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Distribution, abundance, and conservation of Vinaceous Amazons (*Amazona vinacea*) in Argentina and Paraguay

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ABSTRACT. Vinaceous Amazons (*Amazona vinacea*) are endemic to the Atlantic forest of southeastern Brazil, eastern Paraguay, and the province of Misiones in Argentina. We searched for Vinaceous Amazons throughout the western part of its range in Argentina and Paraguay during 1639 days of fieldwork from 1997 to 2006. These parrots have disappeared from most areas where they were historically recorded in these countries, and are now limited to a few sites in northeastern Paraguay and central Misiones (Argentina). We estimate the minimum remaining populations at 220 individuals in Paraguay and 203 individuals in Argentina. Important sites for the species are (1) the farming area from San Pedro to Tobuna (Misiones, Argentina) and (2) the Itaipú reserves complex and Reserva Natural Privada Itabó (Paraguay). In our surveys, Vinaceous Amazons were absent from the largest tracts of forest in Misiones, and were most often observed feeding, roosting, and nesting in small forest remnants and in agricultural areas that included forest fragments and isolated trees. Threats to amazons in these areas include nest poaching, forest clearing, and being shot as a crop pest. We confirmed 40 Vinaceous Amazons kept as pets in 35 homes between San Pedro and Tobuna. Environmental education and law enforcement are urgently needed to reduce threats in populated areas, and subsistence farmers need technical and logistical support to slow or stop the conversion of forest into cropland. Finally, additional study is needed to determine this amazon's habitat preferences, nest site requirements, and demography in different habitats.

SINOPSIS. **Distribución, abundancia y conservación del loro vinoso (*Amazona vinacea*) en Argentina y Paraguay**

El loro vinoso (*Amazona vinacea*) es endémico del bosque Atlántico del sudeste de Brasil, este de Paraguay, y la provincia de Misiones en Argentina. Buscamos esta especie durante 1639 días de trabajo de campo de 1997 a 2006, a lo largo de la porción oeste de su distribución, en Argentina y Paraguay. *A. vinacea* ha desaparecido de la mayor parte de las áreas donde ha sido registrada históricamente en estos paises, y permanece sólo en algunos pocos sitios del noroeste de Paraguay y del centro de Misiones (Argentina). Estimamos el tamaño mínimo de las poblaciones remanentes en 220 individuos en Paraguay y 203 individuos en Argentina. Los sitios importantes para la especie son: (1) la zona rural de San Pedro a Tobuna (Misiones, Argentina) y (2) el complejo de reservas de Itaipú y la Reserva Natural Privada Itabó (Paraguay). *A. vinacea* no fue encontrada en los tractos más grandes de bosque durante nuestras prospecciones en Misiones. Mayormente fue observada alimentándose, durmiendo y nidificando en pequeños remanentes boscosos y en hábitats antropogénicos. Las amenazas en estos hábitats incluyen robo de pichones de los nidos, deforestación, y cacería por daño a cultivos. Confirmamos la existencia de 40 ejemplares cautivos como mascotas en 35 hogares de San Pedro y Tobuna. Para reducir las amenazas se requieren urgentemente educación ambiental y fortalecimiento legal en las áreas pobladas. Es necesario proveer de apoyo técnico y logístico a los agricultores de subsistencia para reducir la conversión de bosques a cultivos. Finalmente, estudios futuros deberían tratar la preferencia de hábitat del loro, sus requerimientos de nidificación, y su demografía en distintos hábitats.

Key words: *Amazona vinacea*, *Araucaria angustifolia*, Argentina, Atlantic forest, conservation, distribution, Paraguay, parrot, poaching, Vinaceous Amazon

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Parrots are among the best loved of all birds, and, paradoxically, are also among the least known and most endangered (Collar 1997). Over a third of parrot species are threatened or near threatened, a higher proportion than in any other large family of birds (Collar 1997). Worldwide, parrots suffer from habitat destruction, trapping for pets, persecution as pests, and, in many cases, a combination of two or all three of these factors (Collar 1997).

The Vinaceous Amazon (*Amazona vinacea*) is a medium-sized parrot endemic to the Atlantic forest region of southeastern Brazil, eastern Paraguay, and the province of Misiones in Argentina (Collar 1997). In the last century, this amazon has disappeared from much of the northern part of its range in Brazil (Collar et al. 1992), and populations have also declined elsewhere (BirdLife International 2004, 2005). Remaining populations are fragmented and the species is considered globally Vulnerable (BirdLife International 2004, 2005).

