RED-BILLED CURASSOW *Crax blumenbachii* **R**[11]

Formerly fairly widespread in lowland Atlantic Forest in south-east Brazil from Bahia south to Rio de Janeiro, this species is now restricted to five protected forest patches – Una and Monte Pascoal (Bahia, although several unprotected sites have recently been found in the state), Rio Doce (Minas Gerais), Sooretama and Linhares (Espírito Santo) – several of which are under threat. The total population must be very small, although birds have bred well in captivity.

DISTRIBUTION The Red-billed Curassow (see Remarks 1) is endemic to eastern Brazil where it is currently restricted to five forest reserves. However, to judge from occurrence of place-names in which the word *mutum* appears, it was once fairly widespread in southern Bahia, eastern Minas Gerais, Espírito Santo and north-east Rio de Janeiro (Sick 1969, 1970, 1972, 1985). The record of the species from Bolivia (Gyldenstolpe 1945), repeated by Meyer de Schauensee (1966), is in error (Vaurie 1968, Gochfeld and Keith 1977). Records in the following account are arranged from north to south, with coordinates from Paynter and Traylor (1991).

Bahia The species is known from forest patches around Camamu, currently at least by local report (da Silva and Nacinovic 1991); Ilhéus, where it was recorded on the rio Salgado, 14°54'S 39°26'W, January 1817, with many remains of hunted birds at ribeirão Issara, c.15°05'S 39°45'W, at the same time (Wied 1820-1821; see Bokermann 1957), and one specimen was collected in 1944 (Stresemann 1954, Pinto 1964); Una Biological Reserve, in the recent past (Coimbra-Filho 1970, S. Lindbergh *per* C. Yamashita *in litt*. 1987); rio Jequitinhonha (as rio Belmonte), specifically on Ilha do Chave, c.15°57'S 39°33'W, September 1816 (Wied 1820-1821, 1831-1833; see Bokermann 1957); Monte Pascoal National Park, where it was recorded in 1977 (King 1978-1979, Sick and Teixeira 1979, Sick 1985) and in October 1986 (Gonzaga *et al*. 1987); rio Itanhém (as rio Alcobaça), formerly (Wied 1831-1833), although accordingly to local reports recently traded individuals came from near Teixeira de Freitas (da Silva and Nacinovic 1991), which stands on the Itanhém; rio Mucuri, at Morro da Arara, formerly (Wied 1820-1821, 1831-1833; see Bokermann 1957). Reports from near Prado and Marajú (Teixeira and Antas 1982) cannot be confirmed as the areas in question are now cleared (LPG), while records from rio Salgado and rio Jucurucu (Pinto 1964) could not be traced to source and may be in error. Despite a claim of its occurrence there, the species is almost certainly absent from the CVRD Porto Seguro Reserve (Gonzaga *et al*. 1987).

Minas Gerais The few records in this state are from "Villa do Fanado" at "Alto dos Bois", near Minas Novas, early in the last century (de Sainte-Hilaire 1830); Mairinque (Mayrink), December 1908 (Pinto 1938, 1952); near the rio Xopotó, 20°45'S 43°05'W, a probable record in 1850 (Burmeister 1853); the Rio Doce State Park (36,000 ha) near Dionísio, currently (M. A. de Andrade *in litt*. 1986, G. T. de Mattos verbally 1987, *in litt*. 1992); and below São Caetano on the Rio Pomba, 21°38'S 42°04'W, undated (Burmeister 1853, 1856). The species has been introduced to two reserves in the state which are not known formerly to have held it (see Measures Taken), though it is not known if stocks have survived.

