Brief Report

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Polyboroides radiatus Predation Attempts on *Propithecus verreauxi*

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Key Words
Verreaux's sifaka · Madagascar harrier hawk · Predation attempts · Antipredator strategies

Introduction

Observations of raptor predation on lemurs are rare [reviewed in Goodman et al., 1993], but indirect evidence derived from raptor prey remains [Karpanty and Goodman, 1999; Thorstrom and La Marca, 2000], raptor pellets [Goodman et al., 1993], and vocal/behavioral responses to potential avian and terrestrial predators [Sauther, 1989; Karpanty and Grella, 2001; Schülke, 2001; Fichtel and Kappeler, 2002] suggest that predation may play an important role in regulating lemur populations. Recent reports of Madagascar harrier hawk *(Polyboroides radiatus)* predation attempts on *Cheirogaleus* [Gilbert and Tingay, 2001] and *Lepilemur* [Thorstrom and La Marca, 2000; Schülke and Ostner, 2001] lend support to Goodman et al.'s [1993] contention that increased predation on nocturnal prosimians has evolutionary significance for some taxa (e.g. *Microcebus murinus*). *Polyboroides* is a potential predator of large-bodied (3–4 kg) diurnal lemurs as well, based upon the ubiquity of lemur alarm calls, but observations of these predations are few [*Propithecus verreauxi:* Rasoaninrainy in Goodman et al., 1993]. Based on prey remains, sifaka make up the largest component of the harrier hawk's courtship diet in terms of biomass [Karpanty and Goodman, 1999] at Berenty and Bealoka Reserves. Here I report three predation attempts of *Polyboroides* on adult Verreaux's sifaka, *P. verreauxi,* at Beza Mahafaly Special Reserve (BMSR), Madagascar.

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Methods

Observations were made during studies of reproduction [Brockman, 1994] and male dispersal [Brockman et al., 2001] in sifaka at BMSR in southwest Madagascar. Data were collected on focal groups selected from the 30–40 groups residing in Parcel No. 1, a 100-ha fenced portion of the reserve bordering the Sakamena River. This seasonal semi-deciduous forest ranges from a riverine forest dominated by *Tamarindus indica* in the east to an increasingly xerophytic scrub forest in the west. The 270 marked and habituated sifaka at this site have been the subject of long-term demographic and behavioral studies spanning 17 years [reviewed in Richard et al., 2002]. These data were obtained during the summer/wet breeding (November 1991 to March 1992; 343 focal hours) and winter/dry birth seasons (July to August 2000, 648 focal hours). Canon 10 × 30 IS binoculars were used to identify and observe the subjects.

Results

Predation attempts on adult sifaka were observed during all-day follows of the Vavy Masiaka and Borety social groups. *Polyboroides* predation attempts on Vavy Masiaka members (1 adult male, 2 adult females, 1 18-month-old male) occurred on February 2 and 4, 1992, in the eastern forest, where 20 to 25 meter tall *Tamarindus* trees line the riverbank. In the first instance, an adult harrier hawk made a glide attack on the group at 14.16 h as they fed 15 m up in a *Tamarindus* tree. The sifaka immediately roared and plummeted 7 m down into the canopy. Moments before the attack, the juvenile male was observed head-tossing and growling eastward toward the river, but the subject of his threat was not apparent until the attack occurred. The second attack occurred on February 4 at 17.33 h, 2 h after the group had moved into their sleeping tree, the raptor approaching from the riverbank ≈50 m away. This gliding attack occurred 7 m from the ground and targeted the adult male (2.85 kg) in the group, who was knocked off his exposed limb. The group members instantly roared while simultaneously dropping lower in the canopy. On December 1, 1991, I spotted a large harrier hawk nest in the top third of a 20- to 25 meter high *Acacia* tree in the middle of Vavy Masiaka's home range. This nest contained an approximately 2- to 4-week-old nestling covered with light gray down. These predation attempts occurred ≈50 m from the nest, which then contained a 2.5- to 3-month-old fledgling [R. Thorstrom, pers. comm.].

The third *Polyboroides* predation attempt occurred on July 30, 2000, in the more open scrub forest of the west. Members of the Borety social group (2 adult males, 10 and 6 years old; 1 adult female, and a 5-week-old infant) were feeding at 09.20 h 5–8 m up in a *Tamarindus* tree. The younger male and the female/infant were feeding 3 m apart on an 8-meter-long horizontal limb with intermittent leaf patches. The female/infant were near the limb's terminus when an adult harrier hawk made a diving attack from high in a neighboring tree. The raptor flew rapidly downward, breaking its descent as it neared the female, the head and body becoming perpendicular to the ground as the feet were extended to grasp the prey. The mother/infant (and younger male) immediately roared and leapt toward the center of the tree. The male fell to the ground, but he recovered and jumped back into the tree. The harrier hawk disappeared and the mother/infant moved to a neighboring tree, followed by the agitated and growling younger male. In this case, aerial predator roars coincided with the raptor's loud wing beats during de-

celeration prior to visual detection of the predator. The sifaka were not pursued after the raptor's initial ambush attack.