Among the factors contributing to the decline of Vinaceous Amazons, habitat loss is considered most important. Accordingly, conservation recommendations have focused on protecting forest habitat (Collar et al. 1992, BirdLife International 2004, 2005). Within the Atlantic forest region, Vinaceous Amazons are thought to prefer parana pine (*Araucaria angustifolia*) forest, and the destruction of this forest is considered the key reason for the decline (Collar et al. 1992). In Argentina, parana pine forest once covered about 210,000 ha (Cozzo 1960), but logging has now reduced it to about 2000 ha (Chebez 1994). Nevertheless, Vinaceous Amazons in both Argentina and Paraguay existed historically outside of parana pine forest, in lowland semideciduous Atlantic forest (Collar et al. 1992). Indeed, although Vinaceous Amazons were once widespread in eastern Paraguay (Bertoni 1914), parana pine only occurred there in one small patch (about 500 trees) surrounded by broadleaf forest (Reitz et al. 1979). Thus, it is not clear how important parana pine forest is for Vinaceous Amazons, or what type of habitat should be protected for this species.

Although both Misiones (Argentina) and eastern Paraguay were once covered with Atlantic forest where Vinaceous Amazons were recorded, management of Atlantic forest has differed in important ways between the two countries and created different landscapes. In Argentina, about 50% of the original Atlantic forest remains in two large tracts (about 290,000 and 390,000 ha, respectively, and about 10 km apart) and in partly connected fragments on farms and around towns. Nearly all remaining forest has been selectively logged. Within the historic range of Vinaceous Amazons, Argentina has 68 protected areas covering 779,000 ha (Bosso 2005). In Paraguay, as in Brazil, only about 10% of the original Atlantic forest remains in a few isolated patches that have been selectively logged, with the largest patch about 70,000 ha in size. These remnants are surrounded by lands dedicated to either commercial agriculture or cattle-ranching. Thus, Argentina and Paraguay provide a useful contrast for comparing the effects of habitat loss on Vinaceous Amazons.

Besides habitat loss, other factors may have contributed to the decline of Vinaceous Amazons. The species has suffered from nest poaching and trapping for pets, and persecution as a pest (Chebez 1987, 1992, Silva 1988, 1989, Collar et al. 1992, Straube et al. 2004), but these threats have been dismissed as less important than habitat loss (Ridgely 1981, Collar and Juniper 1992). However, BirdLife International (2004, 2005) recently reported only two populations remaining in Argentina, and no populations in Paraguay numbering more than 80 birds. With such small populations, poaching and persecution could have a major impact on the species. Thus, our objectives were to (1) determine the historic and current distribution of Vinaceous Amazons in Argentina and Paraguay, (2) assess the species' current abundance and level of protection, (3) contribute information about habitat use and natural history, and (4) make recommendations for conservation strategies.

METHODS

To describe the past and present distribution of Vinaceous Amazons, we used (1) a review of the literature, (2) specimen collections at the Museo Argentino de Ciencias Naturales Bernardino Rivadavia (MACN), Instituto Miguel Lillo (IML), American Museum of Natural History (AMNH), Museo Provincial Antonio Serrano (MAS), and Museo de La Plata (MLP), and (3) our own data collected in the field throughout the historic range of Vinaceous Amazons in Argentina and Paraguay (Fig. 1, Appendix 1). This range included (1)

