

However, the majority of the smaller edentata were incompletely reported in the village. For these species weights were taken from literature, whenever possible from samples originating from cerrado habitats.

Dasyppus sp., *Cabassous* sp., *Priodontes maximus*, and *Myrmecophaga tridactyla*. No special data were gathered, as these were consumed soon after the kill or collected in very small numbers.

Euphractus sexcinctus. No clearly juvenile animals were reported. Mean weight was 5.57 kg (N=7)

Myrmecophaga tridactyla. Of the total harvest of 322 in 33 months, 42 brute weights were taken. Nine individuals weighed below 20 kg and were not considered in the mean weight calculation. Mean 33.6 kg (N=33). The mean weight of males was 36.4 (22-50 kg, N = 10) and females 32.4 kg (21-47 kg, N=23).

The question of giant anteater hunting

The yearly harvest of giant anteater would appear to be high in the Xavante reservation. Lack of data on population density and reproduction makes it impossible, however, to relate the harvest to such parameters.

In order to see whether hunting of the giant anteater is sustainable, we used a number of indicators, which combined should help determine whether or not hunting is sustainable.

When calculating the potential harvest using the quotient of Banse and Moscher (1982), we came to a value of 0.08-0.16 individuals per km². The observed harvest in the reservation was 0.16, 0.14 and 0.13 per km² in 1991, 1992 and 1993 respectively, which depending on the carrying capacity of the area, is close to or above the maximum potential harvest.

During the three years, the sex-ratio was 1 male to 1.46 females. When splitting these data per year we come to a sex-ratio 1:1.8 (N=47) in 1991: 1:1.1 animals is derived from the sex ratio of 241 individuals of known sex which were harvested. The sex ratio for the latter was 1:1.47. The ratio in favor of the females may be an indicator of high hunting pressure, but we have no references of sex-ratios in areas without or with little hunting.

The change in hunting success, measured as the harvest per 1000 hunter days, could very well be an indicator of whether the species is declining. If it is declining and the hunting effort is the same, hunting success will show a decrease. The hunting success was 51, 82 and 47 per 1000 hunter days in 1991, 1992 and 1993, respectively. As the hunting range changed during these years, the increase in 1992 could reflect the fact that the area of 1992 was lightly hunted in the past (which in fact was not the case) or that the capacity of that area is considerably higher than other sub-regions.

Request for help, studies by students

We expect to continue collecting hunting data and hopefully obtain data on the relative abundance of the species. We will be monitoring 24 transects for tracks and sightings of wildlife, and hope to have sufficient data in 1-2 years to estimate population densities. If the Xavante community accepts students from outside, good data could be gathered on population densities and distributions. However, the working conditions will be rough and logistics complicated. The study area and the giant anteater could be extremely interesting as the focus of a graduate thesis. However any such study would need to incorporate practical applications that can be used by the Xavante for the management of their game species.

Survey of the Xenarthrans inhabiting Poço das Antas Biological Reserve

W. J. Loughry and Colleen M. McDounough

Department of Biology, Valdosta State University, Valdosta, GA, U.S.A. 31698-0015. Phone: 912-333-5759, Fax: 912-333-7389, E-mail: jloughry@grits.valdosta.peachnet.edu

Introduction

The Atlantic coastal rainforest of Brazil is one of the most endangered ecosystems in the world, with less than 5% remaining (Mori *et al.*, 1981). It is critical to assess the biodiversity of this system immediately, before further forests are lost and the inevitable extinction of their species. To this end, we conducted a survey of the xenarthrans at the Poço das Antas Biological Reserve in the state of Rio de Janeiro. Poço das Antas is located approximately 70 km north of Rio de Janeiro and contains large patches of Atlantic coastal rainforest (Kleiman *et al.*, 1986). The reserve has been the focus of conservation efforts directed particularly at the golden-lion tamarin, *Leontopithecus*

rosalia (Kleiman *et al.*, 1986). However, almost no data exist on the xenarthrans occurring in the reserve. Our survey was designed to provide such data and generate a clearer picture of potential conservation needs for this group.

Methods

Poço das Antas is 5200 ha in size and consists primarily of steep hills separated by narrow valleys. There are four main habitat types (Camargo, 1996): 1) mata, or Atlantic coastal rain forest, 2) grassland, consisting primarily of *Imperata brasiliensis* and/or *Melinis minutiflora*, 3) disturbed woodland, which contains some grass but is

primarily dominated by the tree *Grouchimatia polimorpha*, and 4) swamp. The first three habitats are found on the slopes of hills, while swamps are restricted to the valleys.

