

SIZES OF HOME RANGES AND HOWLING MONKEY GROUPS AT HACIENDA LA PACIFICA, COSTA RICA: 1972-1991

Evan L. Zucker¹

Margaret R. Clarke²

Kenneth E. Glander³

Norman J. Scott, Jr.⁴

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ABSTRACT

Mantled howling monkeys (*Alouatta palliata*) at La Pacifica have been captured and marked since 1972, and the population surveyed systematically in 1984 and 1991. The presence of marked animals allowed for the positive identification of groups over time. During this 20-year period, group locations have been noted during all procedures, and maximum observed home range sizes for 21 howler groups were calculated. Mean home range size was 27.2 hectares. Home range size correlated most strongly with the number of adults per group, which is the most stable component of a howler group. Home range sizes and range size per monkey at La Pacifica were intermediate in comparison to corresponding values at other sites.

Home range sizes of nonhuman primates are influenced by diet, habitat quality, distribution of resources, degree of arboreality, body weight, group size, and total biomass (see Altmann, 1974; Clutton-Brock and Harvey, 1977; Milton and May, 1976). Primarily folivorous species, like mantled howlers, tend to have smaller home ranges than do comparably-sized frugivores, and arboreal primates tend to have smaller home ranges than do comparably-sized terrestrial primate species (Milton and May, 1976; Clutton-Brock and Harvey, 1977).

Published home range sizes for groups of mantled howling monkeys indicate that range sizes are highly variable across sites. Glander (1978) reported a home range of 9.9 hectares (0.76 hectares/monkey) for one group at La Pacifica, whereas Chapman (1988) reported a home range between 80.8 and 90.7 hectares (2.01 and 2.27 hectares/monkey, respectively) for a large group at Santa Rosa National Park. Milton (in Milton and May, 1976) reported a 45-hectare (2.8 hectares/monkey) home range for howlers on Barro Colorado Island, Panama, and in their

¹ Department of Psychology, Loyola University, New Orleans, LA 70118 USA

² Department of Anthropology, Tulane University, New Orleans, LA 70118 USA

³ Duke University Primate Center, Durham, NC 27705 USA

⁴ National Biological Survey, P. O. Box 70, San Simeon, CA 93452 USA

review of primate species' home range sizes, Clutton-Brock and Harvey (1977), using other data from Barro Colorado Island, reported a mean home range size of 18 hectares (1.06 hectares/monkey). As the home ranges of adjacent groups may overlap (Smith, 1977; Glander, 1978), some of this variability might be due to the extent of overlap at the different sites.

In this paper, we present data for home range sizes and group sizes that are based on observations of 21 howling monkey groups at Hacienda La Pacifica. These data were collected during the 20-year period of 1972 through 1991, and are compared to results from other sites.

MATERIALS AND METHODS

Mantled howling monkeys (*Alouatta palliata*) have been captured and marked at Hacienda La Pacifica, Canas, Guanacaste Province, Costa Rica (latitude 10°28' N and longitude 85°07' W) since 1972 (see Scott et al., 1976 and Glander et al., 1991, for descriptions of capture and marking methods). For most of this time period, La Pacifica was approximately 1330 hectares, of which approximately 25% was forested (Glander, 1978). La Pacifica is presently larger due to recent land acquisitions (see Glander, 1992).

Between 1972 and 1976, Scott and co-workers noted the locations of animals captured, as well as the number of animals in the groups. Between 1983 and 1989, Glander and co-workers have marked several hundred animals (Glander, 1992), and the capture locations of these animals were noted. Surveys of the La Pacifica howler population were conducted in 1984 and 1991, during which group locations and group compositions were noted (Clarke et al., 1986; Clarke and Zucker, 1994). During surveys, most groups could be identified reliably by the presence of marked animals.

The locations of the groups captured, marked, and/or surveyed were plotted on a scale-drawing map of La Pacifica, and the maximum observed home range for 21 groups was calculated. Groups were included only if multiple determinations of locations had been made. In calculating home range sizes, any forested areas connecting adja-

cent patches or strips of larger forests were included. The minimum measurement for any strip or connecting forest was .05 km. The mean number of monkeys per group and the mean number of adults per group also were calculated for the 20-year period, and tested for significant correlations with that group's home range size. Population data from the recent 1991 survey similarly were tested. In these latter tests, only data from the 19 groups located in previous years and 1991 were included.