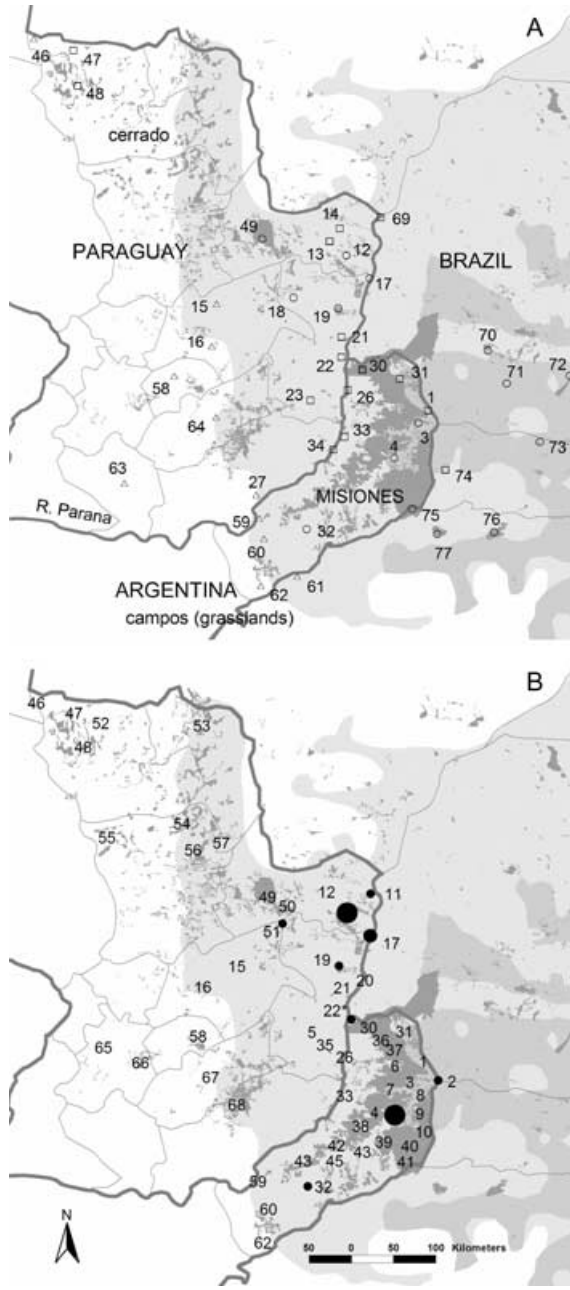

Fig. 1. Maps of Misiones, Argentina, eastern Paraguay, and adjacent Brazil showing original extent of Atlantic forest (Harris and Pimm 2004; palest gray) and parana pine forest (Hueck 1978; medium gray), and remaining forest in 2005 (from LandSat 5 TM satellite images; darkest gray). The patch of parana pine forest at RN Kuri'y in Paraguay is too small to appear on the map. Site numbers correspond to Appendix 1. (A) Compiled localities for Vinaceous Amazons from 1880 to 1939 (triangle), from 1940 to 1989 (square), and from 1990 to 2005 (circle). Recent localities in Brazil are shown for reference; we did not conduct a thorough search for historic records in Brazil. (B) Locations where we searched for Vinaceous Amazons from 1997 to 2006. Dots indicate sites where Vinaceous Amazons were recorded (smallest dots = 1–14 individuals, medium = 15–49 individuals, and largest = 50–200 individuals).

highland parana pine forest [mixed forest with laurel (mostly *Nectandra saligna*), guatambú (*Balfourodendron riedelianum*) and parana pine; Cabrera 1976] in central Misiones (Argentina), (2) lowland semideciduous forest [mixed forest with laurel and guatambú, and mixed forest with laurel, guatambú and palo rosa (*Aspidosperma polyneuron*); Cabrera 1976] in most of Misiones (Argentina) and eastern Paraguay, (3) ecotone between forest and 'campos' grasslands (campos district; Cabrera 1976) in southern Misiones (Argentina) and Paraguay, and (4) ecotone between forest and 'cerrado' scrubland in northern Paraguay. We chose sites that had some remaining forest (from LandSat TM satellite images) or historic records of Vinaceous Amazons. We searched for Vinaceous Amazons on 1150 days at 28 localities from March 1997 to May 2006 in Argentina, and on 489 days at 29 localities from July 2000 to May 2006 in eastern Paraguay. We spent 825 days in small forest fragments (<1000 ha), towns, and farms, and 814 days in large tracts of natural habitat (1000–387,000 ha), including forest tracts and forest/cerrado and forest/campos ecotone. In towns, farms, and forest fragments in Argentina, we searched for Vinaceous Amazons for an average of 3 h each morning and 2 h each evening. At midday, we conducted interviews (see below). In Paraguay and in large tracts of natural habitat in Argentina, we searched for an average of 4 h each morning and evening. Our searches were conducted on foot, and we tried to cover as much terrain as possible. For each location visited, we determined coordinates using a GPS unit. For locations where amazons had been reported previously, we used coordinates provided either in the original records or those given by Paynter (1985, 1989), Paynter and Traylor (1991), Hayes (1995), and Guyra Paraguay (2004).

Vinaceous Amazons are vocally and visually conspicuous, but sex and age (with the exception of dependent young) cannot be determined in the field. To determine abundance and small-scale habitat use and identify key food sources and roost sites, we spent most of our time in two areas where these amazons were fairly numerous (Appendix 1): (1) Reserva Natural Privada (RNP) Itabó, in Paraguay (119 days), and (2) a 27,000-ha agricultural area between the town of San Pedro (26°38′S 54°08′W) and the villages of Tobuna (26°28′S 53°53′W) and Santa Rosa (26°26′S 53°52′W; hereafter, the San Pedro-Tobuna area) in Argentina (620 days). We surveyed the latter area on foot several times, visiting (1) the settlements of San Pedro, Tobuna, Santa Rosa, Cruce Caballero (26°33′S 53°56′W) and Paraje Alegría (26°31′S 53°55′W), (2) two small parks (Parque Provincial [PP] Cruce Caballero, 600 ha, near Cruce Caballero village; and PP de la Araucaria, 92 ha, at San Pedro), and (3) the eastern part of Establecimiento La Alegría (26°27′S 53°58′W), a large forestry property with scattered farms. When Vinaceous Amazons were detected, we recorded the date, time, number of individuals, habitat (e.g., forest with parana pine, forest without parana pine, tree plantation, or town), activity (e.g., feeding, roosting, flying-over, perching, or entering nest hole), and, if applicable and possible, tree species.

