

*Perturbation and pollution (largely as direct and indirect consequences of deforestation) of the shallow, fast-flowing rivers that are this duck's habitat in south-central Brazil, eastern Paraguay and northern Argentina have led to its exceptional rarity and the isolation of very small numbers in distant reserves.*

**DISTRIBUTION** The Brazilian Merganser is restricted to south-central Brazil (Goiás, Minas Gerais, Mato Grosso do Sul, São Paulo, Paraná and Santa Catarina) and the neighbouring regions of Paraguay and Argentina (Misiones), in the basins of the upper Paraná, Tocantins and São Francisco rivers and on a single tributary (arroyo Soberbio) of the río Uruguay (see Remarks 1), with two old records from the rio Itajaí, Santa Catarina. Records generally refer to single birds observed or collected (exceptions are indicated), and coordinates are taken from OG (1968), Paynter (1985) and Paynter and Traylor (1991).

**Argentina** Misiones is the only province from where the Brazilian Merganser has ever been reported. Unreferenced records below are based on single collected specimens listed in Partridge (1956) and Johnson and Chebez (1985), localities (north to south; see Remarks 2) being: arroyo Yacuy (25°34'S 54°11'W), October 1947 (see Remarks 3); Saltos del río Iguazú, before 1914; close above the Iguazú falls, April 1956 (Delacour 1959); Garganta del Diablo (the largest waterfall on the río Iguazú), where a pair with young was observed sometime between 1942 and 1950 and another pair was seen in 1977 (Johnson and Chebez 1985); Destacamento Apepú, Iguazú National Park, 1978 (Johnson and Chebez 1985); arroyo Urugua-í (25°54'S 54°36'W; see Remarks 4), in the years 1947-1954 (26 specimens in AMNH, BMNH, FMNH, MACN, MNRJ, UNP, USNM, YPM; see Remarks 5), July 1960 (specimen in LACM), June 1984 (three birds observed; exact localities in Johnson and Chebez 1985), August 1985 (Forcelli 1987) and July 1988 (Luthin 1988); arroyo Uruzú (25°55'S 54°39'W), sometime between August and September 1986 (P. Canevari *in litt.* 1992) and January 1989 (A. Johnson, A. Giraud and J. C. Chebez *in litt.* 1992); arroyo Aguaray-guazú (26°08'S 54°39'W), May 1948; arroyo Piray-miní (untraced but in Eldorado department, at 26°15'S 54°25'W), where a bird was collected in the 1970s (J. C. Chebez *in litt.* 1992); arroyo Piray-guazú (26°27'S 54°42'W; see Remarks 6), May and September 1951 and August 1952; arroyo Tigre (a tributary of the arroyo Piray-guazú; see, e.g., the map in Johnson and Chebez 1985), 1977 (Johnson and Chebez 1985); arroyo Paranay-guazú (26°41'S 54°48'W), where a pair was reported in 1984 (M. Nores *in litt.* 1984 to W. Belton); arroyo Garuhapé (26°47'S 54°56'W), September 1882; arroyo Mandarinas (a tributary of the arroyo Soberbio, 27°15'S 54°12'W, the only tributary of the río Uruguay on which the species has ever been recorded), where several birds were observed in November 1953 (Johnson and Chebez 1985); arroyo Victoria (26°52'S 54°39'W; another tributary of the arroyo Soberbio), November 1969 (Johnson and Chebez 1985); Bonpland (= Bonplano, 27°29'S 55°29'W), April 1912 (see Remarks 7).

**Brazil** Records of the species from the states of Bahia and Rio de Janeiro are not accepted here (see Remarks 8). Localities (north to south) are:

*Goiás* rio das Pedras (a tributary of the rio Paranã), Nova Roma (13°51'S 46°57'W), June 1950 (Sick 1958); upper rio Tocantins, 1953, 1960 and 1972 (Sick 1985); rio Preto (14°05'S 47°42'W), headwaters of the rio Tocantins, Chapada dos Veadeiros National Park, where pairs were observed on five different occasions between October 1986 and January 1987 (coordinates and data from Yamashita and Valle 1990); Veadeiros, rio São Miguel, March and April 1940 (specimens in FMNH); Guardamor (= Guarda Mor, c.16°00'S 50°40'W), where five birds were collected in October 1823 (von Pelzeln 1868-1871); Emas National Park, where a pair was observed in August 1990 (A. Whittaker *in litt.* 1992);