Espírito Santo Localities include Fazenda São Joaquim on the northern state border and the rio Itabapoana, which forms the southern state border, suggesting that the species originally extended throughout the state. Records are from forest at Fazenda São Joaquim (Fazenda Klabin), now much reduced and converted to the Córrego Grande Biological Reserve (King 1978-1979, Sick and Teixeira 1979), although it was not found there in October 1986 and is almost certainly extinct (Gonzaga *et al*. 1987); córrego do Engano, near Conceição da Barra, where four birds were collected at 245-285 m, three of them in October 1944 (specimens in AMNH, FMNH); Sooretama Biological Reserve (including córrego Cupido and rio São José, whence specimens in MNRJ and AMNH from 1939 and 1941 respectively and one from 1942; also Pinto 1945, Stresemann 1954, Sick 1970), currently (King 1978-1979, Sick 1969, 1983, Scott and Brooke 1985, C. E. Carvalho *in litt*. 1987, Aleixo *et al*. 1991) and, more recently recognized, the contiguous CVRD Linhares Reserve, currently (Collar 1986, Collar *et al*. 1987, Collar and Gonzaga 1988; see Population); Lagoa Juparanã, where it was formerly common on the banks (de Sainte-Hilaire 1833, specimen in MNRJ); rio Doce, rio Itapemirim and rio Itabapuana (Itabapoana), formerly (Wied 1831-1833).

Rio de Janeiro The species was first described from forests in the state (von Spix 1824), one sixteenth-century report from around the city of Rio de Janeiro possibly referring to birds traded by Indians from other areas (Sick and Pabst 1968). The only specific sites for the species are the valley of the rio Paraíba do Sul, where it reputedly occurred until 1963 near São Fidélis, and Cantagalo (Sick 1969, 1972), where it was known only through old hunters' reports (Euler 1868, von Ihering 1900a). Reports

from Desengano State Park and Santa Maria Madalena required verification (Teixeira and Antas 1982).

POPULATION In the early nineteenth century the Red-billed Curassow must have been a relatively common bird in Atlantic Forest in Espírito Santo and Bahia, Wied (1831-1833) referring to it being "not rare", "frequent" on the rios Doce, Mucuri, Alcobaça and Belmonte, and "everywhere a very favourite game bird", with de Sainte-Hilaire (1833) clearly implying that it was common on the shores of Lagoa Juparanã. However, Burmeister (1856) noted that it was already rather scarce in well settled areas, and since then the species has continued to decline not only as its habitat disappeared but also with the extensive penetration of all remaining habitat by hunters, so that since the mid-twentieth century (despite the mistaken optimism that "with such a wide range, in many places little disturbed" the species seemed unlikely to be in great danger: Greenway 1958), it was recognized to be "on the road to extinction" (Stresemann 1954) and "one of the most threatened Brazilian birds" (Sick 1972; also Delacour and Amadon 1973, King 1978-1979). In the late 1970s it was still decreasing owing to illegal hunting and continuing deforestation in southern Bahia, having vanished from some biological reserves in Espírito Santo where, in small numbers, it could be found some years before; by this time, although no population estimates were known, only "a few hundred individuals" were guessed to exist (Teixeira and Antas 1982). By the 1980s only five localities could be shown to hold the species, although very recent research has disclosed one or two more, by local report (see Distribution).

Two of the certain localities, Sooretama Biological Reserve and the adjacent CVRD Linhares Reserve, form the chief stronghold. As long ago as August 1939 local people reported it "not rare" in this area (Sick 1970), and, despite the anomalous and presumably mistaken impression that it was "very rare" there in September 1942 (Pinto 1945), in 1954 and 1961 up to 25 birds were observed together being fed at Sooretama (Sick 1970) and up to six were seen together at the same site, plus two others, over six days in September 1973 (Gochfeld and Keith 1977), when "perhaps fifty at the most" were thought to survive in the reserve (Delacour and Amadon 1973). In 1977 "perhaps 60 or more" were reported there (King 1978-1979) and a minimum of 26 birds (nine males, 11 females and four indeterminate, plus two chicks) was seen over three weeks, December 1980 to January 1981, suggesting that the total population was considerably more than 60 (Scott and Brooke 1985). Another equally important population was subsequently found in the CVRD Linhares Reserve where 25 birds (19 males, five females and one indeterminate) were recorded at 16 sites during a two-week survey of the species, 4-17 October 1985 (Collar 1986, Collar *et al*. 1987, Collar and Gonzaga 1988); just over a year later managers at the reserve were expressing confidence that over 100 birds existed there (B. M. Whitney *in litt*. 1987).