To estimate the number of Vinaceous Amazons in Argentina, we carried out simultaneous roost counts in the San Pedro-Tobuna area every day from 18 March to 2 April 2005 because roosting flocks were consistently largest in March–April (from 2002 to 2005; unpubl. data). Five observers were stationed at key observation points throughout the area for 2 h each morning and evening. The area is a narrow strip of farm-forest mosaic along the ridge of the Sierra Central, with most of the area visible from hilltops. Observation points were selected to permit monitoring of roost sites based on extensive fieldwork in the area and interviews with local farmers. The sites were (1) San Pedro's water tower, (2) hilltops in Tobuna, (3) hilltops near Santa Rosa, and (4) a hilltop in Pje. Alegría. During 620 days of field work throughout the San Pedro-Tobuna area, we never observed a flock of more than 15 Vinaceous Amazons that would not have been visible from one of these observation points. Observers noted the number of individuals observed, direction of flight, and start and end times of observations (usually several minutes to an hour). Minimum total population in the San Pedro-Tobuna area was taken as the sum of simultaneous counts by observers at different localities, where distance, flight direction, and simultaneous observations made overlap impossible. We compared the number of parrots counted at each roost during the simultaneous counts with the number counted at the same roosts at all other times of the year. Because these numbers were similar, we used our maximum simultaneous count as an estimate of population size.

In Argentina, to locate nests, investigate threats to Vinaceous Amazons, and determine whether the species was present or absent at historic localities, we conducted interviews at approximately 150 households from 2002 to 2005. Most interviews were conducted in the San Pedro-Tobuna area, where we made repeated visits to about 50 farms every 1–3 months for 3 years. On our first visit, we asked subjects how many kinds of parrots occurred in the area and asked them to identify the parrots in a field guide (Narosky and Yzurieta 1987). We asked how often, where, and when they observed the different species. Finally, we asked if they knew of any nests. On our first visit, many people volunteered information about species kept as pets and those they considered crop pests. If not, we asked if they knew of any pet parrots, and the species they considered to be crop pests. If told of a household with a pet Vinaceous Amazons, we visited that house with either a local friend or relative of the pet owner. Thus, parrots found in captivity were not based on a random sample of homes, but should be considered a minimum estimate of the number of birds in captivity in the San Pedro-Tobuna area. To avoid pseudoreplication, and because our sampling was not random, we did not analyze our data statistically.

RESULTS

Distribution. Historically, Vinaceous Amazons were recorded in a variety of habitats throughout Misiones (Argentina) and eastern Paraguay, including highland parana pine forest, lowland semideciduous forest, and the ecotones between forest and campos and forest and cerrado (Fig. 1, Appendix 1). Bertoni (1914) included Vinaceous Amazons as among the species widely distributed on both sides of the River Paraná in the forest between Encarnación (27°20′S 55°54′W) and Guairá (Saltos del Guairá; 24°04′S 54°15′W). This area would include eastern Paraguay, Misiones (Argentina), and southwestern Paraná (Brazil). Vinaceous Amazons have also been reported in the departamentos of Misiones and Caazapá (Paraguay; Podtiaguin 1944) and the province of Corrientes (Argentina; Canevari et al. 1991). Sight records and a lost specimen suggest that the species may once have been present in departamento Concepción (Paraguay; Podtiaguin 1944, López 1992). However, these authors described the species as uncommon in Concepción. In addition, we did not record the species during our visits, and no records have been reported in the adjacent state of Mato Grosso do Sul (Brazil; Straube et al. 2004).

All recent records in Argentina and Paraguay, including our own, are from (1) central and eastern Misiones (Argentina), mostly in fragmented parana pine forest between San Pedro and Bernardo de Irigoyen, and a small, isolated population at Campo Viera in lowland semideciduous forest; and (2) a cluster of sites in the lowland semideciduous forest of northeastern Paraguay in departamento Canindeyú and adjacent Alto Paraná and Caaguazú (Fig. 1, Appendix 1). Vinaceous Amazons have disappeared from central eastern Paraguay, southern Misiones (Argentina), and the River Paraná between Argentina and Paraguay. The closest modern records from Brazil are in the highland parana pine forest in southern Paraná, western Santa Catarina, and northwestern Rio Grande do Sul (Fig. 1, Appendix 1).

