

Observations on a population of Red-fronted Macaws *Ara rubrogenys* in the Río Caine valley, central Bolivia

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Summary

A population of about 60 Red-fronted Macaws *Ara rubrogenys*, a parrot endemic to central-southern Bolivia, was studied in an area of around 200 ha in the Río Caine valley, northern Potosí department, in October and November 1990. The habitat was semi-desert steppe dominated by cacti; the very light rainy season (in which the macaws are believed to breed) lasts from November to April. The birds, most commonly to be seen in pairs, were active in the early morning and the later afternoon, feeding during both these periods on groundnuts in a 30 ha area cultivated by local Indians who, however, made no attempts to persecute them. There seem to be no serious threats to the species in the Río Caine valley. However, breeding success appeared to be low, presumably reflecting the sparse dietary resources of the region.

Durante los meses de octubre y noviembre de 1990, se estudió una población de Guacamayo Dorado *Ara rubrogenys* (especie endémica del área centro y sur de Bolivia) compuesta por unos 60 individuos. El área de estudio abarcó unas 200 ha en el valle del Río Caine, al norte del departamento de Potosí. El hábitat en esta zona estaba formado por estepas semidesérticas dominadas por Cactáceas, con un período de lluvias moderadas (tiempo en el que se cree que tiene lugar la reproducción) que se extiende desde noviembre hasta abril. Las aves se observaron preferentemente en parejas, siendo las primeras horas de la mañana y las últimas de la tarde los momentos de mayor actividad en los que se alimentaban de maní (cacahuetes) en un área de 30 ha cultivada por indígenas, quienes no mostraron intención alguna por evitarlo. Aparentemente no hay evidencia que induzca a pensar que la especie se encuentre amenazada en el valle del Río Caine, no obstante, el éxito reproductor aparentemente resultó ser bajo, lo que reflejaría quizás unos recursos tróficos escasos en la región.

Introduction

The Red-fronted Macaw *Ara rubrogenys* is a poorly known parrot endemic to central-southern Bolivia (Forshaw 1989). In the early 1980s the New York Zoological Society and ICBP commissioned an investigation of the species (Lanning 1982) which resulted in a clearer definition of its distribution and population size, plus some ecological and behavioural data. The fragmentary observations of Nores and Yzurieta (1984) and Fjeldså (1987) have supplemented Lanning's pioneering study.

Lanning (1982) recommended that the Red-fronted Macaw should be given threatened species status, and this was duly accorded by its inclusion in Collar and Andrew (1988). By this means its plight came to our attention, and when we

contacted ICBP for further information we received from N. K. Krabbe a copy of his detailed draft account of the species for ICBP's forthcoming *Threatened birds of the Americas*, in which he recommended fuller studies of the species, particularly with reference to the threats it was believed to be facing.

We decided to act on this recommendation, since one of us (JSP) knew of a population of Red-fronted Macaws from a previous (1989) visit to Bolivia; and although our study was of necessity brief (120 hours of observation in October and November 1990) certain new facts about the species emerge which we present in this paper.

Study area and habitat

We chose to study the Red-fronted Macaw in the western part of its restricted range, within the area identified by Lanning (1982). This was the Río Caine, which forms one of the semi-arid intermontane valleys of the Cordillera Real in the Andes of central Bolivia in northern Potosí department (Remsen and Traylor 1989). In 1989 JSP had been informed by a trapper who had worked for Charles Cordier (an exporter based in Cochabamba) that there were important gatherings of the species in this area, and he then spent two days there confirming the truth of this assertion.

The valley of the Río Caine, at around 2,000 m altitude, is enclosed by an uneven relief and has numerous cliffs; it runs roughly from north-west to south-east, and is subdivided along its length by low ridges that isolate the bed of the river itself from the land cultivated by the local Indians. Our study area extended over 2 km along the river with a width of around 1 km, thus covering approximately 200 ha; views are provided in Figures 1–3 and a stylized cross-section of the site is given in Figure 4.



Figure 1. The Río Caine valley amidst the mountains; note the areas of cultivation in front of the riverbed.

