

towns (Altagracia, Moyagalpa), the impact of human activity is pervasive. In the area near our field station, clearing of land between the lake and the foothills of the Volcan Maderas has been so extensive that even selective logging is likely to have a severe negative impact on the survival of local howler populations. In order to address these problems, the Fundación Ometepe has purchased several parcels of land between the foothills and the volcano. This area will serve as a buffer zone to limit continued forest destruction, promote forest regeneration, and provide corridors for howler migration and colonization.

Compared to other atelines, *Alouatta* is characterized by an early age at first reproduction and a high intrinsic rate of population increase (Fedigan and Rose, 1995; Strier, 1996; Crockett, 1998). Given their relatively fast life history pattern and ability to colonize regenerating habitats (Crockett, 1998; Fedigan *et al.*, 1998; Horwich, 1998), we are hopeful that our efforts to protect and conserve mantled howling monkey populations on Isla de Ometepe will succeed. However, in order to safeguard the continued survival of wild primate populations in Nicaragua and other areas of Latin America members of the local community, National governments, and International Aid Agencies must work together to develop informed and successful wildlife management policies.

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## TESTIS SYMMETRY IN THE MANTLED HOWLING MONKEY

Clara B. Jones

Markow *et al.* (1996) studied fluctuating asymmetry (random deviations from symmetry in traits on opposite sides of the body) in the sex combs of two *Drosophila* species and found no evidence for sexual selection in this secondary sexual character, contrary to the predictions of Moller and Pomiankowski (1994). The latter authors argued that symmetry would be positively related to male copulation success and that secondary sexual characteristics would exhibit the

strongest associations because they are under directional selection. Differential symmetry among males, then, may provide cues to females of male fitness, explaining variance in male reproductive success. Markow *et al.* propose that Moller and Pomiankowski's ideas require further investigation in a range of taxa before it can be concluded that they are general. The purpose of this correspondence is to present preliminary observations on fluctuating asymmetry in testis size in the mantled howling monkey (*Alouatta palliata*).

Mantled howlers, large Neotropical cebids, are found throughout the forests of Mesoamerica and the northern coast of South America. Age is negatively correlated with dominance rank and copulation success, and significant sexual dimorphism in weight between adult males and females suggests that sexual selection has operated in this species (Jones, 1985). A prominent aspect of male morphology is the large, white scrotum (Fig. 1) employed in stereotyped displays in sexual and aggressive contexts (C. B. Jones, unpubl. data).

Animals were studied at Hacienda La Pacifica, Cañas, Guanacaste, Costa Rica (see Clarke and Zucker, 1994) in the early to mid 1970's by Dr. Norman J. Scott, Jr. and his assistants, including the present author. Monkeys were tranquilized, aged, weighed, and measured (Scott *et al.*, 1976). I divided adult males into four age classes: I (n = 7), an individual @ 5-7 years old; II (n = 11), @ 7-10 years old; III (n = 7), @ 10-15 years old; and, IV (n = 2), > 15 years old. The vertical and horizontal height and width (mm) of each testis was obtained by measuring its outline through the tissues of the scrotum with a sliding caliper. Mean vertical height of right testis was  $32.2 \pm 2.5$  mm; mean width of right testis was  $23.9 \pm 1.9$ . Mean vertical height of left testis was  $31.4 \pm 2.6$  mm; mean width of left testis was  $23.1 \pm 1.7$ . In order to assess fluctuating asymmetry of each male, I computed two ratios: a ratio of the smallest to largest (left testis to right testis or right to left) vertical height of testis (VR); and a ratio of the smallest to largest (left to right or right to left) horizontal width of testis (HR) of each male. This paper assumes that testis shape and scrotal shape are highly positively correlated.

Across males, weight did not differ significantly by age (Sign Test:  $X^2 = 3.1$ ,  $df = 3$ ,  $P = 0.50$ ). Thus, differences across males in mating success cannot be explained by differences in weight. Likewise, while VR (range = 0.92-0.99, median = 0.97) correlates positively with weight ( $r = 0.44$ ,  $N = 27$ ,  $P < 0.01$ ), VR did not differ significantly across males by age (Sign Test:  $X^2 = 4.18$ ,  $df = 3$ ,  $P = 0.30$ ). Fluctuating asymmetry in the ratio of vertical circumference of both testes, then, apparently cannot explain variance in copulation success across males.

An analysis of HR (range = 0.88 - 1.00, median = 0.95) revealed that it failed to correlate with weight ( $r = 0.10$ ,  $N = 27$ ,  $P = 0.31$ ), possibly exhibiting developmental instability, compared with the vertical orientation. Similar to the findings for VR, HR exhibits no differences across males by age (Sign test:  $X^2 = 2.23$ ,  $df = 3$ ,  $P = 0.70$ ), possibly showing that female mantled howler monkeys do not employ fluctuating asymmetry in testis size as a visual cue of male quality. Fluctuating asymmetry in two secondary sexual characteristics in the mantled howler

monkey (VR and HR) does not appear to be sexually selected, then, consistent with the findings of Markow *et al.* (1996).

Moller and Pomiankowski (1994) predicted that the highest correlations with asymmetry are expected in secondary sexual characters. If the range in asymmetry for mantled howler testes are representative of other secondary sexual traits in the species (e.g. incisor length), it seems unlikely that symmetry will correlate with male fitness or that female "choices" will be a function of low fluctuating asymmetry. It would be important to know the heritability of secondary sexual characteristics for this monkey since a trait with low heritability may not be a reliable measure of fitness for females who may be evolved to select "good genes". Further, female mantled howler monkeys appear to be very sensitive to the proximate context of mating, such as the availability of resources (Jones, 1995), a condition that would dampen any tendency for female selectivity to correlate with secondary sexual characteristics.