RESULTS

Most howler groups at Hacienda La Pacifica have been found consistently in the same ranges, and home ranges of several groups did overlap. During the 1991 survey, several groups containing marked monkeys were sighted where they had not previously been seen during capture and mark sessions.

For the 20-year period (1972-1991), the mean home range size for howler groups at La Pacifica was 27.2 hectares ($N = 21$, $sd = 16.7$; range 6 - 84 ha), mean group size was 14.9, and the mean number of adults in these groups was 10.6. Based on these data, there were 1.83 hectares/monkey (2.58 hectares/adult). Using only the population data for 19 groups from the 1991 survey, there were 2.03 hectares/monkey (2.74 hectares/adult).

For the 20-year period, home range and mean group size were positively, but not significantly, correlated ($r = .38$, $df = 19$, $p = .086$), although the correlation between home range and mean number of adults per group approached significance ($r = .42$, $df = 19$, $p = .056$).

Using only data from the 1991 survey, significant positive correlations were found for range size and total group size ($r = .61$, $df = 17$, $p = .006$) and for range size and number of adults ($r = .68$, $df = 17$, $p = .0015$).

DISCUSSION

Over the 20-year period, groups tended to maintain their home ranges, although the individuals comprising these groups gradually changed

via emigration and immigration (see Clarke *et al.*, 1986; Glander, 1992). During this time period, some groups apparently have modified their ranges, being found during surveys in areas where they had not been captured previously.

Overall, the values for home range sizes, hectares per monkey, and hectares per adult at La Pacifica were intermediate with respect to the range of values reported for mantled howlers at several locations. Mean home range size and hectares per monkey were larger than those reported previously by Glander (1978) for one group at La Pacifica, as well as larger than the mean values calculated by Clutton-Brock and Harvey (1977) for mantled howlers on Barro Colorado Island, Panama. The parameters reported here for La Pacifica, however, are lower than those reported by Milton for Barro Colorado Island howlers (Milton and May, 1976), and the 20-year values for La Pacifica also are less than the corresponding values reported by Chapman (1988) for howlers at Santa Rosa National Park. Using only the 1991 data from La Pacifica (Clarke and Zucker, 1994), the number of hectares per monkey (2.03) is within the range calculated from Chapman's Santa Rosa data (2.01 - 2.27 hectares/monkey). Hectares per adult, however, in 1991, were less at La Pacifica than at Santa Rosa.

The total number of howlers at La Pacifica has remained relatively stable over time, although the number of groups and mean group size have changed (Clarke *et al.*, 1986; Clarke and Zucker, 1994). Changes in group structures and compositions, over a 20-year period, likely hid any significant correlation between home range size and group size, as the average group size for this period was used in the calculations. As most immature howlers of both sexes emigrate from their natal groups (Glander, 1980; 1992; Clarke, 1990), and emigrations can occur at any time during the year, any differences in the timing of population assessments over the 20-year period, relative to the timing of emigrations (see Clarke *et al.*, 1986), could increase the variability in the group size data, thus weakening the overall correlation.

As juveniles of both sexes do emigrate, adult howlers comprise the most stable component of

social groups. The stronger correlations between home range size and the number of adults per group is consistent with this life history pattern. The number of hectares per adult, therefore, might be the most appropriate measure of assessing and comparing mantled howler home ranges, both across sites and over time.

RESUMEN

Los monos aulladores (*Alouatta palliata*) de la Hacienda La Pacífica, han sido capturados y marcados desde 1972. La población ha sido estudiada sistemáticamente entre 1984 y 1991. La presencia de los animales marcados, ha permitido la identificación de varios grupos a través del tiempo. Durante estos veinte años, las localidades de cada grupo se han anotado durante todos los procedimientos. Con base en estos datos se calculó el tamaño máximo de ámbito de hogar observado para 21 grupos de monos aulladores. El tamaño promedio fue de 27.2 has. El tamaño de ámbito de hogar correlacionó más fuertemente con el número de adultos por grupo, el cual es el componente más estable del grupo de monos. El tamaño de ámbito de hogar y el tamaño de ámbito por mono en La Pacífica fueron intermedios en comparación de los mismos valores correspondientes a otros sitios.

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