GLAUCOUS MACAW *Anodorhynchus glaucus* **E/Ex**[4]

The possibly extinct Glaucous Macaw was formerly fairly widespread but clearly very local in south-central South America in northern Argentina, southern Paraguay, north-eastern Uruguay and Brazil from Paraná state southwards, being mostly found along major rivers where it nested in cliffs; the species is now so rare as to be considered extinct, but claims that the cause of its decline must have been natural are made in ignorance of the impact of human colonization of the river systems where it occurred, since it is clear that gallery forest destruction, disturbance at breeding colonies, direct human exploitation and, perhaps most importantly, agricultural development of palm savannas, were likely to have been major influences.

DISTRIBUTION The Glaucous Macaw (see Remarks 1) appears to be or have been endemic to the middle reaches of the major rivers (Uruguay, Paraná and Paraguay) and adjacent areas and watercourses in south-eastern South America, with most records coming from Corrientes province, Argentina. Considerable difficulty attends the elaboration of records owing to problems in tracing all relevant material, the vagueness of old accounts, the ways they have been mediated by subsequent literature, and some doubts about the identity of the species in question. There have been only two acceptable records this century, one direct (in Uruguay in 1951) and one indirect (based on local reports in Paraná, Brazil, in the early 1960s).

Argentina Firm records are from the north-east of the country in north and central Corrientes province (see Remarks 2), with more circumstantial reports from southern Misiones, eastern Chaco and even possibly Entre Ríos and Santa Fe; there is also a skin in MHNG simply labelled "Frontière du Paraguay, Rep. Argentina". Nores and Yzurieta (1988b) thought the species would also have penetrated eastern Formosa. The evidence that follows is presented roughly from north to south.

Chaco Chebez (1986a) noted that a writer a century before (Fontana 1881) had listed the Glaucous Macaw as a bird of the Chaco, i.e. Chaco province (but also presumably Formosa), without evidence.

Misiones Dabbene (1910) cited a source for the species from the province "on the río Uruguay", and Misiones was subsequently listed as part of the species's range by Pereyra (1943, 1950) and King (1978-1979), regarded as probable by Forshaw (1989), but omitted by Ridgely (1981a); Ridgely (1979) also wrote that "despite its being mentioned as occurring around Iguaçu Falls, there is no present evidence for its doing so, on either the Brazilian or Argentinian side" (the source of such reports is unknown).

Corrientes De Azara (1802-1805) recorded the species personally from between 27 and 29°S, while A. d'Orbigny communicated to Bourjot Saint-Hilaire (1837-1838) that his records were from between 27 and 31°S; however, it would appear (see Remarks 3) that on the Paraná d'Orbigny only found the species as far south as Santa Lucía, which is almost exactly at 29°S. D'Orbigny himself only treated the species incidentally in a general narrative of his travels, the first mention being of a bird collected in July 1827 in the Rincón de San Luís, on the northern arm of the río Batel (d'Orbigny 1835: 168), i.e. in the Batel marshes (28°30'S 58°20'W in OG 1968); this is evidently the source of the record from what Chebez (1986a) called the Rincón Batel or "esteros Batel", and which he considered the southernmost record of the species; the skin may well be the one now preserved in MNHN, labelled simply "Corrientes" (Chebez 1986a; see Remarks 4). Two further specimens from Corrientes collected on 1 August 1854 (in USNM) were evidently taken on the río Riachuelo, just south of Corrientes town (see Remarks 5, 6). Chebez (1986a) indicated that d'Orbigny found the bird near Corrientes town itself, but this was a generalization, not based on a specific record in d'Orbigny (1835) (J. C. Chebez *in litt*. 1992). D'Orbigny (1835: 219-221) himself referred to encountering the species on the westward-flowing stretch of the Paraná, first at Iribucua (see Remarks 7) and immediately afterwards upstream at (and a little upstream from) Ita-Ibaté ("Itá Ibaté", at 27°26'S 57°20'W, in Paynter 1985), apparently on a south-east-facing cliff on an island in the Paraná (see Remarks 8).

Entre Ríos/Santa Fe The species was reported by local people to de Azara (1802-1805) to extend – apparently on the río Paraná (i.e. the río de la Plata of de Azara's title) – as far south as 33°30'S, which if true would take the range into southern Entre Ríos and, across the river, Santa Fe.

Bolivia Two chicks were reputedly taken from a nest, sometime before 1983 or 1984, between Santa Cruz (Santa Cruz province) and Corumbá (in Brazil on the Bolivian border); for this and other "evidence"

concerning Bolivia, see Remarks 9.