In Argentina, there were several flocks of Vinaceous Amazons in the San Pedro-Tobuna area, but we could not determine the extent of interaction between these flocks. We did not find Vinaceous Amazons in the two large remaining forest tracts in Misiones (Argentina; Fig. 1), even though large parts of these tracts are protected or partially protected in PP Urugua-í, Pargue Nacional (PN) Iguazú, and the Yabotí Biosphere Reserve.

In Paraguay, the stronghold of Vinaceous Amazons is a small area in eastern departamento Canindeyú and adjacent Alto Paraná, including RNP Itabó and the Itaipú reserves complex (Reserva Biológica (RB) Carapá, RB Limoy, and RB Itabó; Fig. 1, Appendix 1). These localities are more than 150 km from the nearest populations in Argentina (San Pedro-Tobuna area and Bernardo de Irigoyen), and a similar distance from the sites of the nearest modern reports in Brazil (Fig. 1).

Abundance. Evidence suggests that Vinaceous Amazons were once common in Argentina and Paraguay. At Concepción and San Javier in southern Misiones (Argentina), White (1882) reported "incredible numbers" of Vinaceous Amazons feeding in the orange groves where many were shot by local inhabitants. Bertoni (1914) considered the species "widely distributed" on both sides of the River Paraná

and, in Paraguay, reported "flocks of thousands" that "began to darken the sky" in the late 1890s (Bertoni 1927, as cited in Hayes 1995). More recently, at Campo Viera and Montecarlo (Misiones, Argentina), local inhabitants, M. Oleñuk and F. Kruse (pers. comm. to Chebez 1992) described the species as having been very abundant in the 1920s when amazons fed on corn crops and were shot and poisoned by farmers. At Arroyo Urugua-í (Misiones, Argentina), at least 44 skins were collected between 1958 and 1961 (Collar et al. 1992; Appendix 1) and, at Colonia Dorada (Paraguay), a local guide, E. Bazán (1988, pers. comm. to Silva 1989), reported 8000 or more feeding on mineral-rich soil in a swampy area in 1978. When he and Silva returned to the site in 1988, most of the forest had been replaced by crops or pasture, the Vinaceous Amazons population had been reduced to "about 300," and local trappers reported catching 500 adult birds for export through Brazil (Silva 1988, 1989). Finally, at Puerto Paranambú (Paraguay), E. Bazán (1988, pers. comm. to Silva 1989) observed 3000–4000 individuals in 1978.

We recorded Vinaceous Amazons on 568 of 1150 days (49%) in Argentina and 94 of 489 days (19%) in Paraguay. Based on the largest number of birds observed simultaneously at each locality, we estimated the minimum populations in Argentina and Paraguay. In Argentina, our largest simultaneous roost count in the San Pedro-Tobuna area was 163 individuals on 26 March 2005. The two remaining populations in Argentina are small, with approximately 20 amazons at Campo Viera (R. Tarón pers. comm.) and 20 at Bernardo de Irigoyen (pers. obs.; J. Guerrero and G. Strapazón, pers. comm.). Thus, we estimate the minimum total Argentine population at 203 individuals (163 + 20 + 20).

In Paraguay, the largest numbers were found at RNP Itabó where an evening roost count yielded 167 individuals on 3 November 2001. Our records at other sites in Paraguay involved fewer individuals, including 14 at Estancia Golondrina and 39 at the Itaipú Reserves Complex (six at RB Itabó, 12 at RB Carapá, and 21 at RB Limoy; Appendix 1). At the Itaipú Reserves Complex, 70 individuals were observed in 1990 near RB Limoy (López 1992), about 80 were observed on the shores of the Itaipú Dam in 1991 (Nores 1992, as cited in Collar et al. 1992), and 49 were observed in 1991 at RB Itabó (J. Vielliard in litt.). However, N. Pérez (pers. comm.), who has lived and worked in these reserves throughout this period, indicated that "in the early 1990s there were hundreds of Vinaceous Amazons; now there are few." Because sampling effort at the Itaipú Reserves Complex was low, and considering previous observations, we suggest that 90 individuals would be a better population estimate for this area. Although Vinaceous Amazons might still be found in large forest remnants such as San Rafael National Park and southern RNB Mbaracayú, such populations, if they exist, must now number only a few individuals because they were not detected during extensive recent surveys (Appendix 1). Thus, we estimate the minimum total population in Paraguay at 220 individuals (167 + 14 + 39).

