

Won't you be my neighbor? Scanning behavior and nearest neighbor distance in *Alouatta palliata* troops

KIMBERLY A. IWAMOTO, MIGUEL M. LICONA, BENJAMIN W. GUIDI, KIRTLEY C. NAKARADO AND GINA M. FERRIE

Abstract: One benefit that animals derive from living in social groups is an increased number of individuals available to scan for potential danger. We tested this hypothesis for howler monkeys (*Alouatta palliata*) in Palo Verde National Park, Costa Rica. Adult males spent more time scanning than other individuals, but vigilance behavior was not affected by nearest neighbor distance or the sex of the nearest neighbor. Individuals closer to other group members did not spend less time scanning, nor did individuals with adult male neighbors. These results suggest that scanning behavior of howler monkeys may provide benefits in addition to predator detection, such as food searching and locating conspecifics.

Key Words: Howler monkeys, predation pressure, social groups, vigilance behavior

INTRODUCTION

Animals that live in close proximity to conspecifics incur both costs and benefits from this behavior. For example, individuals living in a social group may experience greater intraspecific competition, but they may gain increased protection from predators. The selfish herd hypothesis describes how being in a group may decrease an individual's own probability of being attacked (Begon et al. 1990). More individuals scanning for predators may increase the chances of detecting a predator in time to avoid danger. Therefore, an individual that is part of a group may spend less time watching for predators than one that lives alone, and yet be safer. Within a group, the distance and identity of neighbors might also influence vigilance behavior.

Mantled howler monkeys (*Alouatta palliata*) live in social groups that encompass an average of 18 individuals and include males, females and infants (Glander 1983). Nowak et al. (2002) found that scanning behavior of individual howler monkeys decreased as group size increased, which suggests that individuals living in larger groups need to scan less to gain equal protection. Their study also found that adult males scanned more than other group members did.

In this study, we tested the hypothesis that the proximity and sex of neighbors in howler monkey groups influences individual vigilance behavior. We reasoned that vigilance responsibility might be shared or partitioned among group members, such that the sex, age class, or proximity to other monkeys would influence scanning rates. Specifically, we predicted that individuals with nearby conspecifics would be less vigilant than those with distant neighbors. We also predicted that if adult males are more vigilant than other individuals, then individuals with adult males nearby would be less vigilant than those with females or juveniles nearby.

METHODS

We observed three troops of howler monkeys for 11 total contact hours on 10 and 11 January 2003 near the OTS Biological Station, Palo Verde National Park, Guanacaste Province, Costa Rica. Using the continuous focal animal sampling method (Altmann 1974), we observed each individual for 120 s. During this period, we classified all activity of the focal individual into four categories: scanning, travelling, foraging, and resting. An individual was considered to be scanning if its head was rotating or bobbing and it appeared to be observing its surroundings.

To determine whether an individual's identity influenced amount of time spent scanning, we recorded the sex and age of the focal individuals, categorized as either male or non-males (females and sub-adult males). The nearest neighbor distance (NND) was classified as < 2 m, 2 - 5 m, 5 - 10 m, or > 10 m, and the sex of the nearest neighbor was noted when possible.

Because not all data were available for each focal individual, sample sizes were insufficient for a 3-way ANOVA. Instead, we used one-way ANOVA to analyze the effects of NND, of the nearest neighbor sex and of the sex of the focal individual on individual scanning behavior. Data were not normally distributed, but ANOVA is robust to violations of this assumption (Sokal and Rohlf 1981), and our data met the assumption of equal variance.

RESULTS

Males spent more than twice as much of their time scanning than did non-males (Fig. 1; $F = 13.01$, $df = 1, 64$, $P < 0.01$). NND, however, was not related to time spent scanning (Fig. 2; $F = 1.51$, $df = 3, 62$, $P = 0.22$), and the sex of nearest neighbor did not influence scanning time (Fig. 3; $F = 0.41$,

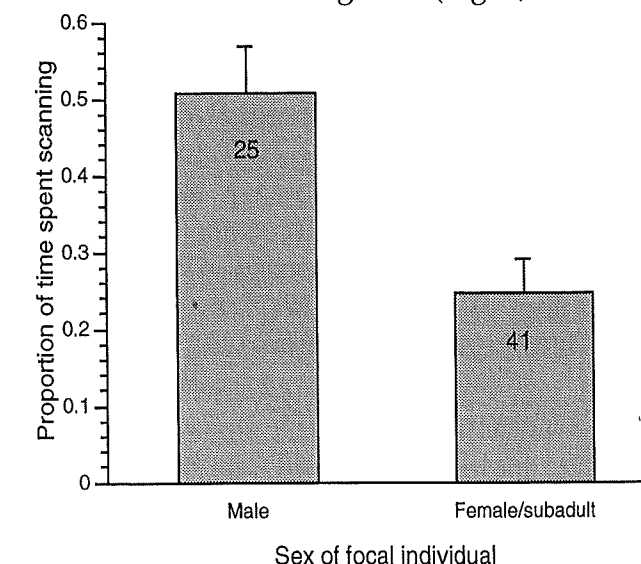


FIG. 1. Proportion (mean ± SE) of time spent scanning by male and female/subadult howler monkeys in Palo Verde National Park, Costa Rica. Number of focal individuals observed (n) is indicated in each bar.