Discussion

These observations support previous studies showing that *Propithecus* represent an important component of the harrier hawk's diet [Karpanty and Goodman, 1999; Rasoaninrainy in Goodman et al., 1993], albeit one difficult to catch when sifaka employ effective antipredator strategies. *Polyboroides* target both adults and juveniles [Rasoaninrainy in Goodman et al., 1993; Karpanty and Goodman, 1999] during the August courtship (harrier hawk) and birth (sifaka) phase of the breeding cycle, suggesting a seasonal predation bias toward lemur birth seasons. This report is the first showing that *Polyboroides* target adult sifaka during the November–February nesting season as well. It is likely that seasonal peaks in predation are timed to the presence of both infants and nestlings, when increased mating (courtship) and parental (nestling) effort has the highest potential rate of return for individual fitness. In fact, harrier hawk predation on diurnal lemurs occurs too infrequently to establish any degree of seasonality; but vocal/behavioral responses of *Propithecus* to repeated playbacks of *Polyboroides* calls suggest that this raptor presents a year-round predation risk for sifaka [C. Fichtel, pers. comm.]. Harrier hawk attack strategies varied with the microhabitat, silent gliding attacks and rapid diving attacks occurring in closed canopy riverine forest and open scrub forest habitats, respectively. Sifaka, nevertheless, employ effective antipredator tactics regardless of the mode of attack, including aerial predator roars and avoidance behaviors, such as dropping rapidly down into the canopy and seeking safety in the dense interior of trees. Harrier hawks here ceased all pursuit of their prey after the element of surprise was lost and arboreal escape was likely, suggesting that there may be energetic costs to hunting large-bodied gregarious lemurs, particularly those which have 2–3 times the body mass of harrier hawks [e.g. sifaka, Karpanty and Goodman, 1999]. These observations offer new insights into *Polyboroides* predation strategies and their outcomes, thereby furthering our understanding of predator-prey relationships in Malagasy vertebrates.

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References

Brockman DK (1994). Reproduction and Mating System of Verreaux's Sifaka, *Propithecus verreauxi*, at Beza Mahafaly, Madagascar. PhD thesis, Yale University, New Haven, CT.

Brockman DK, Whitten PL, Richard AF, Benander B (2001). Birth season testosterone levels in male Verreaux's sifaka, *Propithecus verreauxi:* Insights into socio-demographic factors mediating seasonal testicular function. *Behavioral Ecology and Sociobiology* 49:117–127.

Fichtel C, Kappeler PM (2002). Anti-predator behavior of group-living Malagasy primates: Mixed evidence for a referential alarm call system. *Behavioral Ecology and Sociobiology* 51:262–275.

Gilbert M, Tingay RE (2001). Predation of a fat-tailed dwarf lemur *Cheirogaleus medius* by a Madagascar harrier hawk *Polyboroides radiatus:* An incidental observation. *Lemur News* 6:6.

Goodman SM, O'Connor S, Langrand O (1993). A review of predation on lemurs: Implications for the evolution of social behavior in small, nocturnal primates. In *Lemur Social Systems and Their Ecological Basis* (Kappeler PM, Ganzhorn JU, eds.), pp 51–66. New York, Plenum Press.

Karpanty SM, Goodman SM (1999). Diet of the Madagascar harrier hawk, *Polyboroides radiatus*, in southeastern Madagascar. *Journal of Raptor Research* 33:313–316.

Karpanty SM, Grella R (2001). Lemur responses to diurnal raptor calls in Ranomafana National Park, Madagascar. *Folia Primatologica* 72:100–103.

Richard AF, Dewar RE, Schwartz M, Ratsirarson J (2002). Life in the slow lane? Demography and life histories of male and female sifaka *(Propithecus verreauxi verreauxi). Journal of Zoology London* 256:421–436.

Sauther ML (1989). Anti-predator behavior in troops of free ranging *Lemur catta* at Beza Mahafaly Special Reserve, Madagascar. *International Journal of Primatology* 10:595–606.

Schülke O (2001). Social anti-predator behaviour in a nocturnal lemur. *Folia Primatologica* 72:332–334.

Schülke O, Ostner J (2001). Predation on *Lepilemur* by a harrier hawk and implications for sleeping site quality. *Lemur News* 6:5.

Thorstrom R, La Marca G (2000). Nestling biology and behavior of the Madagascar harrier hawk *(Polyboroides radiatus)* in northeastern Madagascar. *Journal of Raptor Research* 34:120–125.