Within contexts and across tail-use categories, the only statistically significant difference between immatures and adults was in play ($n = 5$, $x = 0$, $p = 0.31$), for the simple reason that adults never played.

Neither adults nor immatures rested by hanging by their tails. Similarly, Tail-Forelimb Suspension was never seen in adults and was seen only in juveniles during play. Both immatures and adults preferred to use Tail-Wrap during resting, feeding, and travel, and this is the most common use of the tail.

Discussion

Howlers are habitual inhabitants of the uppermost canopy and spend most of the day resting. This behavior likely reflects the mostly folivorous diet of howlers that requires

Table 1. Behavior variables recorded.

Category	Definition
General	
Rest	Little or no gross body movement; eyes opened or closed; posture variable
Feed	Eat or forage
Travel	Movement from one place to another
Play	Active exploration or manipulation of environment; social or solitary
Tail-Use	
Tail-Hang	Body-weight fully supported by tail only
Tail-Wrap	Tail flexed loosely or tightly around object
Tail-Hindlimb Suspension	Body-weight supported by tail and one or both hindlimbs
Tail-Forelimb Suspension	Body-weight supported by tail and one or both forelimbs
Tail Idle	Tail not employed in any of above tail-use categories

Table 2. Rates (scans/sample) in four contexts of five behavioral categories.

	Rest		Feed		Travel		Play	
	Immature	Adult	Immature	Adult	Immature	Adult	Immature	Adult
Tail Idle	4.71	2.78	0.02	0.00	0.40	0.20	0.19	0.00
Tail-Hang	0.00	0.00	0.52	0.43	0.24	0.17	3.02	0.00
Tail-Wrap	26.24	30.86	2.05	4.25	1.36	0.85	0.24	0.00
Tail-Hindlimb Suspension	0.02	0.00	0.41	0.45	0.00	0.02	0.50	0.00
Tail-Forelimb Suspension	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Total	30.97	33.64	3.00	5.13	2.00	1.24	4.02	0.00

them to spend much time digesting large amounts of low-quality plant material, making them more sedentary and less socially active than many other species (Baldwin and Baldwin, 1978). Our results show a clear difference in the activity budget and tail-use of immatures and adults. While playing, immatures exhibited a wide range of tail-use but most often hung only by their tails. This confirms previous findings that as howler infants mature into more skillful juveniles, they spend more time playing while hanging by the tail, which allows them to grapple with a play partner from any angle with less effort than a sitting animal expends (Baldwin and Baldwin, 1978). Their play allows young howlers to gain motor and behavioral experience that may later be helpful for hanging from small branches while they eat and for learning how to use their tails efficiently for other purposes, such as locomotion, resting, or sleeping.

While feeding, juveniles hung by their tails more often than adults, but showed less tail-use overall. The former result agrees with findings by, for example, Bicca-Marques and Calegaro-Marques (1993), who recorded that smaller individuals use an extended reach gained by hanging more often, making them more competitive with larger individuals. On the other hand, immatures often failed to use their tails more than adults, especially when traveling or resting. One might think that inexperienced young howlers would be cautious, and so use their tails for extra support and security. Their low rate of tail-use may be because immatures are uncertain as to what they can do with their tails, while still acquiring behavioral experience and knowledge.

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PREDATION OF A BEARDED SAKI (*CHIROPOTES UTAHICKI*) BY A HARPY EAGLE (*HARPIA HARPYJA*)

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The predation of primates is rarely observed in the wild (Cheney and Wrangham, 1987; Stanford, 2002). The main predators are birds of prey (Eason, 1989; Sherman, 1991; Julliot, 1994; Vasquez and Heymann, 2001), reptiles (Corrêa and Coutinho, 1997; Burney, 2002; Gursky, 2002; Tello *et al.*, 2002; Ferrari *et al.*, 2003), and an array of predatory mammals (Stanford, 1989; Peetz *et al.*, 1992; Tsukahara, 1993; Condit and Smith, 1994; Wright *et al.*, 1997). According to Stanford (2002), primate males tend to be preyed upon more often than females. The predation of females and young has been recorded by Corrêa and Coutinho (1997), Vasquez and Heymann (2001), Burney (2002), and Ferrari *et al.* (2003). Here we report on the predation of an adult male bearded saki (*Chiropotes utahicki*) by a harpy eagle (*Harpia harpyja*) in the eastern Amazon. A necropsy was carried out, which provided additional information about the animal and clues as to the exact cause of death.

The attack took place at the Estação Científica Ferreira Penna (ECFPn), Melgaço, Pará (01°42’30”S, 51°31’45”W), an area of 33,000 ha in the Caxiuanã National Forest. The incident was observed during a mammal survey being conducted by two researchers, each walking simultaneously on parallel paths 200 m apart in a 100-ha plot (#4) (01°45’13”S, 51°31’15”W), one of the Tropical Ecology, Assessment and Monitoring (TEAM) Initiative monitoring sites at Caxiuanã (Fig. 1).