Southern bearded sakis beyond the brink

A. D. Johns and J. M. Ayres

The southern bearded saki is a critically endangered Amazonian primate, occurring only in a small area of north-eastern Brazil. The animal is poorly known, and recent evidence suggests that the species may comprise several critically endangered subspecies. All existing forms are threatened by the continuing economic development of their rain-forest habitat. The fate of this monkey is only an example of the dark future faced by many species as forest clearance spreads through the region.

The southern bearded saki *Chiropotes satanas satanas* is undoubtedly the most endangered primate in Amazonia. It is endemic to Brazil, occurring in the rain forests between the Xingu river and the palm swamps (*Cocais de Sampaio*) of eastern Maranhão state (Figure 1). The precise limits of the animal's range are not known, but it is absent from the drier *cerrado* vegetation of the central shield. The northern boundary of this vegetation form may be the southern limit of their distribution. It is nearly extinct in Maranhão state, and in the lower third of the Araguaia River populations occur only in a few locations. Furthermore, they seem to be completely absent from the coastal and mangrove forests of Pará and Maranhão states. It has been suggested that they may occur within the Piriá-Gurupi Ecological Station in the north-east corner of Pará, but since this is mostly mangrove forest (a vegetation type not used by the sakis) their presence is unlikely. The saki has never been the subject of a long-term study, and little information is available concerning its ecology.

The natural habitat of the saki is tall *terra firme* rain forest, although it may make extensive use of riverine forests along clear-water rivers, particularly during the high-water season when these latter forests contain high proportions of fruiting trees. They do not occur, however, in the extensive young *várzea* floodplains on the lower Amazon River or in forested strips surrounded by grassland (a common vegetation type in the eastern portion of Marajó Island). Groups are occasionally observed in regenerating growth around abandoned smallholdings, but never stray far from tall forest. Recent surveys indicate

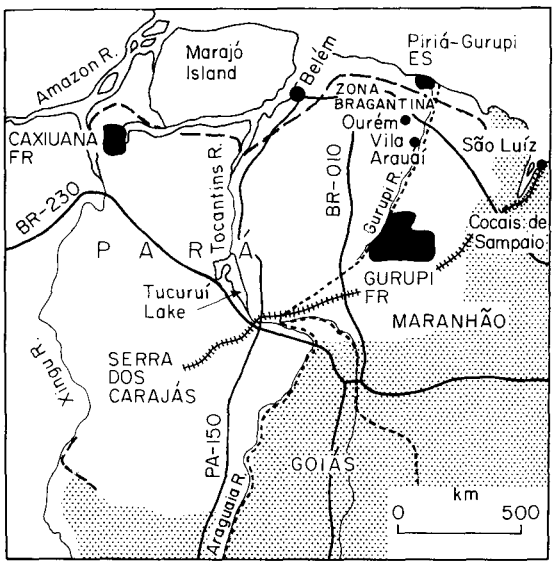

Figure 1. Geographical range of the southern bearded sakis. Shaded areas are non-forest vegetation (*cerrado*); national forest areas are shown in black. The dashed line indicates the extent of the sakis' range.

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that sakis are unable to survive in forests suffering a high degree of agricultural encroachment or a moderate to high level of selective timber logging.

Studies of the northern bearded saki *C.s. chiropotes* and of the red-nosed saki *C. albinasus* suggest that the genus is primarily adapted for seed predation (Ayres, 1981; Mittermeier and van Roosmalen, 1981). Field observations typically show a preference for seeds with hard casings (such as those of the Brazil-nut family, Lecythidaceae), although mesocarps may also be eaten when abundant, and insects have been recorded as food items (Ayres, 1981; Mittermeier *et al.*, 1983).

Groups of *C. satanas* normally number between 10 and 30 individuals, travel very long distances between sources of their preferred seeds, and may range over a total area of more than two-and-a-half sq km. Their habit of travelling long distances very quickly renders them among the least amenable to scientific study of all Neotropical primates.

How many sakis?