We surveyed the reserve on 108 days between 20 January and 1 June, 1996, for a total of 958 hours of observation. Surveys were conducted during the day and night (using miner's headlamps) by walking along roads or trails in the reserve. We used a large net attached to a 1.5 m pole to capture any xenarthrans sighted during these surveys. We also attempted to capture armadillos by placing traps in the mouths of apparently active burrows. Once captured, all animals were sexed, weighed, aged (as either juveniles or adults on the basis of body weight, see McDonough, 1994; Loughry and MacDonough, 1996), measured (see Loughry and MacDonough, 1996), and a small piece of one ear was removed with an ear notcher for genetic studies. The time of capture and the type of habitat in which the animal was caught were also recorded. For animals that were sighted but not caught, we recorded species, time of sighting, type of habitat, age (based on body size), and sex (if the genitalia were visible).

Poço das Antas is the primary site of the Smithsonian Institution's study of the endangered golden-lion tamarin (e.g., Baker *et al.*, 1993; Dietz and Baker, 1993; Kleiman *et al.*, 1986). There are typically 2-3 people on the reserve following groups of these monkeys 5-6 days of every week. As an additional source of data, we requested that they report any sightings of xenarthrans to us. When sightings were reported, we obtained the time of day and location of the animal, its size (for age determination) and the species.

Results

We captured a total of 43 xenarthrans at Poço das Antas. In what follows, we describe our findings for each species separately.

Dasybus novemcinctus: nine-banded armadillo, "tatu-galinha"

This species was the most abundant xenarthran at Poço das Antas. We observed 121 animals during the course of our study. We were able to capture 37 animals (16 adult males, 6 adult females, 9 juvenile males, 4 juvenile females; and 2 carcasses of juveniles were found that could not be sexed). The overall sex-ratio in this population was strongly male-biased (Binomial test, $P = 0.008$), but only for adults ($P = 0.026$; for juveniles $P = 0.125$). *D. novemcinctus* was observed at least once in all habitat types, but was most common in forest and disturbed woodlands and extremely rare in grassland. The distribution of sightings was significantly different from random (Chi-square = 27.22, $P < 0.005$, d.f. = 3), even when data from grasslands were omitted (Chi-square = 7.71, $P < 0.03$, d.f. = 2), suggesting some habitat preference in this species.

Dasybus septemcinctus: seven-banded armadillo, "tauí"

We captured three individuals (2 adult males, 1 juvenile female) of this species, all in either grassland or disturbed woodland habitats. We probably sighted at least 2-3 more, all in the same types of habitats. However, *D. septemcinctus* is very similar in appearance to juvenile *D. novemcinctus*, and so visual identification at a distance is very difficult, and we suspect it may be more abundant than the data would indicate.

Cabassous unicinctus: southern naked-tailed armadillo, "tatu-rabo-mole"

We caught one adult male of this species in swamp/disturbed habitat. A sighting of a second individual in swamp/grassland habitat was reported to us. The individual we captured was resighted on two later occasions, on both occasions in swamp habitat, with a distance of about 800m between the first and last sightings.

Euphractus sexcinctus: yellow armadillo, "tatu-peba"

We saw no individuals of this species on the reserve, although it used to occur there. Dr. J. Dietz collected the carapace of a juvenile in 1983 (which is now at the Poço das Antas Education Center) and people associated with the golden-lion tamarin project reported seeing them occasionally into the late 1980's. It is currently assumed that they are locally extinct, although a juvenile female that had been hit by a car in Macaé was released onto the reserve in May, 1996.

Tamandua tetradactyla: southern tamandua, "tamanduá-colete"

We captured a juvenile female of this species in a stand of bamboo. By using color patterns on the tail, we were able to identify three more individuals (all adults). Two of these animals were also in, or next to, a stand of bamboo, while the other was in swamp habitat.

Bradypus torquatus: maned three-toed sloth, "preguiça-preta"

We did not capture any maned sloths. However, members of the golden-lion tamarin project reported seeing two individuals during the time of our study. Both were located high in trees in the mata.

Discussion

Our survey suggests that the only abundant xenarthran at Poço das Antas is *D. novemcinctus*. However, even so it is not as abundant as it is in populations studied in the United States (Loughry and McDonough, unpublished data). Such low numbers could be due to one or more of the following: (1) **Hunting**: Although illegal, hunting does still occur

on the reserve and may significantly impact armadillo abundance. Indeed, former hunters told us that hunting was what probably led to the presumed extinction of *E. sexcinctus*. (2) **Predation:** Increased predation of xenarthrans at Poço das Antas could generate lower abundances, however, the numbers of potential predators in the U. S. and at Poço das Antas do not appear to be dramatically different. However, we do not have the data on predator-caused mortality at each site that are needed to evaluate this hypothesis. (3) **Competition:** *D. novemcinctus* is the only xenarthran found in the U. S. and, as such, presumably has few close competitors for food. Poço das Antas contains a number of xenarthrans as well as other species (e.g., agoutis, *Dasyprocta agouti*, pacas, *Agouti paca*, and capybara, *Hydrochaeris hydrochaeris*) that may all compete for similar resources, thus lowering abundances. (4) **Intrinsic rarity:** Some species (e.g., *D. septemcinctus*, *C. unicinctus*, *B. torquatus*) are reported to be rare throughout their range (Emmons, 1990; Eisenberg, 1989; Redford and Eisenberg, 1992), so large numbers of individuals may not be expected.