Numbers in Monte Pascoal National Park were believed to be much less than at Sooretama in 1978 (King 1978-1979) and are likely to be even more reduced now (Gonzaga *et al*. 1987: see Threats). No population estimates are known from the Rio Doce State Park and Una Biological Reserve, but numbers are likely to be very small at least in the latter (LPG), where it was said to be rare (Coimbra-Filho 1970), seven birds being seen there on 24-25 November 1986 (S. Lindbergh *per* C. Yamashita *in litt*. 1987) and wardens seeing the species very rarely (LPG). In the mid-1970s there were "possibly as few as 10" in what was then Fazenda Klabin (King 1978-1979), where the species is now almost certainly extinct (Gonzaga *et al*. 1987).

ECOLOGY The Red-billed Curassow inhabits high primary forest in hot, humid regions (Sick 1985; see Remarks 2). The statement that it occurs in both "lowland and highland forests" (Teixeira and Antas 1982) is surely in error, as none of the localities from which it has been recorded lies above (or much above) 500 m. Although recorded "in secluded parts of forests" (Wied 1831-1833), the possibility cannot be discounted that the species prefers habitat that includes forest edge, as all records in the CVRD Linhares Reserve were made from forest tracks that caused a break in the canopy (Collar *et al*. 1987, Collar and Gonzaga 1988; see also Scott and Brooke 1985) and at the rio São José the birds were noted to visit "small areas with lower vegetation as on the banks of the larger rivers, small floodplains, and steep banks, all, however, covered by woods", and were notably to be found at treefalls (Sick 1970). One male was heard calling 8 m up in dense cover in cut-over second-growth forest at Sooretama (Gochfeld and Keith 1977). In the CVRD Linhares Reserve the curassows have been found chiefly in the low-lying eastern half, below the 50 m contour, which could reflect a need for damp substrates and/or proximity to water (Collar *et al*. 1987, Collar and Gonzaga 1988), although further study of the situation there suggested that disturbance and poaching might have contributed to its absence or scarcity in the western half (Gonzaga unpublished).

On the Jequitinhonha Wied (1820-1821) found that they were most frequently to be found when the river was in flood. The birds in Sooretama are quite habituated to man, feeding with chickens round the forestry camp in the mornings and evenings (Sick 1970, Gochfeld and Keith 1977, Scott and Brooke 1985) and being seen along a busy dirt road in the reserve (Scott and Brooke 1985). Birds come out onto tracks after rain to dry and preen (Collar and Gonzaga 1988) and like to drink, taking water as it drips from the leaves after heavy rain or walking to the nearest watering places (Sick 1970) such as fresh puddles on tracks (Gonzaga unpublished). The species lives much on the ground (Wied 1831-1833), being less arboreal than guans *Penelope* and piping-guans *Pipile* (Sick 1970).

Food consists of fruits, buds, seeds and insects (Wied 1831-1833, Sick 1970, Teixeira and Antas 1982, Teixeira and Snow 1982), and is taken on the ground in high forest with rich undergrowth and deep shadow, but is also picked off bushes and trees (Burmeister 1856, Sick 1970, Teixeira and Snow 1982). Grit is always found in their stomachs (Sick 1970), although not by Wied (1831-1833), who anticipated it. Fruits included in the diet are, e.g., sapucaia *Lecythis pisonis*, bicuiba *Virola bicuhyba*, aricanga palm *Geonoma* (Aguirre 1947, Sick 1970), murici *Byrsonima* (Aguirre 1947, Teixeira and Antas 1982), *Byrbicuiba* (Sick 1970, Teixeira and Antas 1982), *Eugenia*, *Ferdinandusa*, *Eschweilera* (Teixeira and Snow 1982) and *Pithecellobium* (Teixeira and Antas 1982). "Hard fruits and nuts", some impossible to split with a hammer, have been found in birds (Wied 1831-1833). Centipedes and venomous spiders *Lycosa* are not rejected as prey (Sick 1985). The statement that "a characteristic sign of [the species's] foraging is bushes with leaves half-eaten" (Teixeira and Snow 1982) seems of little practical scope, since such damage must result from the activities of many other animals in the same habitat. Several other birds and mammals including the Rusty-margined Guan *Penelope superciliaris* and the threatened Black-fronted Piping-guan *Pipile jacutinga* like the same fruits (Aguirre 1947, Sick 1970) and one male curassow was seen feeding on the ground in the company of three Rusty-margined Guans (Gochfeld and Keith 1977).