*Minas Gerais* (see Remarks 9) ribeirão do Salitre, affluent of rio Quebra-Anzol, in the Serra Negra (c.19°17'S 46°55'W) at 900-950 m, near Salitre de Minas (= Salitre, 19°05'S 46°48'W), where two birds were seen sometime between June and August 1973 (G. T. de Mattos *in litt.* 1988 to H. Sick, G. T. de Mattos *in litt.* 1992); "Minas", probably on the rio das Velhas (a tributary of rio São Francisco, early in 1819 (Stresemann 1954; also Partridge 1956); rio São João (untraced but on the northern boundary of Serra da Canastra National Park), sometime between 1978 and 1980 (J. M. Dietz *in litt.* 1986); wetlands of the Serra da Canastra National Park, down to the present (Scott and Carbonell 1986, Bartmann 1988, M. Pearman *in litt.* 1990; see Population); Fazenda Boquerão (on the rio São Francisco, below Serra da Canastra National Park), currently (M. Pearman *in litt.* 1990, Gardner and Gardner 1990b; see Population);

*Mato Grosso do Sul* headwaters of the rio Sucuriú, mid 1940s (P. T. Z. Antas *per* D. A. Scott *in*

*litt.* 1992; specimen in MZUSP);

*São Paulo* unspecified, 1819 (Stresemann 1954; also Burmeister 1856); Salto Grande, rio Parapanema, May 1903 (Pinto 1938); Itararé (24°07'S 49°20'W), where a pair was observed (specimen in BMNH) in August 1820 (von Pelzeln 1868-1871);

*Paraná* Salto da Ariranha (c.24°22'S 51°27'W), on the rio Ivaí, November 1922 (Sztolcman 1926);

*Santa Catarina* unspecified (Burmeister 1856), including specimens taken in the state before 1871 (Stresemann 1935, 1954) and 1887 (in AMNH); Blumenau (von Berlepsch 1873-1874) and Taió (both localities on the rio Itajaí), 1827 (Stresemann 1948, Sick *et al.* 1981); Laguna, before 1877 (Mertens and Steinbacher 1955; see Remarks 10).

**Paraguay** According to Bertoni (1901) the Brazilian Merganser inhabited small streams along the Paraguayan side of the Paraná drainage in the department of Alto Paraná (see Remarks 11); his observations were from 1891. The only precisely known locality in the country is the río Carapá near Catueté (c.24°08'S 54°35'W, read from DSGM 1988), Canindeyú department, where a bird was observed in February 1984 (Scott and Carbonell 1986, N. López Kochalka verbally 1990).

**POPULATION** The Brazilian Merganser's overall population would appear to be extremely small, given that it is present only at a few scattered sites throughout its large range. There may in fact be only three small and isolated populations; one in Argentina (Misiones) and two in Brazil (Goiás and Minas Gerais). A total of around 250 birds (in Ellis-Joseph *et al.* 1992) represents a vaguely informed guess, and may indeed approximate to the truth, although on the evidence provided here the number could equally well be much less than 250.

**Argentina** Between 1942 and 1978 records of the species in Iguazú National Park included a group of up to three or four individuals and a pair with youngsters, the observer remarking that it was not a usual bird and never abundant (Johnson and Chebez 1985).

At least 30 specimens (26 from río Uruguay; see Threats, Remarks 12) were collected on the eastern rivers and streams that flow from the highlands in the interior of the province into the upper Paraná between 1947 and 1954, a time when the species was considered "not rare" although found in low densities (Partridge 1956; see also Distribution). In August 1951 two pairs had their feeding grounds in rapids on the río Uruguay near "km 10", the first occasion when more than two birds were observed together in Argentina (Partridge 1956). Subsequent records from the river occurred in 1960 (see Remarks 13) and 1984, when three birds were seen (Johnson and Chebez 1985), August 1985 (Forcelli 1987) and July 1988 (Luthin 1988), indicating that a small population is extant along its course. In the arroyo Paranay-guazú, the species has only been recorded once (a pair in 1984) despite the habitat there (up to 1984) still being in fairly good condition (M. Nores *in litt.* 1984 to W. Belton). The Brazilian Merganser is nowadays considered to be very rare and one of the most threatened species in Argentina (Canevari *et al.* 1991).