Very recently, Hershkovitz (1985) described a new member for this group: *Chiropotes satanas utahicki*. The description was based on a number of specimens collected in the Tocantins–Xingu river basins. However, there may be additional light-coloured forms, as indicated by Hershkovitz (1985) when describing an aberrant specimen from a locality in a Xingu basin tributary. Our observations indicate that the Tocantins River is not precisely the boundary either of these lighter forms nor of the typical dark *C. satanas satanas*. It may simply be the contact zone. Variants may be extremes of a clinal variation, now largely isolated by agricultural and cattle-ranch development. On the other hand, although light and dark sakis occur on the same bank of the Tocantins River at various points, mixed groups have not yet been observed.

Disappearing habitat

The geographical range of the sakis coincides with one of the most densely populated and heavily disturbed regions of Brazilian Amazonia. The so-called 'Zona Bragantina', east of Belém

Light-coloured western form of the southern bearded saki (*L.C. Marigo*).

(the capital of Pará state), has an area equivalent to 30,000 sq km (about 9 per cent of total Brazilian Amazonia) and was completely cleared during the first few decades of this century (Fearnside, 1984). Surveys carried out in this area have failed to observe this animal, indicating that it is probably extinct over the entire Zona Bragantina.

Subsequent to the completion of the Belém–Brasília Highway (BR-010) in 1960, ribbon development has been extensive and now completely bisects the saki's range. In addition to the Belém–Brasília, there are three other principal roads: the Transamazonica (BR-230), Belém–São Luís Highway and the PA-150, which is currently being upgraded as part of the Belém–Rio de Janeiro Highway. A railroad has also been built through the region, linking the mineral deposits of Serra dos Carajás with port facilities at São Luís in Maranhão: the railroad was completed in 1984, and settlers were encamped along its entire length within months.

The geographical range of the dark saki has been a centre of land conflicts for over a decade and a half. To give an idea of the situation, the official government land register has on record claims for over 110 per cent of the total area. In the late

1970s it was estimated that 34 per cent of the forest habitat of the sakis had been clear-felled for development projects (Ayres, 1978). Today the figure is probably above 50 per cent (Fearnside, 1984). Furthermore, a high proportion of the remaining forests in east Pará and Maranhão has been selectively logged. Owing to their accessibility, these forests provide around 95 per cent of the timber used by the construction and furniture industries of southern Brazil, as well as supplying local demand. Apart from the Gurupi Forest Reserve (FR), which is designated a sustained-yield timber production area, there are virtually no continuously forested areas left in western Maranhão and adjacent areas of Pará. The Gurupi FR is severely affected by agricultural encroachment.

Low resistance to disturbance

In contrast to some sympatric primates (Johns, 1986), sakis survive poorly in disturbed habitats. Selective logging removes many of their important food source trees (for example, massaranduba *Manilkara huberi* and muirapiranga *Eperua bijuga*), and they appear largely unable to feed from colonizing trees (typically cecropias).

During 1983 and 1984 we conducted surveys in heavily logged forest near Tucuruí and along the left bank of the Araguaia River, where around 60 per cent of the trees are destroyed by logging operations. Sakis were not located in logged or fragmented forests, although they occurred at a density of 24 individuals per sq km in adjacent primary forest at the Tucuruí site. In the Gurupi FR (surveyed in 1984), sakis were found at a density of 30 individuals per sq km in unlogged forest, but declined to one per sq km in heavily logged forest (50 per cent of trees destroyed): only solitary individuals were observed. Sakis were observed in atypically lightly logged forest (15 per cent of the trees destroyed) at close to their original density, but normal logging operations effectively eradicate this species.

The saki is often hunted for meat (over much of its range it is the second largest primate) and sometimes for its tail, which is used as a duster or sold as a tourist souvenir. Hunted forests in the Tucuruí region and at Vila Arauaí (south of Ourém) showed lower densities of sakis, although they did not decline as much as did the larger red-handed howler monkey *Alouatta belzebul*: the latter are a preferred target of hunters. The presence of logging roads opens up forest to hunters and may threaten populations of sakis even if environmental damage caused by logging is minimal.