Brazil Evidence for the occurrence of the species in Brazil is not primarily based on the authority of skins – except for two very old specimens simply labelled "Brazil" in MCML (Fisher 1982) and MCZ – or of competent ornithologists, but remains highly impressive at least in three instances.

Rio Grande do Sul The naturalist F. Sellow found a blue macaw nesting in holes in rock cliffs at Caçapava do Sul around New Year 1824 (see Stresemann 1948; identity as Glaucous Macaw accepted by Belton 1984-1985, Sick 1985). The species was reported from the east banks of the Uruguay river in the eighteenth century (Sánchez Labrador 1767), and although this might refer equally to present-day Uruguay as to Rio Grande do Sul, it seems most likely to have referred to both.

Santa Catarina Sick *et al*. (1981) concluded that Glaucous Macaw was the subject of a passage in a text by de Saint-Hilaire (1851) in which he reported finding relatively small, blue-green macaws with yellow eye-rings common along part of the coast near Laguna (although not seen in other regions) in 1820: before arriving at Laguna he passed an island actually called Ilha das Araras because it was a resting place for birds of this species. Sick (1985) appeared somewhat more tentative in his view of this record, but the details are at least as convincing as any other early traveller's record (see Remarks 10), even if the locality is somewhat more anomalous.

Paraná A blue-green macaw with yellow at the base of the bill, smaller and rarer than the Green-winged Macaw *Ara chloroptera*, was reported by locals as living on the steep banks of the rio Iguaçu in the south-west of the state at roughly 26°S 52°W, 1961-1964; this equally can only have been Glaucous Macaw (Straube 1988). This evidence gives strength to the unsupported reports from the Iguaçu Falls (see under Argentina). There is in addition the curious testimony of a letter from G. Rossi dalla Riva in southern São Paulo state (Miracatu) in April 1970, who wrote "it seems certain that the [species] nests in a locality not very far from here (a locality that... I prefer not to reveal otherwise local collectionists would immediately send their hunters and trappers)" (Bertagnolio 1981): it is not impossible that the locality in question was in São Paulo state.

Mato Grosso do Sul/Mato Grosso There is a claim for its survival along the Paraguay river north of Corumbá, plus a vague report of captive birds coming from between 15° and 16°30'S 60°W (Silva 1989a; see Remarks 9).

Paraguay Although Paraguay has always figured as part of the range of the Glaucous Macaw, the evidence is surprisingly tenuous, and seemingly based on ten or so skins and two testimonies from the eighteenth century (there is a remote possibility that the birds seen nesting at Ita-Ibaté were on the Paraguayan side of the Paraná: see Remarks 8). Thus Sánchez Labrador (1767) reported the bird rare on the río Paraguay, while de Azara (1802-1805) found the species only as far north as 27°S, i.e. just inside southernmost Paraguay (but mentioned the species from the Paraná and Uruguay rivers, omitting reference to the Paraguay: hence, doubtless, the question mark against the species in the country by von Berlepsch 1887). In addition, there are specimens labelled from Paraguay in MACN (Orfila 1936-1938), apparently two in RMNH (Finsch 1867-1868), two in BMNH, undated but received before 1859 and 1883 respectively, two in ANSP (undated but acquired by the museum in 1846 or soon afterwards: M. B. Robbins *in litt.* 1991), and two in AMNH, both of them London Zoo specimens (1886-1895 and 1898-1912). There is a wholly mysterious reference to "Río Pelotas, Kl.3 (Alto Paraná)" as a locality (Podtiaguin 1941-1945); there is a river of this name indicated (in Beyer 1886) as a small tributary of the upper Paraná (though not in the modern province of Alto Paraná) just south of Salto de Guaíra, i.e. at the easternmost point of the country. Searches in south-east Paraguay in July/August 1977 were fruitless, local people knew nothing of the species, and even dealers in Asunción, who were well aware of the potential value of a specimen, had never been able to obtain one (Ridgely 1981a).