The main period for the low, booming song seems to be from the middle of September to October, being rarely heard in December and January (Sick 1970); however, booming was heard at Linhares in December 1986 and was heard rather little there in late September (B. M. Whitney *in litt*. 1991), implying variation that presumably reflects seasonal conditions. An apparent variation in the laying date between years is probably due to an extended breeding season within each year (Collar and Gonzaga 1988): thus young have been said to hatch in October (Sick 1970); pairing time was reported as especially from September to November in Espírito Santo (Teixeira and Antas 1982); or from November to January (Wied 1831-1833); a female with two chicks was reported in January (Scott and Brooke 1985); another with one half-grown female was seen on 19 February (Gonzaga unpublished) and a nest was found with two eggs on 15 November at a time when other birds were claimed to have well-grown young around 100 days old (Teixeira and Snow 1982). The nest is placed in lower trees (Teixeira and Antas 1982), a report that it may also be made on the ground (Burmeister 1856) being doubted (Ogilvie-Grant 1897). One nest was 6 m up in a obliquely leaning tree, one of a group growing from the water at the edge of a lagoon; it was solidly based on an arboreal termite nest, well shaded, and well concealed by the surrounding foliage (Teixeira and Snow 1982). Another, probably an old curassow nest, was on a dense viny thicket which covered some fallen trees, at a height of scarcely 2 m (Sick 1970); Wied (1831-1833) reported that the nest was made of twigs and sticks and placed in a tree 8-10 feet (2.5-3 m) from the ground. Clutch-size is commonly two (Sick 1970, Teixeira and Antas 1982, Teixeira and Snow 1982), sometimes one (Sick 1970); Wied (1831-1833) was told it was four. Incubation takes 28 days (Teixeira and Antas 1982) and the young remain with the mother several (up to at least four) months, following her the whole day (Sick 1970, 1985). In one study the female was recorded incubating alone (Teixeira and Snow 1982). The females are capable of breeding at two or three years, being fertile for at least 11 years (Teixeira and Antas 1982). Siblings are always of opposite sexes (Sick 1985). The species is claimed to be polygamous (Delacour and Amadon 1973) and the observation on the "far-reaching" call of the male "calling the hens around him" (Wied 1831-1833) seems to imply that, but the sex ratio may be affected by hunting (Delacour and Amadon 1973).

Birds have been reported as usually found in pairs throughout the year (Wied 1831-1833); groups seen during the winter seldom comprise more than four birds and are surely family units (Sick 1970) but an observation of four males together at the beginning of the breeding season in October could refer to birds that had failed to establish a territory (Collar and Gonzaga 1988).

THREATS This species has declined mainly as a result of chronic habitat destruction and hunting

pressure (Coimbra-Filho and Magnanini 1968, Sick and Teixeira 1979, Teixeira and Snow 1982) and is clearly extremely vulnerable, although perhaps not in imminent danger (Scott and Brooke 1985). Nevertheless, the very protection afforded to the population in Sooretama also brings a threat, since predators are attracted into the reserve by the relative abundance of prey to be found there (Coimbra-Filho and Magnanini 1968). Trade is also an enduring threat (see below).