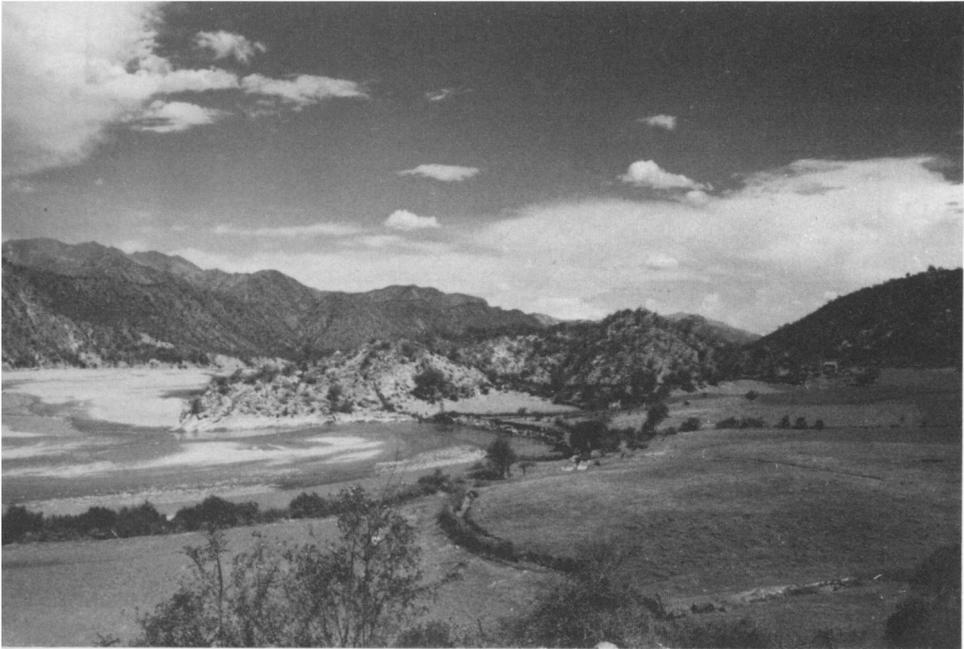


Figure 2. The Río Caine riverbed with adjacent cultivation, with the mountains of the north-east beyond.

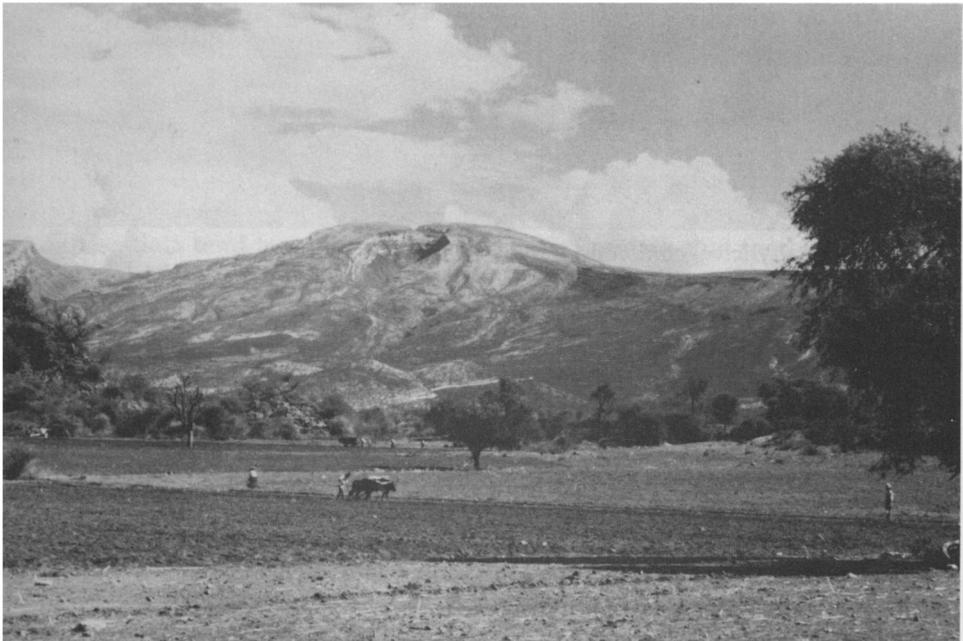


Figure 3. Cultivation in progress, with the mountains of the south-west in the background.

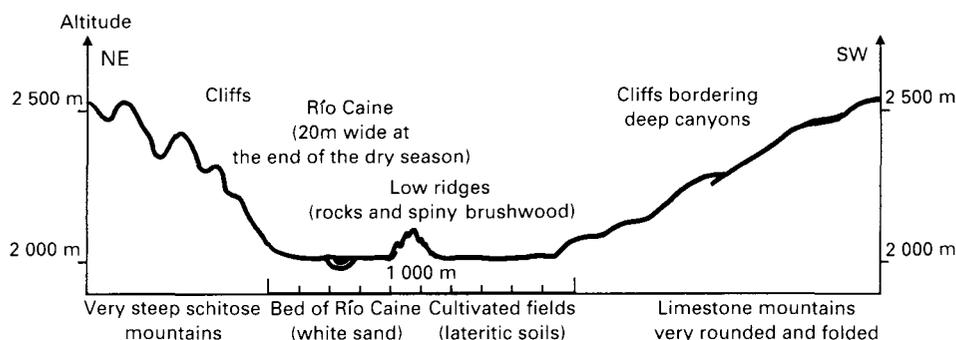


Figure 4. North-east/south-west cross-section of the study area.



Figure 5. Xerophytic vegetation on the low hillsides.

The xerophytic vegetation of the region (Figure 5) consists of cacti (*Cleistocactus* sp., the endemic *Lobivia caineana*, *Echinopsis* sp., *Opuntia* sp., *Quiabentia perezien-sis*), bromeliads (*Hetchia* or *Dyckia* sp., *Tillandsia* sp.), spiny bushes and some modest-sized trees (4–10 m).