**Brazil** Stresemann (1954) believed that the species was apparently not rare around 1820 in the states of Rio de Janeiro, Minas Gerais and São Paulo (but see Remarks 8). The judgement a century later that the bird was "maybe vanishing" (Phillips 1929) was doubtless based on the chronic paucity of specimens. Sick and Teixeira (1979) considered it rare in Brazil, although they indicated that its status was little known. Its population certainly appears to be highly fragmented, the only two known remaining populations being in Serra da Canastra and Chapada dos Veadeiros National Parks (the recent record from Emas cannot yet be judged to reflect a resident population) in the states of Minas Gerais and Goiás, most of the other records listed under Distribution referring to old specimens or to sites where the species is likely to have been extirpated. In 1980, the population in the Serra da Canastra National Park and surrounding areas was estimated at about 50 pairs (Scott and Carbonell 1986), but between 1981 and 1985 Bartmann (1988) could only find two pairs within the park (on the upper rio São Francisco), with a third pair c.50 km downstream, and concluded that the estimate of 50 pairs was too high; he reported 23 sightings (mostly of pairs, once of three birds together) in 68 hours of observation. In the same general area (Fazenda Boquerão), the species is known to have been present during 1987, when five young were

reared, and in July 1989, when a pair with ducklings was observed (M. Pearman *in litt.* 1990). In the upper rio Tocantins drainage area, birds were been reported in 1950, 1953, 1960, 1972, 1986 and 1987 (see Distribution), overall numbers probably being very small; a pair was observed on five occasions in 1986 and 1987 (Yamashita and Valle 1990).

**Paraguay** Despite Bertoni's (1901) view that it was very rare, Partridge (1956) believed that a thorough search along the many tributaries on the western side of the Paraná drainage in Paraguay would probably reveal that the merganser's status there was similar to that in Misiones (i.e., "not rare"). This may have been true at the time, but extensive searches in canoe and on foot during July–September 1989 failed to detect the species along 105 km of the río Carapá, 22 km of the río Itambey, and 71 km of the río Ñacunday, and along accessible points of arroyo Pozuelo, río Yacuy Guazú and río Tambey (Granizo Tamayo and Hayes in prep., Hayes and Granizo Tamayo in press). The species's future in Paraguay is uncertain and recent ecological changes (see Threats) may have left too little habitat to permit a viable population (Granizo Tamayo and Hayes in prep.).

**ECOLOGY** The Brazilian Merganser is a shy inhabitant of silent streams and rivers flowing through remote, undisturbed forest, and prefers upper river tributaries interspersed with rapids and waterfalls from low elevations up to c.1,000 m where steep escarpments and deep valleys with gallery forests are present (Bertoni 1901, Partridge 1956, Johnson and Chebez 1985, Scott and Carbonell 1986, Bartmann 1988; see Remarks 14). On the rio Preto, Chapada dos Veadeiros, the habitat is cerrado, and the major requirement of the species is probably the presence of rapids and clear waters (Yamashita and Valle 1990), as suggested elsewhere (e.g. Partridge 1956, Johnson and Chebez 1985, Bartmann 1988, Granizo Tamayo and Hayes in prep.) rather than the type of vegetation bordering the rivers.