Uruguay Sánchez Labrador (1767), de Azara (1802-1805) and d'Orbigny (in Bourjot Saint-Hilaire 1837-1838) all found the species on the Uruguay river, and although their records could have referred to the present Brazilian section as much as to the Uruguayan, it seems most likely that both were involved; and indeed there is good reason to interpret d'Orbigny's information to mean that he found the species as far south on the Uruguay as 31°S (see Remarks 3), i.e. through Artigas department into Salto. Burmeister (1856), Finsch (1867-1868) and Goeldi (1894) even asserted that its range extended as far south as

Montevideo, but without clear evidence (the latter two were doubtless copying the first, whose statements on species distributions are sometimes questionable); Tremoleras (1920) merely listed the species for Uruguay, although he provided more precise localities for species if known. It is wholly improbable that d'Orbigny's longitudinal limit was the cause of the subsequent listing of Artigas as a locality (Steullet and Deautier 1935-1946, SOMA 1935-1942), and the source of this information remains unknown; the species's one-time presence in Artigas has been treated as possible (King 1978-1979), probable (Ridgely 1981a, Forshaw 1989) or certain (Silva 1989a), while Cuello and Gerzenstein (1962) and Gore and Gepp (1978) assumed the bird to be probably (still) a rare or local resident in the north. A sight-record of the species by R. Vaz-Ferreira has come to light only recently (Nores and Yzurieta 1983; hence Chebez 1986a, Silva 1989a), and involved a single bird perched on a fence-post some 10 km south of Bella Unión in north-west Artigas, on the old road to Salto, in March 1951 (not 1950 as in the above references); surveys in this general area, 1952-1955 and 1978-1988, yielded no records, and the precise locality of the 1951 sighting has been altered by eucalyptus plantations (R. Vaz-Ferreira *in litt*. 1991). This record may conceivably have been known to Decoteau (1982), who made the otherwise unsubstantiated claim that "evidence now reveals that this bird could still be around in very small groups in Uruguay". Finally, there was apparently a pair of skins in ZMB from Uruguay (Finsch 1867-1868), a record which seems to have been overlooked (although today only an unlabelled male can be found there: G. Mauersberger *in litt.* 1991).

POPULATION Lack of records of the Glaucous Macaw both in the wild and in captivity for most of this century has led to the near-universal view of its probable extinction, always however accepting a remote chance of its survival (Vielliard 1979, Ridgely 1981a, Sick 1985, Chebez 1986a, Forshaw 1989). Only Silva (1989a) has claimed to have items of evidence that "incontrovertibly prove that it is extant" (see Remarks 9). If it does survive, its numbers must be extremely low (King 1978-1979).

In the second half of the eighteenth century the species was abundant ("muchísimas") on the east bank of the río Uruguay, becoming rare in the woods of the río Paraguay (Sánchez Labrador 1767). That de Azara (1802-1805) found it quite common along the río Paraná (Ridgely 1981a) somewhat exaggerates the record: in fact he merely reported seeing "some pairs" between 27° and 29°S. That d'Orbigny (1835) found it still common along the Paraná near Corrientes in 1827 (as suggested in Sick and Teixeira 1979, Sick 1985, Chebez 1986a) is similarly uncertain – the evidence under Distribution suggests that it grew commoner higher up the Paraná towards Misiones – particularly as it seems highly probable that the Glaucous Macaw was one (and perhaps all) of the "rare birds" obtained in 1854 just south of Corrientes by Page (1859; see Remarks 5), which suggests that its status in the area was then not strong. Indeed, in a much overlooked commentary on the species (reproduced in Remarks 3), d'Orbigny informed Bourjot Saint-Hilaire (1837-1838) that the birds were not very numerous. De Saint-Hilaire's (1851) record in 1820 from coastal Santa Catarina specified that though the species was common at the one locality it was never seen elsewhere on his (extensive) travels. Overall, the species may have been fairly or at least locally common for perhaps the first third of the nineteenth century, but no museum specimens are known to have been obtained directly from the wild after 1860 (see Remarks 6), and only very small numbers of captive birds apparently came into trade thereafter: three in Amsterdam Zoo, from at least 1862 to at least 1868 (Silva 1989a); several in Hamburg, 1878 (Silva 1989a); "several" in Antwerp Zoo in 1886 (*Proc. Zool. Soc. London* 1886: 320); two in London Zoo (the first stemming from Antwerp Zoo: see *Proc. Zool. Soc. London* 1886: 417) between 1886 and 1912 (these birds originating in Paraguay: see above); one in Berlin Zoo, 1892 (Neunzig 1921, Sick 1985); one in the Jardin d'Acclimatation, Paris, 1895-1905 (Sick and Teixeira 1980, Ridgely 1981a, Forshaw 1989), although Silva (1989a) gave its dates as 1896-1914; somewhere in Denmark, 1900, and the Netherlands, 1928 (Silva 1989a). Tavistock (1926) referred to it as "very seldom imported" (i.e. into Britain), which nevertheless indicates somewhat more than just the two in London Zoo; Smith (1991b) wrote confidently of one in Cambridge, U.K., "more than half a century ago". There was a specimen in Buenos Aires Zoo in 1936 (Orfila 1936-1938), and although it might equally have been a Lear's Macaw *Anodorhynchus leari* (Ridgely 1981a), it was seen by Porter (1938), who said that it had been there for over 20 years and was known to be over 45 years old ("evidently suffering from senile decay"); one was supposedly in the Netherlands in the 1970s (Silva 1989a), one in Sweden then or in the 1980s (J. Cuddy verbally 1992), and another or others in Brazil in the mid-1970s (Silva 1989a), one of these belonging to G. Rossi dalla Riva, apparently from the site he claimed existed near São Paulo, and which died in January 1976 (Bertagnolio 1981), although Low (1986) thought any

