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CHEST CIRCUMFERENCE DIFFERS BY HABITAT IN COSTA RICAN MANTLED HOWLER MONKEYS: IMPLICATIONS FOR RESOURCE ALLOCATION AND CONSERVATION

Clara B. Jones

Introduction

Primates exhibit a significant degree of morphological variability within species (Fleagle, 1999); however, few studies have quantified this variation in relation to habitat differences, or examined its consequences. With the exceptions of human beings (*Homo sapiens*: e.g. Sundaram *et al.*, 1995) and, arguably, the genus *Pan* (Boesch *et al.*,

2002) and howlers (*Alouatta* spp.: e.g. Crockett, 1998; Jones, 1997), the functional ecology underlying phenotypic plasticity has received little attention by primatologists (but see Kappeler and Pereira, 2003; Jones and Agoramorthy, 2003). In this brief communication, I present data showing that chest circumference is significantly smaller in adult male and female Costa Rican mantled howler monkeys (*Alouatta palliata*) in severely degraded habitat. These results have important implications for the conservation of threatened primates. Moreover, they may indicate the existence of developmental tradeoffs between energetic investment in cardiopulmonary structures on the one hand, and survival, growth, and/or reproduction on the other.

Methods

Morphometric data (weight, tail-to-crown length, length of tail, length of pubis, length of arm, circumference of chest, in addition to age) were collected in the mid-1970s at Hacienda La Pacifica, Cañas, Guanacaste, Costa Rica (10°18'N, 85°07'W) by Dr. Norman J. Scott, Jr. and his assistants, including the present author (Scott *et al.*, 1976). Marked animals (120 adult females, 36 adult males) were censused and measured in three habitats of tropical dry forest (Frankie *et al.*, 1974): riparian (canopy cover estimated at 65-100%), deciduous (canopy cover 40-75%), and a degraded secondary habitat contiguous to irrigation ditches (canopy cover 10-45%), which were constructed consequent to anthropogenic perturbation for the purposes of farming and cattle ranching. Some of the numbers (n) reported below are smaller than the total numbers of individuals for each sex measured because some data sheets were incomplete. *Alouatta palliata*, which has been classified as a "diurnal arboreal folivore", is wholly herbivorous (primary consumer), preferring new leaves, flowers, and fruit (Crockett and Eisenberg, 1987; Glander, 1975; Jones, 1996). All tests are two-tailed.

Results

For the sample as a whole, there was no significant difference between habitats in the proportion of each of four age classes represented in the sample (Chi Square test of independence: $\chi^2 = 6.6985$, $df = 6$, $p = 0.350$). There was a highly significant correlation between weight (g) and habitat for males ($r = -0.5424$, $p < 0.003$, $n = 21$) but not for females, possibly consistent with the view that females are "energy maximizers" (Schoener, 1971), working to obtain some threshold level of nutritional requirements despite variations in habitat quality. Males in the (presumably) poorest habitat (irrigation) weighed, on average, less than (5333.13 g, $n = 15$) males in riparian (5912.00 g, $n = 10$) or deciduous (5755.45 g, $n = 11$) habitat, a comparison approaching significance ($F_{2,33} = 3.1413$, $p = 0.056$), supporting the view that males are not investing a significant portion of their "fitness budget" in feeding (Schoener, 1971; also see Trivers, 1972). On average, female weight did not differ by habitat (irrigation:

4439.44 g, n = 39; deciduous: 4554.57 g, n = 37; riparian: 4530.91 g, n = 44; $F_{2,117} = 0.8602$, n.s.).

Chest circumference (cm) correlated highly with habitat for both adult females ($r = -0.1851$, $p = 0.021$, $n = 89$) and males ($r = -0.3273$, $p = 0.024$, $n = 21$). For adults of both sexes, an ANOVA demonstrated that mean chest circumference was smallest in irrigation habitat (n = 39 females and 14 males), somewhat larger in riparian habitat (n = 44 females and 10 males), and largest in deciduous habitat (n = 37 females and 11 males). Chest size, however, was significantly smaller on average in the irrigation habitat only for females ($F_{2,117} = 3.5986$, $p = 0.03$). No other comparisons of morphometric data were significant.

Discussion

The results presented here lead to two primary conclusions deserving further study. First, habitat—and presumably diet—appear to influence weight, probably through mechanisms of energy allocation (see Nagy *et al.*, 1999). Although mean weight x habitat did not reach significance in this study, a clear trend was evident, with mean weight decreasing from deciduous to riparian to irrigation habitats, possibly indicating differences in habitat quality and/or dietary habits of the animals across the three forest types. Future studies of functional ecology in howlers need to investigate possible differences in reproductive success as a function of habitat and the possibility of habitat selection in this species.

The finding that chest circumference is significantly smaller in the most degraded habitat may provide documentation of a tradeoff in the allocation of resources (energy) between cardiopulmonary function and some other structure or function related to survival, growth, or reproduction (see, for example, Sundaram *et al.*, 1995; Emlen, 1997; West-Eberhard, 2003). That adult females and males in deciduous habitat were found to have the largest chest circumference—and, it is proposed, the greatest allocation of resources to cardiopulmonary function in this regime—is also of interest. An investigation of the structural and functional costs associated with habitat heterogeneity, and in particular habitat disturbance, may enhance our understanding of the abiotic and biotic (including social) risks impacting population viability of mantled howlers and other primates. Studies of functional ecology are important for the conservation of endangered primates, since habitat destruction may lead to fundamental changes in the energetics of organisms, including their capacity to grow, survive, and reproduce.