Brazilian Mergansers are good swimmers and dive with great agility in pursuit of fish; they feed actively during the day, especially in the morning and evening; feeding occurs mostly in shallow, fast-flowing waters (Partridge 1956, Bartmann 1988). Examination of 11 stomachs and gullets in Misiones revealed that the species feeds primarily on fish and occasionally on aquatic insects and snails; however, in one case 80% of the contents of the stomach and gullet consisted of remains of the larvae of a large dobson fly (*Corydalis*) and also a few (0.8%) snail shells (Partridge 1956). Fish size found in the gullet varied from 6 to 19 cm long, and these included mojarra (Characinidae), catfish (Pimelodidae), "virolito" *Parodon* (Hemiodontidae) (Partridge 1956). In the Serra da Canastra, Bartmann (1988) believed that the staple of adults was the "lambari" *Astyanax fasciatus* with sizes up to 15 cm, while ducklings fed on insects on the water surface or in the shallows with their heads submerged, probably consuming aquatic invertebrates (Trichoptera, Plecoptera, Diptera). Fish seemed to replace invertebrate food in the growing ducklings. The stomach of a female taken in November in Santa Catarina contained vegetable matter (Sztolcman 1926). "Fish" fauna in the rio Preto, Chapada dos Veadeiros seemed very poor, merely consisting of "lambaris" and small "cascudos" (C. Yamashita *in litt.* 1987)

The mergansers rest perched on stones, branches or fallen trees projecting from the water; they fly close to the surface following the river's course, increasing altitude to as much as 15 to 30 m when potential risks are present (Giai 1950, Partridge 1956). Rivers and streams in Misiones, Argentina, were believed to be inhabited by isolated, sedentary populations; pairs probably never leave their territory (Partridge 1956, Johnson and Chebez 1985, Bartmann 1988), and may spend their entire lives along one river or stream (Partridge 1956). Bartmann (1988) found that one pair with a duckling at the Serra da Canastra occupied a stretch of river estimated to be c.7 km in length. The breeding season runs from June, when birds in Argentina have been seen displaying (Giai 1950), with incubation in July and August (Partridge 1958). However, records of display in August (Partridge 1958) possibly indicate slight variation in seasonality (or, e.g., preparation for a replacement clutch). A nest discovered on 24 August 1954 was in a tree-cavity (*Peltophorum dubium*) c.25 m above water level (Partridge 1956). Flightless young have been reported throughout August, including the only known nest from which chicks left on 30 August 1954 (Giai 1950, Partridge 1956, Bartman 1988, M. Pearman *in litt.* 1990; see Remarks 15).

**THREATS** The Brazilian Merganser has been suffering from steady habitat loss as a result of human activities, the main cause of the species's decline probably being the increasing turbidity of rivers and streams throughout its range as a result of watershed degradation and erosion (Partridge 1956, Johnson and Chebez 1985, Scott and Carbonell 1986).

Among natural predators are the near-threatened Black-and-white Hawk-Eagle *Spizastur melanoleucus* (Giai 1951, Partridge 1956), otters (Bartmann 1988) and fish (Partridge 1956).

**Argentina** The riverine habitat of the Brazilian Merganser has suffered from staggering deforestation, especially since the 1950s, and from the construction of a dam on the arroyo Urugua-í which flooded large areas where the species had previously been reported by Partridge (1956), Johnson and Chebez (1985) and Forcelli (1987) including the area in which the only known nest was found (Chebez 1984, 1990, Johnson and Chebez 1985). In addition, the lower Urugua-í basin has been greatly transformed by reforestation with pines *Pinus elliotii* and *Araucaria angustifolia*; this has involved increasing human activity in the area with obvious negative consequences for the species (Johnson and Chebez 1985). Hunters searching for mammals on the riversides must have disturbed the mergansers and would occasionally have shot them (Johnson and Chebez 1985). From 1942 to 1978 the water quality of the río Iguazú deteriorated seriously, owing to deforestation in the upper basin of the river in Brazil; similar habitat degradation has also been noted in other streams in Misiones, namely Aguary-guazú, Garuhapé and Yabebirí (Johnson and Chebez 1985). The species's increasing rarity has resulted in transactions with local people of as much as US\$6,000 for a single stuffed specimen (Johnson and Chebez 1985), a problem already flagged in the 1940s by Giai (1976), although who was or is buying such material is not clear; Johnson and Chebez (1985) implied that museums might be involved. The collection of 26 specimens in the period 1947–1954 (see Population) cannot have helped the species.