such specimen could have been *leari*; Low's (1986) own report of a specimen in Australia is regarded with scepticism by Forshaw (1989). Decoteau's (1982) claim of a breeding pair in Europe at the time of his writing is mystifying. Reports of extant birds in a British newspaper (*Mail on Sunday* 2 June 1991 and 29 March 1992) are unsubstantiated.

Because this species became rare before or early in the second half of the last century, its documentation in the literature virtually does not exist. A report in 1895 that the species was very rare in north-east Argentina (see Holmberg 1939) appears to have been repeated in 1959 (Forshaw 1978), with no fresh evidence from the field. Sick and Teixeira (1979) seem to be the first to point out that the species had not been seen anywhere this century (which was an accurate assessment then, only seriously challenged now by the records from Paraná and Uruguay), although Forshaw (1978), in calling it extremely rare, had not then regarded it as extinct except in Brazil. It was evidently the conclusions of Ridgely's (1979, 1981a) field- and deskwork that pushed opinion towards the view that the Glaucous Macaw is probably extinct throughout its range.

ECOLOGY The dependence of the Glaucous Macaw on riverine habitats (including their fringing subtropical forest) is strongly suggested by the consistency with which records (see Distribution) derive from along major rivers. It is possible, of course, that these records reflect true habitat choice less than travellers' dependence on river transport, and certainly it is fair to suggest that the species ranged away from the rivers into the "lightly wooded savannas", like other *Anodorhynchus* species (Ridgely 1981a, Forshaw 1989), a view to which d'Orbigny's (1835) hitherto insufficiently considered record from marshland in the Rincón de San Luís, and de Saint-Hilaire's (1851) from coastal Santa Catarina, lend weight. Nevertheless, d'Orbigny's generalizing notes to Bourjot Saint-Hilaire (1837-1838) referred to the species keeping to the interior of littoral woodland, and Sánchez Labrador (1767) noted its abundance in the forests ("bosques") on the east bank of the Uruguay, so that altogether the fragmented image is one of a species which, like Lear's Macaw (see relevant account), is at least partly constrained by use of traditional nesting and roosting sites in cliffs, and which therefore occurs locally, but then relatively commonly, where such cliffs exist (which, in the region in question, may have meant principally along rivers). For all this, Olrog (1984; hence presumably also Canevari *et al.* 1991), from undisclosed sources, noted the species as reported from savannas and "bosques de pino de Brasil" (*Araucaria angustifolia* pinewoods), and Chebez (1986a), also from undisclosed sources, as woodland ("parque") or forest or scrub patches surrounded by grassland and marsh or palm-covered zones near steep-banked rivers (in both cases the habitat simply represents the prevalent vegetation types in the region: J. C. Chebez *in litt.* 1992); for "pantanal" as habitat, see Remarks 9. De Saint-Hilaire's (1851) record from Santa Catarina concerned birds gathered on an evidently low island in a river or lagoon close to the sea, with adjacent terrain also low and covered in scrub; it was mid-May, and the island was apparently used for roosting and resting; from context (see Remarks 10) it does not appear that any rock-faces could have been in the vicinity, and the consideration arises that possibly this record refers to wintering immigrants from the interior.