Habitat destruction It was reported that in 1973 almost all the forest in north-east Espírito Santo, where the species formerly occurred, had been cleared, much of it within the year, and that the rate of forest destruction, mainly for charcoal, markedly accelerated in the preceding decade (Gochfeld and Keith 1977). The rate of forest destruction in eastern Brazil is so severe that in the past decade it has become evident that virtually no areas of lowland forest survive in the belt north of Rio de Janeiro that are not under active protection (Collar *et al*. 1987); the surrounding areas may be completely cultivated, like the São José region in the vicinity of Sooretama (Sick 1970) or largely abandoned after timber exploitation followed by cattle-grazing for a few years (LPG). Two decades ago Sooretama was considered "nearly abandoned" and lacked permanent policing (Sick 1969), and it was reported that a state governor once contracted a firm to log out and replace Sooretama with eucalyptus and pines, which was only prevented by federal intervention (Gochfeld and Keith 1977). Concerns about the future of Monte Pascoal as a protected area have been expressed as the forest there faces a major problem from its Indian population (Padua 1983, Gonzaga *et al*. 1987, Redford 1989). In the middle of the last century it was land clearance and settlement that caused the species's retreat northwards to the Paraíba do Sul valley (Euler 1868) and its extinction at São Fidelis, the last site in Rio de Janeiro, was due to clearance of forest there in 1963 (Sick 1969, 1972). The almost certain extinction at Fazenda São Joaquim (Fazenda Klabin) must unquestionably be related to the clearance of three-quarters of the forest there since the 1970s, less than 1,500 ha remaining in October 1986 (Gonzaga *et al.* 1987).

Hunting This bird is valued as food because of its size, although the flesh is quite dry (Sick 1970). In the early nineteenth century it was "everywhere a very favourite game bird... often caught in snares and eagerly hunted... especially in the period when they give their loud, deep calls" (Wied 1831-1833); it was much hunted (e.g.) near the ribeirão Issara alongside the Black-fronted Piping-guan (Wied 1831-1833), and at Lago Juparanã by the people of Linhares (de Saint-Hilaire 1833), while it was well-known in the rios Mucuri and Doce, where it was one of the most prized gamebirds (Goeldi 1894). Three specimens obtained in 1939 in Espírito Santo were killed by local hunters whose traps consisted of a heavy log hung above the ground over maize and manioc (Sick 1970).

Trade At the Caxias bird-market, Rio de Janeiro (see Carvalho 1985), the species had not been available for nearly 20 years (C. Torres *in litt*. 1985). Nevertheless, the species is highly prized by illegal marketeers (Teixeira and Antas 1982). It is to be noted that about fifty percent of the birds succumb to stress soon after capture: a "specialist" reported that most Red-billed Curassows, when removed from the nets, are already dead (Teixeira and Antas 1982). The apparent ease with which the species could still be obtained from the wild in the mid-1980s was a source of both surprise and concern (Collar and Gonzaga 1988) with reports of capture even in biological reserves and national parks (Teixeira and Antas 1982); in August 1984 a dealer with a pair from Sooretama claimed that certain wardens were working for him (C. Torres *in litt*. 1985).

MEASURES TAKEN All areas where the species currently occurs are forest reserves (see Distribution). Sooretama has been considered "a well protected nature reserve" (King 1978-1979) and in 1981 Red-billed Curassows at Sooretama seemed "to be doing well" and were considered "under very good protection" (Scott and Brooke 1985); however, although it is patrolled and permits are needed to enter it, no complacency is permissible (Gochfeld and Keith 1977; see Threats, Measures Proposed). Protection of CVRD's privately owned Linhares Reserve has been judged excellent (Collar 1986, Collar *et al*. 1987), with poaching not perceived as a problem there (Collar and Gonzaga 1988). This bird is listed on Appendix I of CITES and protected under Brazilian law (Bernardes *et al.* 1990). Its hunting has been prohibited in Espírito Santo since 1947 (Sick 1969).