**Brazil** Agricultural development, watershed degradation and soil erosion have occurred everywhere outside national parks and nature reserves within the species's range (Bartmann 1988). According to C. Yamashita (*in litt.* 1992), many small dams have extirpated considerable amounts of potential habitat. Extensive diamond mining occurs near the Fazenda Boquerão (M. Pearman *in litt.* 1990).

**Paraguay** The Alto Paraná region has suffered great changes in the last 15 years, including the construction of the Itaipú and Acaray dams, which flooded large areas of prime merganser habitat; deforestation has also caused land erosion and hence an increased amount of siltation in the watersheds (Granizo Tamayo and Hayes *in prep.*). Economic development of the area accompanied the construction of the dams, resulting in a large influx of people with inevitable new pressures on the environment (e.g. the use of pesticides in agriculture, which have already caused mass fish deaths: Granizo Tamayo and Hayes *in prep.*). Furthermore, Itapúa department has now been greatly deforested (F. E. Hayes *in litt.* 1991).

**MEASURES TAKEN** Very little has been done over the years to promote the long-term security of this interesting but problematic animal.

**Argentina** Some 55,500 ha of Atlantic forest are protected within the Iguazú National Park, but the scant records from the area show that this does not guarantee the species's survival in the country (Johnson and Chebez 1985). In 1988 the provincial government of Misiones – with considerable financial assistance

from ICBP (using a donation from the late J. S. Dunning) and Fundación Vida Silvestre Argentina – established two natural provincial reserves of great importance for the species, namely the Urugua-í (84,000 ha, incorporating the Islas Malvinas Provincial Park) and the Yacuy; this has resulted in the protection of the upper reaches of arroyos Urugua-í, Uruzú and Yacuy and, because these reserves are contiguous with the Iguazú National Park, a huge continuous protected area is now effectively in place (Chebez and Rolón 1989, J. C. Chebez *in litt.* 1992). Educational proposals emphasizing the importance of wildlife in general and the Brazilian Merganser in particular have been put to the government of Misiones by the Fundación Vida Silvestre Argentina and Asociación Ornitológica del Plata (see Johnson and Chebez 1985).

**Brazil** The species is protected under Brazilian law (King 1978-1979, Bernardes *et al.* 1990), and seemingly very small numbers are protected by the Serra da Canastra, Chapada dos Veadeiros and Emas National Parks (see Distribution). In the first of these, protection was regarded as excellent (Scott and Carbonell 1986).

**Paraguay** None is known apart from the unsuccessful searches conducted in 1989 (Hayes and Granizo Tamayo *in press*).

**MEASURES PROPOSED** The Brazilian Merganser has been proposed for inclusion on Appendix I of CITES (Johnson and Chebez 1985, Granizo Tamayo and Hayes *in prep.*; see Remarks 17). However, the overriding requirements are for more survey work throughout its range, monitoring of known populations, and further biological studies to clarify the ecological factors affecting such parameters as territory size and breeding success.

**Argentina** Proposals by Johnson and Chebez (1985) to protect and manage the upper reaches of the Urugua-í and to protect the entire Yacuy have been accepted and implemented (see Measures Taken), but there remain several further points to be addressed: (1) a thorough search of remaining populations using rowing boats, at least in the breeding season, should be conducted on the rivers and streams of northern and central Misiones, in the following order: upper Urugua-í and Yacuy basin, arroyo Piray-guazú and its tributary arroyo Tigre, arroyo Garuhapé, Aguaray-guazú, Yabebirí, upper río Iguazú, the arroyo Soberbio, San Antonio, San Francisco, Piray-miní and Paraíso; (2) regulations against hunting should be established and fully enforced; (3) an educational campaign should be launched to highlight the enormous importance of the wildlife of the province of Misiones with particular emphasis on the Brazilian Merganser (see Measures Taken).

On the evidence given by Bertoni (1901) and Partridge (1956), Johnson and Chebez (1985) did not recommend captive breeding.