The importance of palms is suggested by Goeldi's (1894) casual and unattributed report that the species feeds on the nuts of tucum and mucujá, which evidently led Sick (1985) to write that it "lived in valleys with palms (tucum, mucujá)" (this is evidently assumption, based on Hyacinth Macaw *Anodorhynchus hyacinthinus*: see Remarks 11). De Azara (1802-1805) merely remarked that its food consisted only of fruits, seeds and dates, while Silva (1989a), in recording that the bird's food is undescribed, said it was believed to be the fruit of "*Atalea*" (i.e. *Scheelea*) *phaletera*. In fact, d'Orbigny informed Bourjot Saint-Hilaire (1837-1838) that its food was the kernel of various types of palm (see Remarks 3). Recent analysis of bill structure and nuts from palms in the region, involving comparisons with Lear's and Hyacinth Macaws, which are both heavily dependent on palm nuts (see relevant accounts), has indicated that, as might be expected, the Glaucous Macaw was adapted to consume palm nuts as its staple, the only palm within its range showing the appropriate size and type of nut being the palmera yatay or chatay *Butia yatay* (C. Yamashita and M. P. Valle *in litt.* 1991), and this perception has provided the clearest explanation for the species's extinction (see Threats). Most interestingly, J. C. Chebez (*in litt.* 1992) has traced a reference (Martin de Moussy 1860) that states that the fruits of the yatay were indeed the basic food of the Glaucous Macaw (see Remarks 12).

The importance of rivers is suggested by records of birds nesting in the river banks: de Azara (1802-1805) noted that they nested in both tree holes and vertical river banks, more frequently in the latter, along both the Paraná and Uruguay; d'Orbigny (1835), on 20 December 1827, observed pairs occupying

the "enormous holes that they dug in the cliffs to make their nests", and F. Sellow recorded it nesting (at New Year) in holes in cliffs at Caçapava do Sul (see Stresemann 1948, Belton 1984-1985). That two eggs were laid (Goeldi 1894, Orfila 1936-1938) seems reasonable, but twice a year (Goeldi 1894) does not (see Remarks 11).

THREATS The apparently rapid decline of this species, when there was little habitat destruction or disturbance and when hunting pressure could not have been strong, was regarded as somewhat mysterious by Ridgely (1981a), Sick (1985) and Forshaw (1989), who speculated (or agreed with speculation) that natural phenomena – such as disease or a cold period that reduced its food supply – could have been responsible; Low (1984) even claimed that "man played no part in its extinction". As Ridgely (1981a) pointed out, though little subtropical forest survives in Brazil there is (or was in the late 1970s) much left in south-east Paraguay and north-east Argentina, and even a good deal of gallery forest; moreover, if confinement to gallery forest had made it more vulnerable to hunting, other game species survived in them well enough. However, the fact that in the 1820s the species was still apparently fairly common at least in Argentina (see Distribution, Population) suggests that its decline may have come half a century later than assumed above; moreover, the fact that extensive habitat remains in Paraguay and north-east Argentina, i.e. Misiones, is of no particular significance if, as the evidence mustered under Distribution suggests, the species barely penetrated Paraguay and in Misiones it was only present in the south.

Chebez (1986a) thought that the navigation and settlement of the Paraná and Uruguay rivers probably transformed conditions along them, and this is borne out by (e.g.) various references in d'Orbigny (1835) to the widespread clearance of trees on the shores of the Paraná between Corrientes town and Misiones, including the cutting of palms (C. Bertonatti *in litt.* 1991). J. C. Chebez (*in litt.* 1992) has added that Corrientes was founded as early as 1588, and has therefore been the focus for man-induced changes in the region for over four centuries. The evidence that the species was dependent on palm nuts (see Ecology) points to the most likely cause of its demise, for, as indicated above, settlement of the major river basins within the species's range was accompanied by the widespread loss of palm groves, either through direct clearance (yatays indicated good soils for agriculture) or through the total suppression of regeneration by the colonists' cattle, which were already an economic mainstay of the region when de Azara was there (C. Yamashita and M. P. Valle *in litt.* 1991, J. C. Chebez *in litt.* 1992).

Chebez (1986a) also thought that the size and appearance of the bird made it a significant target for hunters, and even that the taking of young as pets – a tradition extending back into the eighteenth century – could have been important. Again, d'Orbigny recorded its use as food (see Remarks 3 and 7), and if this was a widespread habit among travellers, merchants and prospective settlers, and if, as indeed seems likely, the Glaucous Macaw was closely associated with riverine cliffs along major navigation routes, it is easy to see how it might have been exploited for food or sport at quite different rates or at least with quite different results from the other game species dwelling in gallery forests; and it would appear consistent with the evidence that the species's major period of decline was only after 1830 and possibly not until 1850.