Habitat and natural history. In Paraguay, forest occurs either as isolated fragments or larger tracts in a matrix of commercial agriculture. There, we recorded Vinaceous Amazons on 48 of 410 days (12%) spent in large tracts of natural habitat, and during 49 of 75 days (65%) spent in forest fragments, towns, and farms. All individuals observed in the latter habitat were either in the canopy of a shade-grown crop or in trees in a nearby pasture.

In Argentina, there were (1) large tracts of forest and (2) mosaic landscapes of forest corridors on small subsistence farms, with many clumps of trees and capueras (shrubby vegetation on abandoned agricultural land). There, we recorded Vinaceous Amazons on 34 of 404 days (8%) spent in large tracts of natural habitat, and on 535 of 750 days (71%) spent in forest fragments, towns, and farms. Vinaceous Amazons were observed (1) perched in trees in towns, on subsistence farms, in forest fragments, and in large tracts of forest; (2) roosting in trees in forest fragments and in isolated trees on farms; (3) feeding in trees in towns, on farms, and in forest fragments; and (4) nesting in forest fragments both on farms and at the town of San Pedro (Misiones, Argentina).

We observed Vinaceous Amazons roosting at five sites: San Pedro (34 observations of up to 76 amazons), Tobuna (five observations of up to 50 amazons), Paraje Alegría (one observation of 36 amazons), Siete Estrellas near San Pedro (one observation of three amazons) in Argentina, and RNP Itabó (44 observations of up to 167 amazons) in Paraguay. All individuals roosting in Argentina were observed in parana pines.

Many of these trees were isolated (branches not touching other trees) and in areas where the understory and most trees had been cleared for farming. At San Pedro, flocks changed roost sites frequently, using specific roost trees for only 1–5 successive days, but often returning to them after 1–2 weeks. At RNP Itabó, where there were no parana pines, the amazons roosted from October to December 2001 in isolated pindó palms (*Syagrus romanzoffiana*) in a 500-ha pasture surrounded by secondary forest, and from 24 March to 17 April 2002 in unidentified trees (possibly also palms) in secondary forest about 2 km from the pasture.

Nests ($N = 6$) were found at four sites in the San Pedro-Tobuna area and at Campo Viera, and all were located along forest edges or in forest fragments ranging in size from 0.5 to 100 ha. Nest cavities were formed by broken branches ($N = 4$) and woodpeckers ($N = 2$) and were 5–20 m high ($x = 12.8 \pm 6.6$ [SD], $N = 6$) in trees 10–25 m tall ($x = 18.4 \pm 6.7$, $N = 5$), including two parana pines and one each of the following: *Parapiptadenia rigida, Prunus subcoriacea, Cabralea canjerana*, and *Apuleia leiocarpa*. During interviews, nests ($N = 22$) were reported in parana pine ($N = 5$), *Parapiptadenia rigida* ($N = 4$), *Ocotea puberula* ($N = 2$), *Apuleia leiocarpa* ($N = 1$), *Myrocarpus frondosus* ($N = 1$), *Ruprechtia laxiflora* ($N = 1$), *Peltophorum dubium* ($N = 1$), and trees of unknown species ($N = 7$).

The earliest date on which we observed signs of nesting was 16 September at San Pedro. Residents of the San Pedro-Tobuna area reported that chicks were traditionally captured from nests just prior to fledging "at Christmas." We observed a fledged chick begging near two adults on 11 March 2005 at San Pedro.

We observed groups of 1–80 (median = 8) Vinaceous Amazons feeding together, occasionally with one or more individuals that did not feed, but acted as sentinels near the tops of trees. The amazons fed mainly on fruits, seeds, leaves, and young shoots of nine native plant species, including *Araucaria angustifolia* ($N = 10$), *Holocalyx balansae* ($N = 7$), *Parapiptadenia rigida* ($N = 6$), *Matayba eleagnoides* ($N = 5$), *Ateleia glazioveana* ($N = 5$), *Syagrus romanzoffiana* ($N = 2$), *Aechmea* sp. ($N = 1$), *Peltophorum dubium* ($N = 1$), and *Allophylus edulis* ($N = 1$), and six exotic plant species, including *Melia azedarach* ($N = 31$), *Eucalyptus* sp. ($N = 11$), *Hovenia dulcis* ($N = 2$), *Eriobotrya japonica* ($N = 1$), *Persea* sp. ($N = 1$), and *Citrus* sp. ($N = 1$). Similarly, other authors have reported Vinaceous Amazons feeding on fruit and flowers of exotic [e.g., *Citrus* sp. (White 1882), *Melia azedarach* (Chebez 1990), *Eucalyptus* sp. and *Pinus* sp. (Collar et al. 1992)] and native plants [e.g., parana pine (Belton 1984, Prestes and Martinez 1996, Abe 2000, Krauczuk and Baldo 2004), *Euterpe edulis* (Brooks et al. 1993, Lowen et al. 1995), *Guadua* sp. (Lowen et al. 1996), *Cedrela fissilis* (Krauczuk and Baldo 2004) *Podocarpus lambertii* (Prestes and Martinez 1996), *Syagrus romanzoffiana, Psidium longipetiolatum, Eugenia uniflora, E. involucrata, Erythrina falcata, Mimosa scabrella, and Laplacea fruticosa (Abe 2000)*]. When feeding on *Eucalyptus* fruit, they scraped and mashed the outer skin of the fruit. In addition, they were observed chewing *Eucalyptus* bark ($N = 1$) and taking unidentified food items from nests of tent caterpillars ($N = 2$).