**Brazil** It is very important to regulate the increasing amount of tourism in the Serra da Canastra National Park (Bartmann 1988), and those pairs breeding outside the park (e.g. Fazenda Boquerão and rio São João; see Distribution) should be afforded protection. A comprehensive study and survey of the birds both here and in the Chapada dos Veadeiros National Park are needed, and a broader investigation of possible sites in appropriate habitat throughout its potential range from Goiás south to the Argentina border is long overdue. Furthermore, the similar habitat requirements of the Brazilian Merganser and the Fasciated Tiger-heron *Tigrisoma fasciatum* (see Yamashita and Valle 1990) suggest that searches where the latter species was recorded in northern Goiás on the rio Piratinga, Formoso municipality (where habitat has great similarities with that in the Chapada dos Veadeiros National Park), would perhaps result in further localities for the mergansers (G. T. de Mattos *in litt.* 1992).

**Paraguay** Although most of the rivers considered likely to hold populations were visited in 1989, searches are still needed along the following ríos and arroyos: Piraty, Alto Acaray, Pozuelo and Guarapey; the relatively recent sighting of the species on the río Carapá (see Distribution) indicates the need for continued monitoring (it was surveyed without success in 1989) in order to ascertain whether the species may yet survive there (Granizo Tamayo and Hayes *in prep.*). The only chance for the species in the country lies in protecting what little habitat remains, especially along the río Carapá (F. E. Hayes *in litt.*

1991).

**REMARKS** (1) Meyer de Schauensee (1966, 1982) and thus presumably Blake (1977), Mayr and Cottrell (1979), Sick and Teixeira (1979) and Johnson and Chebez (1985) included the río Paraguay as part of the Brazilian Merganser's range. However, this is not supported by precise localities and was not indicated by earlier reviewers (e.g. Hellmayr and Conover 1948, Partridge 1956) or in recent extensive waterbird surveys (F. E. Hayes *in litt.* 1992). (2) Further details (e.g. exact collecting dates, collectors, age and sex of the specimens plus a map showing collecting localities) can be found in Partridge (1956) and Johnson and Chebez (1985). (3) Two additional specimens, taken at the same locality, were probably collected in 1949 (see Johnson and Chebez 1985). (4) Most specimen labels simply read "arroyo Urugua-í", but exact localities where birds have been reported feeding and nesting are "km 10" and "km 30" eastward from the río Paraná (Partridge 1956). (5) Birds collected from 1947 to 1954 were secured in every month from March to September; also in December. (6) The labels of two specimens in AMNH read: "Puerto Piray, 15 km" and "18 km" respectively; the reverse of the latter explains this as 18 km east of the río Paraná. Date or collector of two additional specimens from the same arroyo is not indicated (Johnson and Chebez 1985). (7) According to Partridge (1956) and Johnson and Chebez (1985), the specimen in question was probably procured on the río Yabebirí (north of Bonpland). (8) A specimen from "Bahia" taken before 1859 (Fisher 1981) was presumably a trade skin originating elsewhere in Brazil. The occurrence of the species in Rio de Janeiro was indicated by Stresemann (1954), but apparently as a guess. (9) De Mattos *et al.* (1985) claimed to have the first observations of the species in the state, but this is mistaken (G. T. de Mattos *in litt.* 1992). (10) This locality was regarded as uncertain (Mertens and Steinbacher 1955). (11) Bertoni (1901, 1914) referred to "Alto Paraná", presumably meaning the province, although in the former publication he indicated a latitude of 27°S, which corresponds to Itapúa department (where the species was most likely to be found). (12) Data are from the list of specimens provided by Johnson and Chebez (1985) plus specimens in BMNH, FMNH, UNP and YPM. (13) Johnson and Chebez (1985) referred to a lapse of 30 years during which the species was not recorded on the arroyo Urugua-í, evidently unaware of the specimen collected in July 1960 (see Distribution). (14) Von Ihering (1898) thought that the species might occur along the coast, but this has never been shown. It has been suggested that the species's apparent absence from the río Paraná is due to the dorado *Salminus maxillosus*, a serious threat to ducklings but absent from the smaller rivers whose cataracts bar the progress of migratory fish (Giai 1950, Partridge 1956). (15) Extensive information on the species's natural history (including nesting behaviour of adults) can be found in Partridge (1956) and Giai (1950, 1951 and 1976). (16) Argentina could unilaterally place the species on Appendix III, which would automatically prohibit trade out of the country.