Group living and vigilance in howler monkeys

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Abstract: Animals living in groups may benefit from a decreased risk of predation. Individuals in a large group may be expected to spend less time scanning for predators than individuals in a small group because they benefit from the combined vigilance of other group members. We tested whether time spent scanning by howler monkeys, *Alouatta palliata*, varied with group size, with the number of nearby group members and with sex and age classes (adult males versus juveniles). Group size had a significant effect on time spent scanning but the number of nearby conspecifics did not. There was no significant difference in scanning rate by sex or age, although adult males tended to scan more often than other monkeys. Overall, we conclude that per capita vigilance varies inversely with group size. Although howler monkeys may receive other benefits from group living, our findings support the proposition that relative safety from predators may have been important in the evolution of group behavior.

Key Words: Alouatta palliata, *Palo Verde, predation risk, social groups*

Introduction

Animals receive benefits from living in social groups, one of which may be a decreased predation risk due to an increased ability to detect predators. An individual's predation risk might therefore be expected to decrease as the number of nearby group members increases because total conspecific vigilance increases. Many studies document this relationship between group size and vigilance for birds, spiders and other groups, but support from primates is apparently lacking (Hall and Fedigan 1997).

Howler monkeys, *Alouatta palliata*, live in social groups of varying sizes (Janzen 1983). Because larger howler troops have more individuals capable of detecting predators, we predicted that per capita vigilance should decrease with increasing troop size. We also predicted that individuals with nearby conspecifics would be less vigilant than individuals farther from other troop members. Further, if these predictions are upheld, we would expect individuals in larger groups to allocate more time to non-vigilant behaviors such as resting and foraging.

Howler troops consist of individuals of different sexes and ages (Janzen 1983), which may vary in their vigilance behavior. Thus, we further predicted that adult males would be more vigilant than females and juveniles, and that females with infants, which may be at greater risk of predation, would be more vigilant than other females.

Methods

We studied four troops of howler monkeys between 07:15 and 11:30 on 8 – 9 January 2002 near the O.T.S. Biological Station, Palo Verde National Park, Guanacaste Province, Costa Rica. We located howler troops primarily by vocal cues and movement in the canopy. Using the focal animal continuous sampling method (Altmann 1974), we recorded behavior in 2-min samples. Individuals were randomly selected for observation and identified according to physical characteristics such as general appearance, size, amount of brown coloration and size and coloration of genitalia. Each individual was observed only once (except a troop of 11 individuals, 7 of which were sampled twice, 4 h apart, on one day). We classified activity as foraging, resting, traveling and scanning. An individual was considered to be resting if it was asleep or staring blankly, and scanning if it was moving its head back and forth searching its surrounding and/or the observers. We

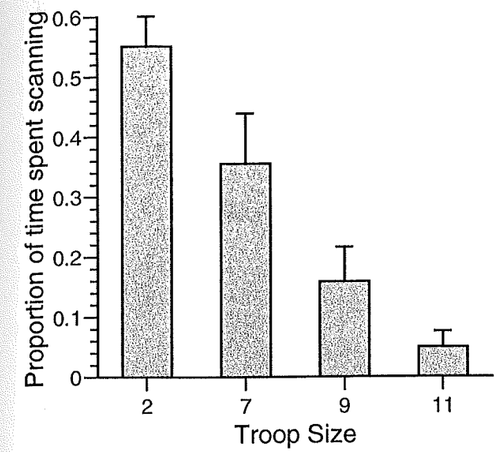

FIG. 1. Relationship between proportion of time spent scanning and howler monkey troop size. Means ± SE.

recorded the sex and age of the focal individual, the numbers of conspecifics within 10 m and troop size, and calculated the percentage of time spent on each activity during the 2 min interval.

Results

Group size significantly influenced the amount of time an individual monkey spent scanning. Individuals in larger troops spent less time scanning than individuals in smaller troops (Kruskal-Wallis $\chi^2 = 16.32$, df = 3, P = 0.001; Fig. 1). The number of conspecifics within 10 m of the focal individual, however, was not significantly correlated with time spent scanning (r = 0.14, df = 44, P = 0.34). Individuals in the largest group spent more time resting, but there was little difference among individuals in the other group sizes (Table 1). Overall, the differences in resting time across all four group sizes were not significant (Kruskal-Wallis $\chi^2 = 5.48$, df = 3, P = 0.14). Time spent foraging varied with group size, while individuals in larger groups spent about 15% of the time resting; no foraging was seen among individuals (n = 2) in the smallest group (Table 1). The differences across the four groups sizes in time spent resting, however, were not significant (Kruskal-Wallis $\chi^2 = 1.95$, df = 3, P = 0.58).

TABLE 1. Frequency of resting and foraging for howler monkeys at Palo Verde as a function of group size. Differences between means were not significant for either resting or foraging times (see text). Group size does not include infants.

Group size (n)	Mean % time resting	Mean % time foraging
2 (2)	45.0 ± 5.0	0.0 ± 0.
7 (18)	48.0 ± 9.5	10.8 ± 5.1
9 (7)	40.2 ± 12.5	15.7 ± 7.1
11 (19)	70.2 ± 9.6	15.2 ± 6.6

n = number of 2-min focal samples

Males, on average, spent 37.5 ± 8.5% (n = 16) of their time scanning compared to 26.4 ± 6.1% (n = 24) for females, a non-significant difference (Kruskal-Wallis $\chi^2 = 1.21$, df = 1, P = 0.27). The average frequency of scanning for juveniles was 10.6 ± 0.9% (n = 6), which did not differ significantly from that of males (Kruskal-Wallis $\chi^2 = 1.77$, df = 1, P = 0.18). Females with infants scanned, on average, 17.3 ± 7.2% (n = 9) of the 2-min sampling intervals, compared to 34.6 ± 11.3% (n = 15) for females without infants. This difference was not statistically significant (Kruskal-Wallis $\chi^2 = 1.32$, df = 1, P = 0.25).

Discussion

Our finding that individual howler monkeys in larger groups spent less time scanning supports the hypothesis that larger group size may confer a decreased predation risk on individual group members. Our data, however, did not support the prediction that individuals with nearby conspecifics would scan less than individuals farther away from conspecifics. Perhaps if we counted conspecifics within a smaller radius around the focal individual, a different relationship would be found. Males scanned notably more often than either females or juveniles, but the variance in scanning rates for males was too high

for these differences to be significant. Despite the possibility that predation on infants may be greater than adults, females with infants did not scan more than females without infants, and in fact, appeared to spend less time scanning (see Results). Therefore, troop size seemed to be the most important factor determining how much time an individual allocates to scanning.

Evidence linking vigilance and predation rate in primates is not well established (Hall and Fedigan 1997). Because we could not directly measure predation risk, our conclusions rest on the untested assumption that scanning in howlers reflects this danger. At our study site, the predation threat to adults appears to be low; no large monkey-eating eagles occur in Palo Verde (Stiles and Skutch 1989). Some resident hawks and large snakes, however, do occur and could potentially prey upon infant and juvenile monkeys.

If time spent vigilant is a valid indicator of predation risk, then our results suggest that living in a large group is a way for howler monkeys to find relative safety. In a more dangerous environment, this may be essential to monkey survival, and could have been an important factor in the evolution of group living in this primate species.

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