The most widespread shrub is *Prosopis kuntzei* (Mimosaceae [Leguminosae]), which has yellow flowers and large podded fruits (Figure 6). It resembles a type of broom whose leaves have transformed into spines some 10–15 cm long and which fully justify the Spanish name of *lanza lanza* (the lance). Called *culqui* in the local Indian language, Quechua, this plant is sufficiently common for areas where it grows to be called locally *culquipampa*; the Indians use it, dried, to make a network of defensive, almost impenetrable hedges. The other shrubs are either covered in thorns, like *Acacia aroma*, or sting badly, like the white-flowered



Figure 6. *Prosopis kuntzei*.

spurge-nettle *Cnidoscolus* sp., called locally *itapallo*. Trees are rare; *Schinus molle*, known locally as *molle* or as the false wild pepper, is by far the commonest, reaching 6–7 m in height and keeping its leaves in the dry season.

The vegetation, characterized by Reyes (1981) as semi-desert steppe with dry winters, is the product of the climate of the region. Rain basically only falls between November and April, and never in great quantity, so that the region lies between the 300 and 600 mm isohyets. Figure 7 charts the daily variations in temperature (more than 20°C) and humidity (over 45%) that we measured at the end of the dry season during our visit; it clearly shows how hot and dry the midday period became in the valley.

All these data tend to confirm Ridgely's (1981) remark that the habitat of the Red-fronted Macaw is most unusual for a parrot in a genus largely associated with hot humid lowland forest. The paucity of plants, and the defences most of them possess against being eaten, must have serious dietary repercussions which, combined with a general lack of perches and protective cover, make for a seemingly hostile environment for a relatively large parrot to survive in, and dictate some notable behavioural adaptations.

Abundance and daily movements

During our study it was not difficult to assess the number of Red-fronted Macaws as it proved to be a common, noisy and rather tame bird, as indicated by Ridgely (1981). We counted a mean of 180 birds per day in our study area. Aware that parrots go to feed in the morning and return in the afternoon, the total

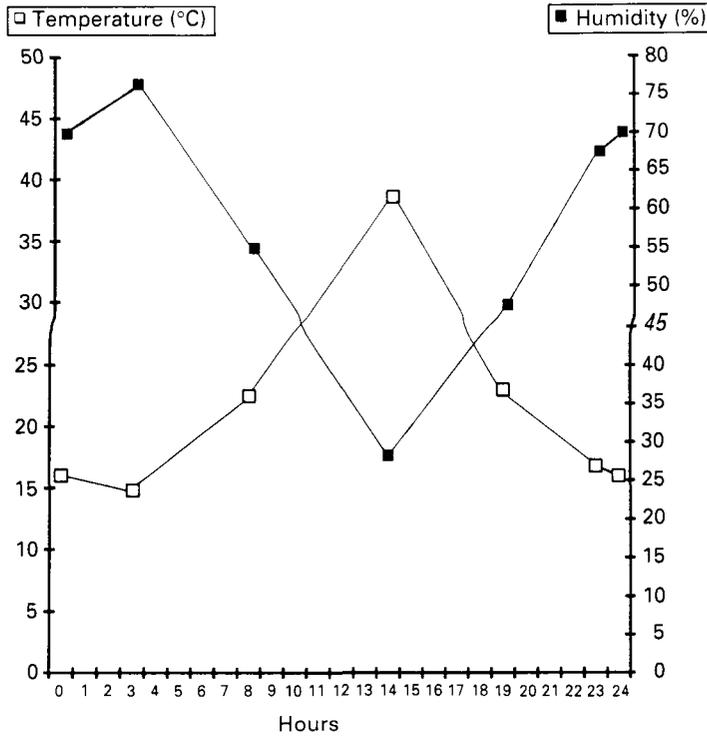


Figure 7. Mean daily variation in temperature and humidity in the study area at the end of the dry season (October–November).

number of individuals believed to be involved was halved to 90. However, we were aware that we would still be likely to have done some double counting, and therefore allowed for a 30% inflation of the true figure, something by no means impossible given their constant flights from one site to another. Thus we feel it reasonable to estimate that the population under study in that portion of the valley was at least 60 birds.

The accuracy of this estimate is supported by the fact that on six occasions a flock of about 30 birds was witnessed, sometimes in flight, sometimes on the ground, at a time when a similar number was being noted elsewhere. At the time of our study these 60 macaws were feeding almost exclusively on a 30 ha area of land cultivated by the Indians, so that they were present at a density of two birds per hectare.

Four major movements of birds occurred daily during our study (Figure 8). Between 05h30 and 07h00, the macaws arrived from the cliff areas to the south and south-east of the study area, and flew north-west towards the feeding grounds. Between 07h00 and 10h00 the birds flew back in the direction of the cliffs to the south-east. Between 14h00 and 17h30 they returned to feed a second time, and between 17h00 and 18h30 they once more departed towards the cliffs in the south and south-east.