Finally, Allen and Simmons (1996) suggest that fluctuating asymmetry in visual signals, such as scrotal displays, exhibit an "equivocal" association with male fitness compared to structures having "mechanical significance" (e.g., the penis), and show for dung flies that "coercive mating" is correlated with symmetry and male mating success. The mating system of mantled howlers is not characterized by coercion (Jones, 1985), possibly explaining the failure to find a relationship between fluctuating asymmetry, age, and, thereby, male mating success in this species. These tentative results for mantled howlers should be tested with larger sample sizes but suggest that Moller and Pomiankowski's predictions require adjustment to taxonomic and, possibly, to ecological differences.



Figure 1. Adult male mantled howler monkey exhibiting asymmetrical scrota. Note outline of testes in scrotal sac.

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## ON A NEW WHITE BALD UAKARI POPULATION IN SOUTHWESTERN BRAZILIAN AMAZONIA

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Eduardo de Souza Martins

The geographic distributions of the four subspecies of the bald uakari, *Cacajao calvus*, have been reviewed by Hershkovitz (1987) and Barnett and Brandon-Jones (1997). They occur in the upper Amazon, with *C. c. calvus* restricted to a very small range between the lower Rio Japurá and the Rio Solimões, west as far as the Auatí-Paraná, *C. c. rubicundus* to the west of *C. c. calvus*, in a small area north of the Rio Solimões west of the Auatí-Paraná and also between the Rios Solimões and Içá, *C. c. ucayalii* between the Ríos Ucayali and Javará in Peru and Brazil, and the disjunct population of the white uakari, *C. c. novaesi* described by Hershkovitz in 1987, which, with the limited information available to him, he restricted to the south bank of the upper Rio Juruá between the Rios Eiru and Tarauacá. Hershkovitz (1987) indicated the likelihood of its occurrence, however, west to the Rio Gregório or beyond to occupy the entire basin between the Rio Tarauacá and right bank of the Rio Juruá. Here we summarize some recent information that modify the distributions of *C. c. calvus* and *C. c. novaesi*, and report on the discovery of an outlying, new white bald uakari population on the border of the states of Amazonas and Acre in Brazil.

The Museu Paraense Emílio Goeldi (MPEG) mammal collection has a specimen of *C. c. calvus* labeled "Rio Juruá" (MPEG-576), a south bank tributary of the Rio Solimões. Peres (1990) recorded *C. calvus* on the upper Rio Riozinho, an affluent of

the Rio Jutaf (west of the Rio Juruá), and (Peres, 1997) at Vira Volta, left (west) bank the lower Rio Juruá. A. Percequillo (pers. comm.) also observed the uakaris from Vira Volta, recognizing them as *C. c. calvus*, based on specimens in the Zoology Museum of the University of São Paulo (MZUSP). On the basis of this, *C. c. calvus* evidently occurs on both sides of the Solimões occupying at least the interfluvium between the Rios Juruá and Riozinho and possibly extending to the Jutaf, just south of the Rio Solimões. The red uakari, *C. c. rubicundus*, occurs in the Jutaf-Solimões Ecological Station, west of the lower Rio Jutaf (Nogueira-Neto, 1992).

*C. c. novaesi* is distinct from the white *C. c. calvus* in having a general orange color, with the dorsum, from the nape to the tip of the tail, paler orange, buffy or whitish (Hershkovitz, 1987). Peres (1988, 1990, 1997) recorded it to the north-east of the range described by Hershkovitz (1987), on the left bank of the Rio Juruá, at Lago da Fortuna, Carauari; 500 km to the north and roughly tripling the size of the range. Peres (1997) also recorded *C. calvus* at Sobral on the right bank of the upper Rio Juruá, but whether they belong to the subspecies *ucayalii*, extending the range to east, or to *novaesi*, extending the range to the west, as was proposed by Hershkovitz (1987), is not known.

Unconfirmed reports of a number of uakari populations were also obtained by Fernandes (1990) in the state of Acre. They included: the Mamoadate Indigenous Area on the Peruvian border on the upper Rio Iaco, a right bank tributary of the Rio Purus (possibly *ucayalii*); the Seringal Republica, on the Rio Moa, a left (west) bank tributary of the upper Rio Juruá (possibly *ucayalii*); the Seringal Boca da Pedra on the headwaters of the Rio Tarauacá (possibly *novaesi*); the Rio Acurauá a left (west) bank tributary of the middle Rio Tarauacá (possibly *novaesi*); and the Kulina Indigenous Area on the upper Rio Envira (possibly *novaesi*).

In September 1988, a preliminary inventory of the primate communities on the border between the Brazilian states of Amazonas and Acre was carried out by ESM. A new white bald uakari population was discovered in the flooded forests along the Rio Jurupará, a right bank tributary of the Envira-Tarauacá-Juruá drainage, Amazonas (Figure 1). Three adult specimens were collected and deposited in the MPEG (21861, 21862, 21863). The Rio Jurupará is outside the known geographic distribution of any *C. calvus* form. Due to the proximity of Jurupará to the Rios Eiru and Tarauacá, the uakaris were identified in the field as *C. c. novaesi*. A comparison with the material in the collections of MPEG, MZUSP and the Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ), however, revealed differences in the pelage of the specimens collected with that of *C. c. novaesi*. The appearance of the specimens from the Rio Jurupará was closer to *C. c. calvus*. *C. c. novaesi* has an almost entirely reddish coat, with a short whitish mantle that extends from the nape to the lower third of the back (Hershkovitz, 1987). The uakaris of the Rio Jurupará are almost entirely white on the upperparts, without a contrasting mantle on the back, and yellowish on the underparts (including throat and beard), as in *C. c. calvus*. The Jurupará series was examined by P. Hershkovitz in the MPEG, and later