Obviously any modern trade in eggs, skins or live specimens of the species, if still extant, could be very harmful (Bertagnolio 1981, Silva 1989a). Inquiries made in Argentina over the past 10 years reveal that only one bird-exporter had reliably seen a Glaucous Macaw in captivity, many years before: but even this indicates that the species was indeed in trade at one stage (C. Bertonatti *in litt.* 1991). Rumours of birds in trade in Brazil in 1979 (Sick 1981), presumably refer to the birds Silva (1989a) claimed to be in captivity in the mid-1970s (see Population); Silva (1989a) also reported that four birds were imported into the U.S.A. in the 1980s, and it is very obvious from his account that keen interest in the species exists amongst dealers and aviculturists.

MEASURES TAKEN The Glaucous Macaw is protected under Brazilian law (Bernardes *et al.* 1990) and has been listed on Appendix I of CITES since its inception (King 1978-1979). Silva (1989a) claimed to be keeping secret the exact site of his supposed extant population (see Remarks 9) as an alleged protection against traders and trappers, although he admitted sharing this secret with E. Koopmann and his daughter G. Cáceres, bird dealers from Asunción, Paraguay, at whose home two young Spix's Macaw *Cyanopsitta spixii* were seized in 1987 (see Measures Taken and Remarks 14 in the relevant account).

MEASURES PROPOSED Chebez (1986a) has called for a careful survey of all rivers and gallery forest

in Argentina to see if a population cannot be found; this forlorn sentiment may be echoed with respect to northern Uruguay and the remoter regions of southern Brazil from Rio Grande do Sul north through Santa Catarina to Paraná. Remoter marshland areas of northern and western Corrientes where rich stands of palm, particularly the chatay, may still perhaps occur should also be considered for searching. It ought to be possible to revisit some of the old sites for the species, if only to discover if subfossil remains exist (e.g. in the cliffs near Itá Ibaté or at Caçapava do Sul). Meanwhile Silva (1989a) planned to visit the area of Brazil in which he claimed the species survives (see Remarks 9, including the last sentence where a second proposed search is mentioned) to assess numbers there and at a nearby reputed locality, and to set in motion plans for habitat conservation; but whether anything has resulted is not clear. Silva (1989a) has also called for the management of birds said to be in captivity in California so that they begin breeding, although Clubb and Clubb (1991) express scepticism over the existence of any such stock and indeed the value of any such actions.

REMARKS (1) Glaucous and Lear's Macaws are so closely related that they could be treated as races of one species (Forshaw 1989, Smith 1991b), and certainly with Hyacinth Macaw they form a superspecies (Vielliard 1979, Sick and Teixeira 1980). All three – hence the genus *Anodorhynchus* – are now at risk, both Glaucous and Lear's being highly critical.

(2) Faced with the quality of evidence concerning Corrientes (for which see also Remarks 12), it is staggering that Meyer de Schauensee (1966) could blindly follow Olrog (1963, 1979) in asserting that "there is no authentic Argentine record of this bird", and that he could continue to exclude the country from its range (Meyer de Schauensee 1970, 1982).

(3) Bourjot Saint-Hilaire (1837-1838) reported that d'Orbigny "a recontré le Guacamayo bleu depuis le 27° jusqu'au 31° latit. australe, aux bords de l'Uraguay [*sic*], du Parana, et jusqu'à Sainte-Lucie di [*sic*] Corrientes"; since Santa Lucía is on the Paraná, it seems reasonable to deduce that the 31°S refers to the río Uruguay, which conforms well with other evidence presented under the country of the same name. D'Orbigny's neglected notes to Bourjot continue: "Ces individus ne sont pas très-nombreux; ils se tiennent dans l'intérieur des bois du littoral, sont sédentaires, vivent par couples, timides, peu querelleurs; ont le vol lent, droit, prolongé; ne se posent jamais à terre, mais passent de branches en branches; vivent de l'amande du noyau des différents palmiers; nichent dans les falaises des rivières, et ont un cri désagréable... On mange leur chair." Given the great value of this testimony, it is mystifying to find Finsch (1867-1868) describing Bourjot's entire text as "mit grosser Leichtfertigkeit behandelt und gänzlich werthlos" ("put together with great sloppiness and totally worthless"), unless he felt (though he did not say) that it simply referred to the wrong species (see Remarks 8).