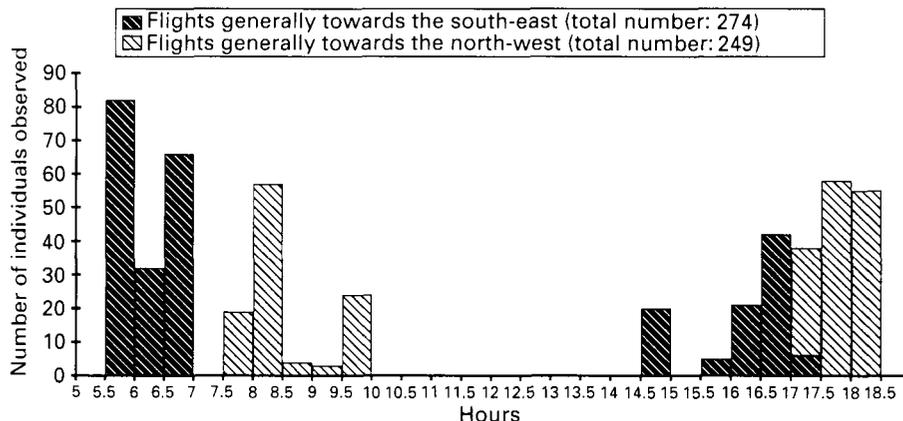


Figure 8. Frequency of daily movements of Red-fronted Macaws (total number of observations: 523).

Locomotion and calls

The Red-fronted Macaw is a fine, powerful flyer: we saw several pairs crossing the Río Caine against a very violent sandstorm, with no great or obvious difficulty and with no apparent adjustment of their line of flight. Birds can fly at very great height, particularly when near cliffs, and will then make long glides to lose altitude. We estimated a normal flight speed of 60 kph.

When a bird perched in one of the few trees of the area, it would always be in full view, on the top of a ridge or on the bank of the river, which probably allowed for scrutiny of the surroundings. Certain trees showed clear evidence of being used regularly by these macaws before and after they went to settle on the ground: the tips of the branches were broken off and barked by the constant rubbing of powerful mandibles (Figure 9).

The Red-fronted Macaw spends much of its time on the ground looking for food in cultivated plots. Its gait is graceless and heavy, rather similar to vultures. Progress is not facilitated by the large clods of earth turned up by the plough, nor by the species's long, encumbering tail. Nevertheless, at least four hours of each day is spent walking the length and breadth of the fields, foraging in a systematic, uninterrupted manner.

Close study of a dozen foraging birds showed that they took an average of 100 steps per minute, each step being of about 5 cm, which represents a distance of 300 m covered every hour. It is therefore a fairly capable walker, exceptionally so for a macaw, and fully justifies its local name of *loro burro*, "donkey parrot".

The species calls a great deal. The most frequent vocalization is given at regular intervals. Short, rather shrill, very ringing, it resembles the call of a conure *Aratinga* much more than that of a large macaw. It is delivered during all group activities of the birds, whether in flight or on the ground, and may assist their social cohesion. Even the immatures give it, albeit less powerfully and higher-pitched.

The frequency (of delivery) and intensity of this call increases during periods



Figure 9. Regular Red-fronted Macaw perches, with the branches worn down and broken off by repeated rubbing of the bill.

of heightened social excitement. This happens when the parrots, perched in trees, are about to settle on the ground or fly away.

When uneasy, the Red-fronted Macaw mingles with these calls an alarm call, lower and more raucous, “*raaah*”, which closely resembles the usual call of large macaws. We watched a pair, perched in a tree, that for about 10 minutes performed a kind of duet; the calls they gave were rather melodious, but continuous and monotonous, accompanied by a light vibrato.

Social organization

We systematically assessed the flocking propensity shown in each type of activity observed (see Figure 10). A single parrot was a very rare sight, comprising less than 4% of all our counts. In contrast, the mean number of birds involved when all activities are combined is 7.2, which indicates that like other macaws (see Forshaw 1989) the Red-fronted is a rather sociable species.

Two general points need to be made in respect of the histogram analysis. First, nearly 37% of counts concerned a pair or a trio: this shows the very strong bond that unites the members of a pair, whether accompanied by an offspring or not. This association is permanent and can be seen even in a flock, as the two birds will stay very close to each other. Again, this is the case in other macaws (Forshaw 1989), although our observations took place at the supposed start of the breeding season and the situation may be different at other times of the year.