Current threats–habitat loss. In Paraguay, deforestation is a major threat to Vinaceous Amazons. About 90% of Paraguay's Atlantic forest has been replaced by industrial agriculture (e.g., soybeans and cattle), and most of the landscape contains no trees. Vinaceous Amazons have disappeared from all but a few localities in the last part of Paraguay to experience widespread deforestation. The species' stronghold, RNP Itabó, is on private land with only minimal legal protection.

In Argentina, less than 50% of the Atlantic forest has been eliminated, and the landscape is a mosaic of large forest tracts, small clearings, and small corridors of forest. In Argentina, Vinaceous Amazons regularly occur only near farming areas and towns. There have been no published reports outside of these habitats since 1983, despite extensive fieldwork by ornithologists and park rangers in the province's large protected areas (Benstead et al. 1993, Giraudo et al. 1993, Contreras et al. 1994, Saibene et al. 1996, Chebez et al. 1998). We found Argentina's largest population of Vinaceous Amazons in the San Pedro-Tobuna area, where about 7% of the forest was lost to deforestation from 1997 to 2002 (Benesovsky and Placci 2003). Local-scale deforestation threatens this population of Vinaceous Amazons. Unfortunately, however,

protection of large forest tracts such as PN Iguazú and PP Urugua-í has not prevented the local extinction of this species.

Current threats – nest poaching and persecution. We confirmed the presence of 40 Vinaceous Amazons in captivity in 35 homes in the San Pedro-Tobuna area (i.e., 25% of the wild birds counted in the same area and 20% of the estimated minimum population in Argentina). We were told that many more had died as young pets, and many were replaced with new chicks from the wild.

White (1882) and Chebez (1992) reported that the species was shot regularly in southern Misiones. In our interviews, we found no evidence of people shooting Vinaceous Amazons for food. In addition, few people mentioned this species as a crop pest, in strong contrast to their comments about shooting and poisoning other species of parrots (Bodrati et al. 2006). However, in March 2005, we received an injured bird that had been shot near San Pedro, and one man reported shooting another Vinaceous Amazons that he had mistaken for a Scaly headed Parrot (*Pionus maximiliani*). This suggests that, in contrast to historic times, Vinaceous Amazons are now rarely shot, and, if so, perhaps by accident.

DISCUSSION

Vinaceous Amazons were once found throughout the Atlantic forest of Argentina and Paraguay, but now appear to be restricted to just a few sites in each country (Fig. 1, Appendix 1). The small numbers we observed at these sites (maximum 167 birds at any single site and a total minimum estimate of 423 individuals) contrast starkly with the large numbers reported from the late 1800s and early 1900s (Bertoni 1927, White 1882, as cited in Chebez 1992, Hayes 1995), and even the 1970s (Silva 1988, 1989).

Although Vinaceous Amazons have disappeared from the most extensively deforested areas in both countries, they use different habitats in Argentina than in Paraguay. In Paraguay, where there is only one patch of parana pine forest and little mosaic farming/forest habitat, they inhabit large tracts of semideciduous forest and adjacent pasture. In Argentina, where there are both large tracts of semideciduous forest and mosaic farming landscapes with parana pine forest patches, Vinaceous Amazons are absent from the large forest tracts and principally inhabit the mosaic landscape of farms with patches of parana pine forest. Importantly, it has disappeared from large protected areas in Argentina, like PN Iguazú and PP Urugua-í, where the most forest habitat remains. Given the severe decline in numbers in Argentina, it is not clear that protecting forest habitat will be enough to conserve the remaining populations of Vinaceous Amazons. Several hypotheses, perhaps in combination, might explain the current distribution of Vinaceous Amazons and their absence from large protected areas in Misiones (Argentina):