(4) A Boucard skin from Corrientes was exhibited in London in 1879 (*Proc. Zool. Soc. London* 1879: 551), which may have been that from MNHN, as both BMNH skins are from Paraguay. The MNHN skin from Corrientes (there is another, from "Buenos Aires") is also labelled "Flamant Corrientes", but it is not clear that a specific locality is thereby intended, and in any case none has been traced on nineteenth century maps of the province (NJC).

(5) The collector of the USNM material was T. J. Page, who provided a general narrative of his explorations at that time in Page (1859): although no dates are attached to his activities between an entry for 4 July and another for September 1854, his account makes it clear that most of this time was occupied with a hunting trip, introduced (p.264) as follows: "Wishing to see the country adjacent to the river during the rainy season, and with the hope of adding something new to our collections, I determined to make a little boat-cruise up the Riachuelo, a small stream that rises in the interior and empties into the Parana nine miles below Corrientes. I was fortunate in obtaining some rare birds..." The species is listed in an appendix of birds as *Anodorhynchus cinereus* (Cassin 1859).

(6) There is a third specimen in USNM, not labelled from Corrientes but, like the other two, tagged as collected during the "Exploration of the Paraná: Capt. T. J. Page"; another hand has pencilled in "March 1860", i.e. six years after the other two, suggesting possibly a different provenance. This is the specimen mentioned by Ridgely (1981a) as the last wild bird collected, and hence the date of 1860 repeatedly crops up as a key date in the species's history, after which it is seen as extremely rare. Regrettably, Page appears to have published nothing on his second exploration of the river. A complete review of Page's material in USNM might allow some reconstruction of his itineraries, though this is doubtful; but it is worth noting that in March 1860 he also collected a specimen of Bearded Tachuri *Polystictus pectoralis* at "Irarana", which seems likely to have been in Chaco or Corrientes (see Remarks 2

under Strange-tailed Tyrant *Yetapa risora*).

(7) Iribucua, though untraced by Paynter (1985), is marked on a map in Parchappe and d'Orbigny (1835) as at approximately 27°20'S 57°50'W, and d'Orbigny (1835: 219) described it as 24 leagues (roughly 120 km) from Corrientes. It is not, however, clear that Glaucous Macaw was collected precisely at this locality. The relevant passage, coming in a section concerning embarcation at Iribucua, reads: "Nous étions réduits à vivre de notre chasse, consistant en canards musqués, en pénélopes et en aras bleus; mais la chair de ces oiseaux est si coriace, que je ne pouvais en manger."

(8) The relevant passage (d'Orbigny 1835: 220) reads: "...nous démarrâmes [from Ita-Ibaté] et fîmes force de rames contre le courant... Une falaise élevée, couverte de bois, était à notre gauche; à droite s'étendait le Parana, qui, lorsque sa rive opposée n'était pas masquée par des côtes, nous offrait presqu'une lieue de largeur; et, au-delà, le territoire du Paraguay. Tout le long de la falaise, on voyait disséminés des couples d'aras d'un bleu glauque, dont les échos des bois répétaient incessamment les cris aigus. Chaque couple se montrait soit sur le bord des énormes trous qu'ils se creusent dans les falaises, afin d'y déposer leur nichée, soit perché sur les branches pendantes des arbres qui couronnent la côte". If the cliff was on the left and they were rowing against the current, the cliff was either on a riverine island or else in Paraguay. It would be barely worth noting that Finsch (1867-1868) considered that these observations referred "without doubt" to Hyacinth Macaws *A. hyacinthinus* (he was, in this, without doubt wrong), were it not for his extraordinary dismissal of everything (including notes by d'Orbigny) written about the Glaucous Macaw by Bourjot (see Remarks 3 above).