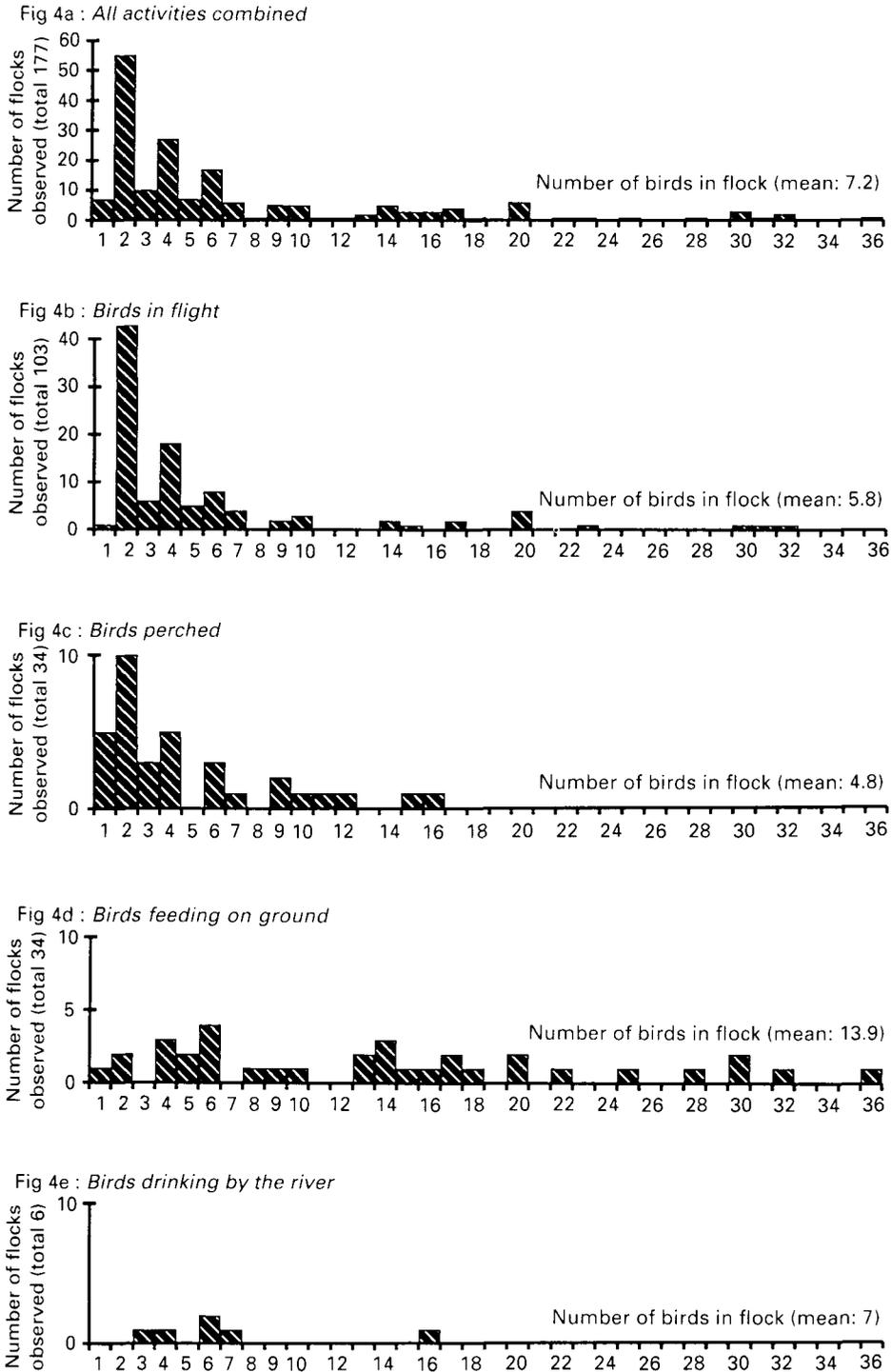


Figure 10. Flocking frequency in Red-fronted Macaws for various activities.



Figure 11. Red-fronted Macaws feeding in a small flock on tilled soil.

The second point is that flock size varies with activity. In flight, small flocks are normal, with 42% of counts referring to a single pair and 17% to two pairs, although particularly towards the end of the day flights of up to 30 may occur (all of which accords with the findings of Lanning 1982). When perched the macaws stay mostly in small groups: the percentages (30% being observations of pairs, 15% of two pairs) resemble those of normal flock size in flight. In contrast, feeding is clearly more sociable an activity (Figure 11): the arithmetical mean of flocks foraging on the ground is close to 14, of those drinking at the river's edge seven.

Our observations suggest that the Red-fronted Macaw is sociable but not strongly gregarious: the fact that the birds arrived in the morning at the feeding grounds in pairs, threes or fours indicates that they probably do not all come from the same roosting site. The larger concentrations we saw can be attributed to the smallness of the favoured foraging area and to the need for increased vigilance when the birds are on the ground and thus particularly vulnerable. The large evening flights are simply a consequence of these feeding aggregations and probably later break down into pairs returning to their separate roost sites.

The Red-fronted Macaw showed no association with other species of parrot, of which there were four in the area: Mitred Conure *Aratinga mitrata*, Blue-crowned Conure *A. acuticauda*, Grey-hooded Conure *Bolborhynchus aymara* and Blue-fronted Amazon *Amazona aestiva*. However, it foraged on the ground in the company of a large grey pigeon and a species of tinamou, neither of which we could identify precisely. We also saw a flock in a tree with some guans. The macaws showed no alarm when feeding close to domestic animals such as

chickens, pigs, goats, cattle or donkeys, but were startled by a group of overflying Black Vultures *Coragyps atratus*, although having nothing to fear from them.