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26° C. El Parque, fundado en 1958, cubre una superficie de 8.0 ha, de las que 6.0 ha están forestadas. Aún cuando en el sitio existía vegetación selvática residual, se sembraron especies arbóreas y no arbóreas externas al Neotrópico, dando como resultado un área de vegetación heterogénea, compuesta por vegetación nativa e introducida. Algunas de las especies arbóreas nativas que predominan en el sitio son *Vochysia hondurensis*, *Cedrela odorata*, *Pouteria zapota*, *Ceiba pentandra* y *Bursera simaruba*. Entre las especies arbóreas introducidas sobresalen *Byrsonina crassifolia*, *Mangifera indica*, *Delonix regia*, *Pimenta dioica* y *Citrus sinensis* (Capello y Alderete, 1986).

REPORTE PRELIMINAR SOBRE EL USO DE RECURSOS ALIMENTICIOS POR UNA TROPA DE MONOS AUILLADORES, *ALOUATTA PALLIATA*, EN EL PARQUE LA VENTA, TABASCO, MÉXICO

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David Muñoz and Yasminda García

Introducción

En la parte septentrional de Mesoamérica, el estado de Tabasco es único por resguardar poblaciones representativas de las tres especies de primates que existen en México: *Alouatta palliata*, *A. pigra* y *Ateles geoffroyi* (Smith, 1970; Horwich y Johnson, 1986; Rylands *et al.*, 1995). Originalmente, cerca del 60% de la superficie del estado (24,141 km²) estaba cubierta por selvas, pero como resultado de la actividad humana, cerca del 80% de estos ecosistemas han desaparecido a una tasa de 600 km² ó más al año, siendo las tierras bajas en donde ha ocurrido la mayor transformación de la selva a pastizales, a otros agrosistemas y a áreas abiertas causadas por la explotación petrolera (Maser, 1996; SEMARNAP, 1999; INEGI, 1996).

La conservación de los primates silvestres de Tabasco es un problema íntimamente ligado a la destrucción de las selvas en esta entidad. La falta de información en el estado acerca de la distribución geográfica actual y tamaño de las poblaciones y la falta de datos sobre la historia natural, ecología, conducta y estado de conservación de las tres especies de primates dificulta su conservación. Este trabajo reporta los resultados de un estudio parcial sobre los patrones de alimentación de una tropa de monos aulladores (*Alouatta palliata*) existente en el Parque La Venta, localizado en la parte central de la ciudad de Villahermosa en Tabasco.

Métodos

Sitio de estudio

El Parque Museo La Venta está ubicado en el centro de la ciudad de Villahermosa (18°20'N, 93°18'O) a una altura de 10 m sobre el nivel del mar. El clima es cálido y húmedo, la precipitación media anual oscila entre 1600 y 2000 mm y la temperatura media anual varía de 22° a

Sujetos de estudio

En el Parque existe una tropa de monos aulladores cuyo origen no está documentado, pero se conoce su existencia desde la fundación del Parque a fines de los años cincuenta. Actualmente, la tropa está constituida por 15 individuos (dos machos adultos, ocho hembras adultas, dos juveniles y tres infantes).

Observaciones de los monos aulladores

Las observaciones del comportamiento de alimentación de los aulladores se llevaron a cabo durante ocho días de cada mes entre febrero y junio de 2001. Con el objeto de refinar los procedimientos de registro del comportamiento de alimentación de los monos aulladores, se llevó a cabo un muestro piloto dos meses antes del inicio del estudio. En este periodo se hicieron pruebas de confiabilidad entre observadores para establecer concordancia en las conductas registradas. El método de muestreo empleado en las observaciones fue el de animal focal (Altmann, 1974) y el tiempo de duración de la muestra focal para individuos representativos de cada clase de edad y sexo en la tropa (machos adultos, hembras adultas, juveniles e infantes) fue de 10 minutos. Los observadores (EF, BF y YD) se turnaron para la realización de las observaciones focales y éstas se concentraron durante las horas de mayor actividad alimentaria de los aulladores (0700-0100 hrs y 1600-1800 hrs), tratando de balancear las muestras obtenidas durante estas horas del día. Durante la muestra focal se registró el tiempo dedicado a cada una de las siguientes actividades generales: descanso, alimentación, locomoción, interacciones sociales y viaje. En el caso del comportamiento de alimentación, se especificó la parte consumida (hojas jóvenes, hojas maduras, frutos jóvenes, frutos maduros y flores) y se marcó e identificó, a nivel de especie, la planta de la cual se alimentaron. La distancia viajada por los individuos fue medida con un pédometro y el viaje se definió como el desplazamiento del individuo sincronizado con el del resto de la tropa de un árbol o grupo de árboles a otros y en donde la distancia recorrida excedía 20 m. A los árboles utilizados como fuente de alimento se les midió la altura y el diámetro a la altura del pecho (1.30 m). Cuando el comportamiento fue viaje, aparte de la duración de éste, se midió la distancia recorrida en metros.

La localización de los árboles utilizados por los aulladores se indicó en un mapa a escala del sitio de estudio. La