(9) Silva (1989a) gave four pieces of evidence that "incontrovertibly" establish the continued existence of the Glaucous Macaw. The first of these, (a), Vaz-Ferreira's 1951 sight-record, can be dismissed merely on the subsequent 40-year time gap (but also on the evidence provided under Distribution for Uruguay concerning subsequent search-efforts in the relevant region). The other three refer to (b) a chick offered for sale, (c) several specimens in trade, and (d) a 1988 sighting by a hired trapper. The chick story (b) derives from an apparent avicultural acquaintance of Silva's who declined the offer of a curiously coloured Hyacinth Macaw chick (taken with its sibling in Bolivia somewhere between Santa Cruz and Corumbá) and then decided it might have been a Glaucous; this is patently unacceptable as hard evidence. The specimens in trade story (c) concerns four Glaucous Macaws supposedly finding their way into California ("vehemently denied, but two knowledgeable sources confirmed that they were indeed *glaucus*"); this, too, is unacceptable until the birds are produced and their identity proven. However, the story's authenticity is assumed to be bolstered by C. Cordier reporting to Silva that, just before this shipment, he had seen Glaucous Macaws in a Bolivian dealer's compound, and that they came from the borderland area of Bolivia and Brazil at 15°-16°30'S 60°W; Silva invoked the authority of J. Delacour to certify Cordier's competence in this matter, although the area indicated by the coordinates is completely different from that where Silva then asserted the species survives, as if this anomaly were of no significance to the overall veracity of his case. The location of the 1988 "sighting" (d) was in the Pantanal on the eastern edge of the Paraguay river, i.e. inside Brazil, and the hired trapper who reported the sighting also reported being told of a cliff site for the species on the western edge of the same river; this trapper was the man who reputedly caught a Glaucous Macaw in the 1970s which went first to Germany and then "reportedly" (the word is Silva's, although later in his account he omitted this qualification) to the Netherlands. All this amounts to is hearsay: the man who saw the chick could have been mistaken; the California shipment could all be an inflated rumour; Cordier's testimony is flimsy; and the trapper's powers of identification might not be quite sufficient.

The story of the sighting (d) differs somewhat from an apparent version of the same in Smith (1991b): while Silva said the trapper had previously caught a specimen in the 1970s, Smith said that up to around April 1988 the trapper had never seen the like of such a bird; and while Silva only agreed to work with the trapper (from the chronology this appears to be shortly before February 1988) so long as none of the birds was caught, Smith reported that the man in question actually caught three in around April that year, although these somehow ended up in the hands of his employer's rival (i.e. cannot be traced). Smith (1991b) also claimed that trappers in Bolivia had encountered the same bird "which was widely scattered"; moreover, Smith (1991b) gave credence to a British newspaper report in June 1991 that the species was being offered for sale in Argentina, and disclosed that a third-hand report by a British peace-worker had identified an area in Bolivia where the species still survives and to which he (Smith) would be travelling in 1991/1992.

(10) De Saint-Hilaire (1851) was travelling from Villa Nova to Laguna, and the relevant passage

(p.377) reads: “La première pointe qui se présenta à nous s'appelle Tapiruva... Avant d'y arriver nous passâmes en face d'un îlot inhabité qu'on nomme *Ilha das Araras* (l'île des aras), parce qu'il sert d'asile à une espèce d'aras communs sur cette côte et que je n'avais encore recontrées nulle part. Ces oiseaux, dont le plumage est d'un bleu verdâtre, ont le tour des yeux jaune; le seul que je vis de près me parût plus petit que l'espèce commune. Entre la pointe d'Embituva, que j'avais laissée derrière moi depuis quelques jours, et celle de Tapiruva, le terrain, à une faible distance de la mer, s'élève un peu, et l'on y voit des arbrisseaux d'un vert foncé pressés les uns contre les autres. Après avoir passé derrière la pointe de Tapiruva, nous nous trouvâmes sur une seconde plage... En cet endroit, les sables s'étendent fort loin de la mer, et au délà de cet espace entièrement nu on ne voit qu'une végétation maigre...”

(11) Goeldi's (1894) and Orfila's (1936-1938) stated source for the breeding information is de Azara; but there is nothing confirming these attributions in the relevant pages of de Azara (1802-1805). Goeldi's (1894) source for the dietary information was evidently his own imagination, as he introduced it with the phrase “ao que parece” (“as it seems”): he had presumably read Finsch (1867-1868) on Hyacinth Macaw, who said its chief food was nuts of mucujá *Acrocomia lasiospatha* and tucumá *Astryocaryum tucuma* (this itself being based on Bates 1863: see Remarks 3 under Hyacinth Macaw), and had extrapolated from that; in this regard it is worth noting that Goeldi's rendering of d'Orbigny's experience (“for some time he lived exclusively off the unpalatable meat of this macaw”) is completely mistaken (see Remarks 7 above), and thus scarcely enhances the reliability of the dietary information in his account.

(12) After describing macaws that are evidently Green-winged (in Misiones) and Blue-and-yellow *Ara ararauna* (in Paraguay), Martin de Moussy (1860) wrote: “La province de Corrientes possède un autre Ara plus petit, mais à longue queue comme les précédents, qui vit principalement dans les bois de palmiers, où il se nourrit du fruit du Yatai: sa couleur est violette.”