$df = 2, 63$, $P = 0.67$). Focal individuals spent the highest proportion of their time scanning, which accounted for $34.8 \pm 3.9\%$ (mean ± SE) of the observed behavior. Resting was the second most frequent behavior ($33.4 \pm 4.4\%$), followed by travelling ($18.2 \pm 2.8\%$) and finally foraging ($13.6 \pm 3.1\%$).

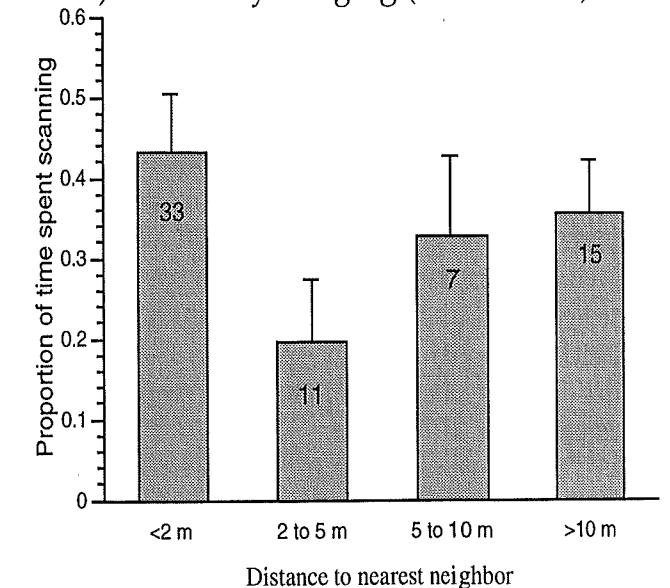


FIG. 2. Proportion (mean ± SE) of time spent scanning by howler monkeys with nearest neighbors at varying distances in Palo Verde National Park, Costa Rica. Number of focal individuals observed (n) is indicated in each bar.

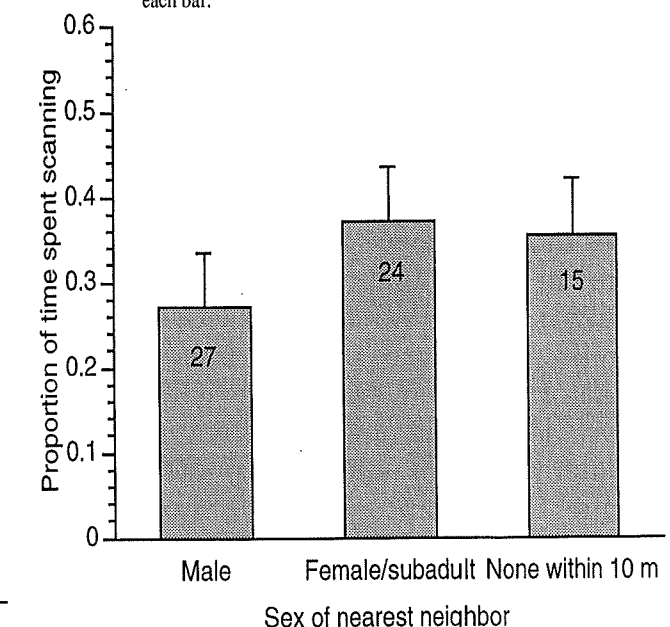


FIG. 3. Proportion (mean ± SE) of time spent scanning by howler monkeys with male, nonmale, or no neighbor within 10 m in Palo Verde National Park, Costa Rica. Number of focal individuals observed (n) is indicated in each bar.

DISCUSSION

Our results support the conclusion of Nowak et al. (2002) that adult males spend a higher proportion of their time scanning than other individuals. Adult male reproduction may be more limited by access to mates than that of females, so protection of the group may benefit them more.

Contrary to our predictions, individuals with close neighbors did not scan less than those with distant neighbors. It may be that neighbors more than 10 m away improve an individual's safety as much as closer neighbors. However, the safety of individuals with neighbors beyond this distance may decrease, possibly resulting in increased scanning time.

We also found that the sex of the nearest neighbor did not influence time spent scanning. Since NND does not affect scanning rate, it follows that the sex of the nearest neighbor would similarly have no effect.

Although scanning time has been found to vary inversely with troop size (Nowak et al. 2002), our findings suggest that howler monkeys living in groups do not spend less time scanning based on nearest neighbor distance or identity. On average, howler monkeys spent between 25 - 50% of their time scanning, which illustrates the importance of this behavior. As there are few extant predators of howler monkeys in Palo Verde, the exact benefit of scanning behavior is unclear. In addition to predator detection, scanning may be involved in locating new food resources or in social interactions among troop members. Further investigation of howler monkey

behavior may help clarify the value of scanning in the behavioral repertoire of this primate species.

As a caveat, we noted that it was often difficult to differentiate sub-adult males, sub-adult females, and adult females in the field. Careful planning, strict definitions of behavior categories and better identification of age and sex will be necessary in future studies of howler monkey group behavior.

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