Food and feeding

Food

At the time of our visit the Red-fronted Macaws were feeding mainly on the land cultivated by the Indians, who told us that they did so almost all year round. The two main crops of the Río Caine valley, and indeed throughout this region of the Andes (Reyes 1981), are groundnuts *Arachis hypogea* and maize *Zea mays*.

Groundnuts are sown in October, at the start of the rainy season, and are harvested in June. During ploughing, the macaws follow less than 30 m behind the labourers in order to take any nuts missed at the last harvest that are turned up by the plough. They can then form flocks of up to 30 individuals. (One can easily create such flocks by scattering groundnuts on a field, something we did regularly to obtain close-up photographs.) After the sowing, the macaws next forage on the nuts when the green shoots appear and can be used to extract the germinating seed. According to the Indians, the macaws try to pull the ripe nuts from the soil when the haulms dry out in June. In the period between harvest and new sowing, the macaws search for any unharvested groundnuts on the surface of the fallow fields.

Maize is planted in November–December and starts to ripen in February: from this time until April, according to the Indians, the grains, then soft and milky, are very actively sought out by the macaws.

The Red-fronted Macaw supplements this diet with various wild plant seeds and fruit. The local Indians identified the following as being utilized: *Cenchrus* sp. (Gramineae), *Tribulus* sp. (Zygophyllaceae), *Cnidoscolus* sp. (Euphorbiaceae), *Prosopis kuntzei* and *P. juliflora* (Mimosaceae [Leguminosae]), *Aspidosperma* sp. (Apocynaceae) and *Schinus molle* (Anacardiaceae). All this information agrees with the findings of Ridgely (1981) and Lanning (1982).

To drink, the macaws formed small groups not at the main body of the Río Caine itself but along its backwaters where the water, though shallow, flows slowly.

Feeding methods

The Red-fronted Macaw feeds on the ground, steadily walking over the earth with chicken-like pecking actions of the bill. A count made on a dozen birds indicated that they dug or scratched on average seven times a minute, while continuing to walk. We assumed that the food items thus discovered were small enough to be swallowed directly or almost so. A larger-sized food item such as an entire groundnut shell was first recovered with the bill and then held in one foot and raised to the bill to be opened.

Members of a pair squabble frequently when one of them discovers a choice item: they argue over it with wings wide open, calling stridently, and pushing at each other with one raised foot. On the other hand, preceding a copulation, one

bird (presumably the male) was witnessed feeding the other: after repeated tosses of the head, it twice regurgitated food into the open bill of the presumed female.

Such repeated regurgitations are also the means whereby a parent feeds its accompanying young: the latter, head ruffled, closely following the adult, begs food of it with a distinctive harsh call. In fact, immatures show little interest in foraging for themselves. Often they simply sit on the ground, moving little and scarcely ever digging or scratching with the bill. One that we watched did not even come off its perch to join its parents, but remained in the tree for two hours, waiting for them.

Feeding pattern

Red-fronted Macaws of the Río Caine valley feed twice a day in clearly defined periods (see Figure 12): in the morning, from 05h30 to 08h30, with drinking between 07h30 and 08h30; and in the afternoon, between 15h30 and 18h00.

We noted that frequently before landing on the ground the macaws would perch for several minutes in the small trees bordering the fields. They would then call a lot, probably indicating a certain nervousness. However, once a number of birds had settled on the earth the new arrivals would tend to fly directly down to join them.

The time spent in a field depends not only on the quantity of food available and on the area to be prospected, but also on the level of disturbance. In this last regard, we watched a group of 15 forage exhaustively over a field of 2 ha and then rest quietly there for an hour and twenty minutes. The time spent drinking, by contrast, lasts less than 10 minutes, after which the macaws often fly to perch in trees bordering cliffs.

Daily cycle

The Red-fronted, like many other macaws (Boussekey 1987), observes a very strict daily cycle (see Figure 13), even in the face of intemperate conditions such as sandstorms and violent downpours.

The birds probably pass the night in the sheer cliffs that flank deep canyons at 2,500 m to the south and east of our study area. We were unable to confirm this, however, despite searching several roost sites indicated to us by local Indians.

From sunrise at around 05h30 they fly in to feed, as indicated above. After two or three hours they fly to drink, then return south-east towards the roost sites, but spend the midday hours, i.e. between 10h00 and 14h30, perched quietly in trees, shading themselves from the powerful sun, and sleeping. This long siesta does not, however, preclude periods of great social agitation: on one occasion, around 14h00, a flock of 15 macaws, perched in trees by the river a kilometre from the feeding grounds, showed a most animated play behaviour, birds fluttering from perch to perch, some hanging upside down, wings wide open, on the thinnest of the branches, others bickering noisily. Towards 15h00 the birds begin to return to feed and drink. They finally leave the feeding grounds just before nightfall, around 18h30, heading for their roost sites in the cliffs.