D. novemcinctus is the most abundant xenarthran on the reserve and it appears to prefer forests and disturbed woodlands over other habitats. We censused armadillo burrows on the reserve (McDonough and Loughry, unpublished data) and found more burrows in forest than anywhere else. Thus, it appears that *D. novemcinctus* may spend most of its time underground in the forest, moving out to feed at night in other areas (e.g., swamps, which are probably too wet to be suitable for burrow construction but which provide rich supplies of food). *D. novemcinctus* is the largest armadillo present on the reserve. Currently, it is not known if competition with *D. novemcinctus* forces the smaller species (*D. septemcinctus* and *C. unicinctus*) into grassland/disturbed woodland. However, given that these areas seem to be the only ones in which these rarer species are found, the current program of reforestation at Poço das Antas could lead to the extinction of these species from the reserve.

Acknowledgments

We are extremely grateful to Carlos Ruiz-Miranda for encouraging us to pursue this work. This project would not have been possible without the exceptional tatu-catching abilities of Marcelo Coelho, to whom we are

deeply indebted. This work was supported by an Organization of American States Fellowship (to W.J.L.), a Valdosta State University faculty research award (to C.M.M.), the Smithsonian Institution, TransBrasil, and the Associação Mico-Leão-Dourado (AMLD). We wish to extend our thanks to the Director of AMLD, Denise Rambaldi, and the Director of Poço das Antas, Dionfizio Pessamfilio, for facilitating our research.

References

- Baker, A.J., J. M. Dietz and D. G. Kleiman. 1993. Behavioural evidence for monopolization of paternity in multi-male groups of golden lion tamarins. *Anim.Behav.* 46:1091-1103.
- Camargo, J.L.C. 1996. Mundaças na cobertura da vegetação do habitat do mico-leão-dourado (*Leontopithecus rosalia*, Lesson 1840) na Reserva Biológica de Poço das Antas: 1969-1994. P. 13, in *II Encontro de Pesquisadores, Reserva Biológica de Poço das Antas*. IBAMA, Silva Jardim.
- Dietz, J. M. and A. J. Baker. 1993. Polygyny and female reproductive success in golden lion tamarins, *Leontopithecus rosalia*. *Anim.Behav.* 46:1067-1078.
- Eisenberg, J. F. 1989. *Mammals of the Neotropics. Vol. 1: The Northern Neotropics*. University of Chicago Press, Chicago. 449 pp.
- Emmons, L. H. 1990. *Neotropical Rainforest Mammals: A Field Guide*. University of Chicago Press, Chicago. 281 pp.
- Kleiman, D. G., B. B. Beck, J. M. Dietz, L. A. Dietz, J. D. Ballou and A. F. Coimbra-Filho. 1986. Conservation program for the golden lion tamarin: captive research and management, ecological studies, education strategies and reintroduction. Pp. 959-979, in *Primates: The Road to Self-sustaining Populations* (K. Benirschke, ed.). Springer-Verlag, New York, 1044 pp.
- Loughry, W. J. and C. M. McDonough. 1996. Are road kills valid indicators of armadillo population structure? *Amer. Midl. Nat.* 135:53-59.
- McDonough, C. M. 1994. Determinants of aggression in nine-banded armadillos. *J. Mammal.* 75:189-198.
- Mori, S. A., B. M. Boom, and G. T. Prance. 1981. Distribution patterns and conservation of eastern Brazilian coastal forest species. *Brittonia* 33:233-245.
- Redford, K. H. and J. F. Eisenberg. 1992. *Mammals of the Neotropics. Vol. 2: The Southern Cone*. University of Chicago Press, Chicago. 430 pp.

Armadillos del noroeste argentino (Provincias de Jujuy y Salta)

Sergio F. Vizcaíno

Departamento Científico Paleontología de Vertebrados, Facultad de Ciencias Naturales y Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina.

Abstract

Data on the presence of species, abundance and habitat association of armadillos from Northwestern Argentina

were collected during two field seasons in 1988. Four of the eight previously cited species were recorded. Among them, *Tolypeutes matacus* showed a well defined association to xeric habitats. *Dasyypus yepesi* and