Nails in the coffin

In September 1984 Tucuruí dam was closed and an area of 2400 sq km began to be flooded, around 70 per cent of it primary rain forest, in the centre of the range of the sakis. This rain forest was occupied by sakis at densities between 15 and 33 individuals per sq km. The development of agricultural schemes on the periphery of the newly formed lake will almost certainly dispose of any animals that escaped outwards from the rising waters, as well as the 450 sakis that were rescued and subsequently released during the US$30-million operation to remove non-swimming wildlife trapped on islands in the lake. Plans for several small biological reserves around the lake do not appear to have been implemented. In any case, settlements along the peripheral roads provide a market for a large amount of commercial hunting, and unprotected reserve areas would not be viable.

One of the principal functions of the Tucuruí hydroelectric project is to provide cheap energy for the mining industries around and supplied by Serra dos Carajás. The ore deposits at Carajás comprise some millions of tons each of nickel and manganese ore, copper, tin, gold and so on. Exploitation of this enormous wealth is the focal point of economic development plans in eastern Amazonia.

Although the mining industries themselves are fairly localized, large forest areas have been lost through the construction and subsequent colonization of the railroad from the ore deposits to the coast. More will disappear with the proposed development of silvicultural plantations to supply charcoal for ore smelting. Some 24,000 sq km of *Eucalyptus* plantations are planned, and experiments are under way with around 160 varieties of five species to determine the most appropriate strains for different soil types (D. Oren, pers. comm.). Until the plantations are

established, pig-iron smelters are likely to be supplied with native timber. The ultimate effect of this development will probably be the loss of almost all forest remaining east of the Tocantins River.

The development at Serra dos Carajás is only part of a US$33,000-million plan, underwritten by the International Monetary Fund during the previous government, to exploit to the fullest possible extent (through mining, agriculture and industry) some 800,000 sq km of eastern Amazonia. This is one-fifth of the entire Amazon basin and covers the entire geographical range of all forms of the southern bearded saki.

Dark future or no future?

Much of the forest clearance in eastern Amazonia is unplanned, haphazard and illegal. Logging takes place without any controls to minimize damage levels or any limits on the minimum size of trees cut. Subsistence hunting is a way of life. Population density is continuously increasing as settlers arrive from the drought-stricken areas in Brazil's north-eastern states. Even capital-intensive government (and internationally) financed schemes are often remarkably uncaring concerning environmental matters. In a part of Brazil where logging is threatening all remaining forests, some 2.7 million cubic m of commercial timber were submerged under Tucuruí Lake. Under such conditions it is impossible to be optimistic about the future of the bearded sakis.

The light-coloured western forms are probably the least endangered, although threatened by the overall development plan for the region and industrial expansion linked to hydroelectric plants being built on the Tocantins and proposed for the Xingu River. They probably still occur in the Caxiuanã FR (2000 sq km) and are found in at least some of the three entirely protected areas that have been established at Serra dos Carajás (the largest is 358 sq km).

The dark eastern form is presently quite common within Gurupi FR and perhaps in Indian tribal lands to the north and south. Sakis will not persist if the forest area continues to be reduced or if heavy logging levels are practised. In late 1985 plans to split off a part of the Forestry Reserve for fully protected status were initiated (D. Oren, pers. comm.). If this occurs, it will go a long way towards preserving the endemic wildlife of the region, including the sakis, but will require curtailment of illegal hunting, tree-felling and ranch encroachment. Social problems render the adequate protection of a reserve in this area highly unlikely (Ayres, 1986).

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Andrew D. Johns, Subdepartment of Veterinary Anatomy, University of Cambridge, Tennis Court Road, Cambridge CB2 1QS, UK.

J. Márcio Ayres, Departamento Zoologia, Museu Paraense Emílio Goeldi, CP 399, 66.000 Belém, Pará, Brazil.