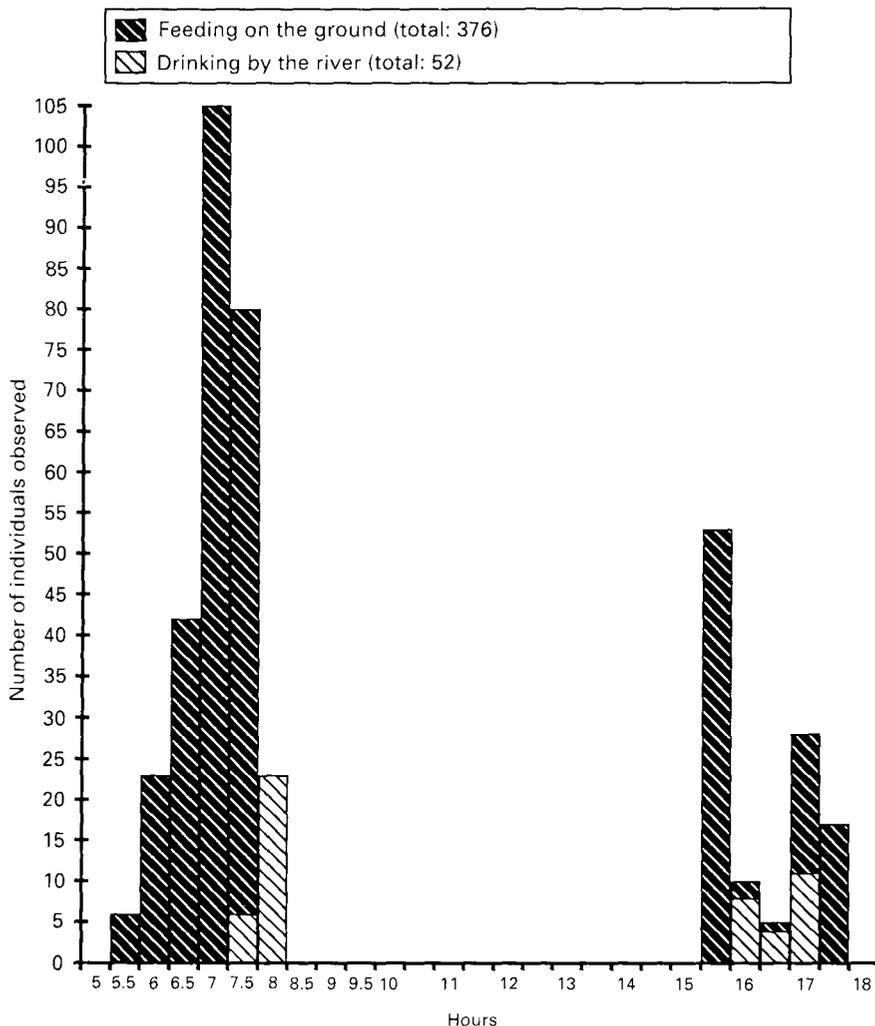


Figure 12. Daily feeding pattern of Red-fronted Macaws.

Breeding

Our study in October–November 1990 coincided with the supposed start of the breeding season of the Red-fronted Macaw, which appears to be linked to the onset of the rainy season, as noted by Ridgely (1981) and Lanning (1982).

On two occasions, on the mornings of 30 and 31 October, we witnessed copulation or attempted copulation. The performance was very noisy, the male vigorously tossing his head, quickly circling round the female, feeding her by regurgitation, then mating with her on the ground, the birds standing side-by-side. Similar behaviour in a captive male has been described by Hoppe (1983), although a copulation we witnessed in Santa Cruz Zoo on 7 November took place on a perch.