Captive breeding and (re)introduction The view that this bird can only be saved in future by captive breeding (Sick 1985) is not wholly supported by the evidence above, since proper conservation and management (including anti-poaching controls) of the remaining sites must be the primary requisite (Collar and Gonzaga 1988). Nevertheless, it is clear that "reserve" stocks of this bird in captivity are important in themselves and as sources of birds for reintroductions (Teixeira and Antas 1982), following

the guidelines laid down in Black (1991). The species has already been successfully bred in captivity, in Brazil (see, e.g., Euler 1868, 1900, who records egg-laying, King 1978-1979, da Silveira and Pais 1986, Collar and Gonzaga 1988) and is known to be held in zoos outside the country as well (Olney 1977, Geerlings 1992). In 1985, at least 67 adult birds were known to be held in zoos and private aviaries in Brazil (see da Silveira and Pais 1986, Collar and Gonzaga 1988). Nearly half of these were kept by R. M. A. Azeredo of Fundação Crax (with support from Stichting Crax) in Minas Gerais and, fulfilling the need perceived by da Silveira and Pais (1986) to expand the captive population urgently, his stock grew from 34 birds in October 1985 up to 75 in May 1987 (Collar and Gonzaga 1988) and had reached 258 (45 breeding pairs) by July 1991 (G. Scheres *in litt*. 1991). In December 1990 15 pairs from this stock were released ("reintroduced", although there is no evidence of former occurrence at the site) into the Caratinga Reserve (Fazenda Montes Claros) in eastern Minas Gerais (*Atualidades Ornitológicas* no.39 [1991]: 1). In the middle of 1991 20 further pairs from this stock were introduced into the CENIBRA Reserve at Ipatinga, Minas Gerais, although this area is regarded as seriously deficient in appropriate habitat (G. T. de Mattos *in litt*. 1992).

MEASURES PROPOSED It has become a matter of permanent concern that the protection of Sooretama Biological Reserve should be enhanced and maintained, with the introduction of stronger measures against poaching and trapping (Sick 1969, Gochfeld and Keith 1977, Teixeira and Antas 1982, Scott and Brooke 1985) and possibly even the control of predators (Coimbra-Filho and Magnanini 1968). CVRD deserves congratulation and encouragement for its high-standard protection of the adjacent Linhares Reserve. However, a conservation education project was to be implemented by CVRD around the Linhares Reserve, adopting this species as the campaign's symbol (V. Velloso verbally 1987), but has apparently been shelved; it needs revival. Searches of other remaining forest tracts within the species's range for unknown populations has been urged (Gochfeld and Keith 1977) and partially achieved more recently (Gonzaga *et al*. 1987, Collar and Gonzaga 1988, da Silva and Nacinovic 1991); the discovery that unprotected relict populations may survive in 3,000-5,000 ha forest patches around Camamu must be followed up with thorough investigations and, if results are positive, strong action to maintain and manage the sites. Meanwhile, surveys are still needed, especially at Rio Doce State Park, Monte Pascoal National Park and Una Biological Reserve to assess the species's status more accurately in these areas. Ecological research on the species at Linhares to start permanent monitoring has also been suggested (Collar *et al*. 1987, Collar and Gonzaga 1988).

Captive breeding and (re)introduction The fate of the stock introduced to the Caratinga and CENIBRA Reserves needs to be monitored and reported. Certain other areas exist where attempts might be made to introduce captive-bred birds, e.g. Fazenda São Joaquim and the nearby Córrego do Veado Biological Reserve (see IBAMA 1989, Oliver and Santos 1991), but only if sufficient wardening could be provided to prevent all stock being poached out. Oliver and Santos (1991) provided an inventory of other smaller reserves within the species's range. G. T. de Mattos (*in litt*. 1992) has suggested that bolstering the population in Rio Doce State Park would be welcome; however, this would need to be done only after careful evaluation of the health of the birds to be reintroduced (see Black 1991 for general guidelines).

REMARKS (1) Detailed comparisons of skins of the Red-billed Curassow and Wattled Curassow *Crax globulosa* (see relevant account) reveals that "the males are sometimes indistinguishable and the females very similar" (Teixeira and Sick 1981). The two forms cannot, however, be considered conspecific, as the Wattled Curassow does not possess the low, booming song of the Red-billed (Delacour and Amadon 1973). (2) Calling the habitat "Amazonian primary forest" (King 1978-1979) is misleading, although the habitat certainly resembles Amazonian forests in its components (Rizzini 1979).

1992 Threat categories