From the absence of red on the forehead, which in one report appears at nine

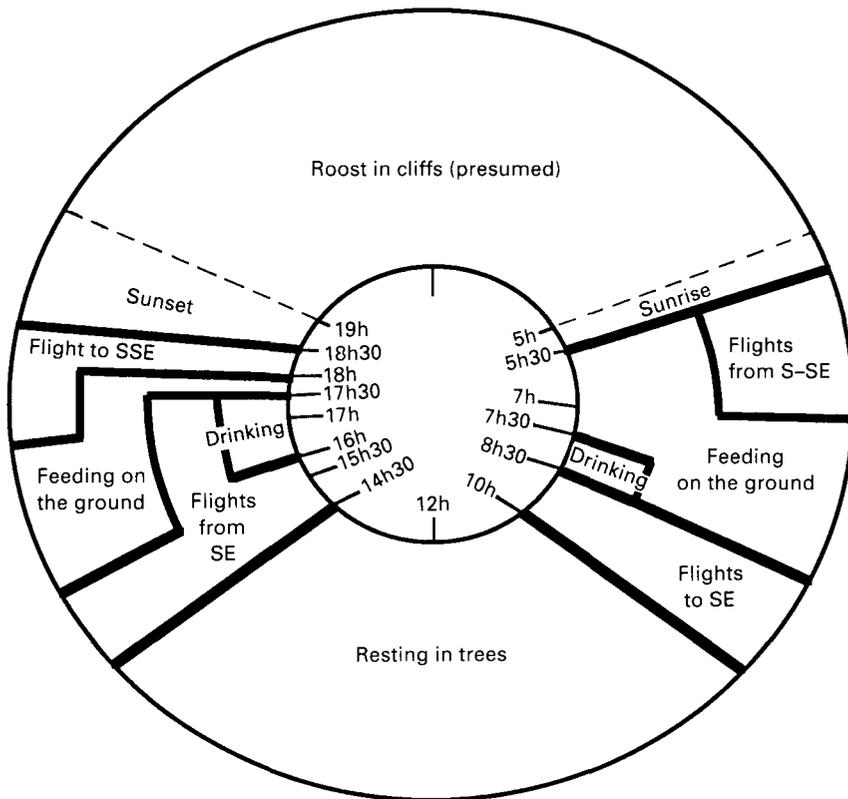


Figure 13. Daily cycle of activity in the Red-fronted Macaw.

months (Bock and Schurer 1988) and in another at 6–12 months (Low 1990), the young birds we saw in our study area appeared to be aged around 6–8 months, which would suggest hatching between March and May and therefore egg-laying between February and April. These (rather rare) immatures were probably the last born of the year; the first clutches may have been laid as early as November or December. The local Indians confirmed that young birds are numerous on the feeding grounds in May and June.

We searched in vain for nests in several cliffs, each with a stream at its base, indicated by locals as habitual sites. From what we were told, the nests are rather dispersed: the species does not appear to nest colonially.

In 26 observations of pairs accompanied by immatures (on the ground, perched, or in flight), 24 (92%) involved a single offspring, one involved two, and one three. From this evidence the majority of Red-fronted Macaws can only rear one young per year, at best. If so, this would surely be attributable to the extreme dietary impoverishment of the species's natural environment.

Man and threats

The Red-fronted Macaw feeds for a large part of the year on land cultivated by the Indians, yet we never once witnessed any persecution of the birds as a

result. At worst, in December 1989 one of us (JSP) once saw an Indian woman try to drive off some macaws from a field by twirling a frond, but she made no attempt to kill them. A campesino with a rifle (a rare combination) told us he hunted them occasionally, but only ever killed a few, and rarely, although he reported the meat to be as dark and savoury as a deer's.

It thus appears that at least in the sector of the Río Caine valley that we studied, and in accordance with Ridgely's (1981) and Lanning's (1982) findings elsewhere, there is no systematic human persecution of the Red-fronted Macaw. Indeed, the highly confiding nature of the species suggests it has no great fear of man: it feeds on the ground 100 m from dwellings, follows the plough at less than 30 m, and takes flight from an approaching observer at only some 40 m. It took them scarcely half a day to accept a hide that we erected on open ground.

The Red-fronted Macaw is not kept locally as a pet, unlike the Blue-fronted Amazon, because it has less capacity to imitate speech. We only found three captive birds, one in the Río Caine valley and two in Cochabamba, all three having been caught in a rather brutal manner: one had lost the two front toes of its left foot, the two others each had a broken wing, one the result of a gunshot.

During the 1980s, however, the macaw was exported in large quantities to Western countries. One of us (JSP) counted over 100 in the possession of Onishi, the Japanese exporter in Santa Cruz. We spoke to the trapper who supplied the Cochabamba-based Swiss exporter Cordier. He claimed to have trapped 200 in total. His method was to bait an egg-shaped area 6–8 m long and 3 m wide with groundnuts, with netting attached to stakes hidden carefully in the soil. When a good number of macaws had settled there, he would pull a cord that lifted the stakes and hence the netting 1.5 m off the ground and onto the birds. In 1983 each macaw earned him US\$50, a considerable fortune in terms of the local cost of living. They were then sold on for \$350 each (Onishi's price-list in 1983) to wholesalers who retailed them for \$700 apiece (the price in France at the start of the 1980s).

With the placing of the species on Appendix I of CITES in July 1983, thereby outlawing all trade, and with the total ban on capturing, transporting and exporting all wild animals in Bolivia by Supreme Decree 21312 of 27 June 1986 (Fuller *et al.* 1987), the fortunes of the Red-fronted Macaw appear to have improved. We saw no trapping in the Río Caine, we found no official dealer in Cochabamba and no macaws for sale in the market, and Cordier's trapper had gone back to taxi-driving.

Although we cannot speak for other parts of the species's range, in the Río Caine the threats to the species are minimal, with no direct persecution, no trapping, and no degradation of habitat, since the human population density of the region is very low (50 Indian families in the part of the valley we investigated).

The only possible threat to the species in the valley could be the development of a network of local roads to promote tourism at the Torotoro archaeological site 20 km from our study area, albeit in a different valley. At present it is only accessible by lorry in the dry season, or else by light airplane. The consequences of road improvements could clearly be to change the character of life in the valley to the long-term detriment of the macaw.

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