(1) The species may never have been common in areas where large forest tracts now remain in Argentina. The earliest specimens of Vinaceous Amazons from Argentina and Paraguay were collected from sites in southern Misiones (ecotone between lowland semideciduous forest and campos) and at Iguazú Falls (semideciduous forest; now PN Iguazú). There are no historical records of Vinaceous Amazons from RB Yabotí, and only one record from the approximate location of PP Uruguaí (Deseado; Navas and Bó 1988). However, these areas were little explored until recently, probably explaining the lack of historic records. Further, the current absence of these amazons from PN Iguazú is striking, and cannot be attributed to historic absence, because Eckelberry (1965) reported that the species could be observed daily.

(2) Lowland semideciduous forest tracts may have been sink habitats that relied on source populations in the highland parana pine forest. We do not know how far Vinaceous Amazons move, how metapopulations once functioned, or how important parana pine forest was before human colonization. We did not find strong evidence for historic dependence on parana pine forest, but most Vinaceous Amazons remaining in Argentina are now found at sites with parana pines forest where they use parana pines for roosting, feeding, and nesting. Despite Sick's (1993) suggestion that parana pines rarely have cavities and so do not provide good nest sites, 7 of 22 nests (32%) we found were in parana pines. Bencke and Kindel (1999) reported an apparent severe decline of Vinaceous Amazons following removal of parana

pines at a site in Rio Grande do Sul (Brazil), and we can only guess at the source-sink dynamics and seasonal movements of historic populations in Argentina and Paraguay. In Rio Grande do Sul, Vinaceous Amazons were also collected historically in other habitats, but are now confined to parana pine forest, perhaps because parana pines provides a key resource (such as seeds) that has allowed *A. Vinacea* to survive in this habitat while it disappeared elsewhere (G. A. Bencke in litt.). This may also explain why the species' Argentine stronghold is the logged and fragmented parana pine forest in the San Pedro-Tobuna area.

(3) Like many other parrots (Bucher 1992), Vinaceous Amazons may be attracted to farming areas. We frequently found Vinaceous Amazons in highly disturbed habitats, feeding, nesting, and roosting in forest fragments in towns, farms, and capueras. In addition to abundant exotic fruit trees that provide food, farming areas provide Vinaceous Amazons with isolated trees that they appears to prefer for roosting. The natural habitat of Vinaceous Amazons include the ecotone between Atlantic forest and grassland/scrubland, suggesting that they may tolerate natural forest edges and natural forest islands. Thus, subsistence farming areas in Argentina may be similar to some parts of its native habitat. Forest tracts that have been selectively logged may now offer lower quality habitat for Vinaceous Amazons because nest holes and food trees may be rare.

Although Vinaceous Amazons may be flexible in terms of habitat use, occurring in towns, on farms, and in forest fragments, we cannot conclude that these are "good" habitats for the species. If habitat loss was the main threat, and if farmland and towns in Argentina provided good habitat, then the species should not have disappeared from so much of its former range in this country. Agricultural areas may be attractive, but dangerous for Vinaceous Amazons. Although food may be abundant in agricultural areas, survival and reproductive success may be low because birds are shot (White 1882, Chebez 1992) and nest poaching reduces reproductive success. Although the pet trade has traditionally been considered a minor threat to Vinaceous Amazons (Ridgely 1981, Collar and Juniper 1992, but see Silva 1988, 1989) and the species is rarely found in captivity in the United States (Wright et al. 2001), an important threat to the remaining populations may now be nest poaching for local use as pets. In a recent study comparing 21 species of Neotropical parrots, Vinaceous Amazons, at an unspecified site in Brazil, suffered the highest rate of nest poaching: over 80% of nests failed because of poaching (Wright et al. 2001). Thus, subsistence-farming areas may represent ecological traps—a phenomenon that may affect long-lived animals (such as parrots) in rapidly changing landscapes (such as the western Atlantic forest) if they, paradoxically, prefer poor quality habitat to good quality habitat (Battin 2004). To test these hypotheses, we would need to confirm the habitat preferences of Vinaceous Amazons, and compare survival and reproductive success between farming areas (in Argentina) and large forest tracts (in Paraguay).

Conservation recommendations. Key sites for Vinaceous Amazons are (1) the Itaipú reserves complex and RNP Itabó (Paraguay), and (2) the San Pedro-Tobuna area (Misiones, Argentina). In Paraguay, measures are needed to ensure the long-term protection of forest at RNP Itabó. At the Itaipú reserves and RNP Itabó, further studies are needed to determine whether Vinaceous Amazons use habitat outside of the reserves, as do many other parrot species in the Brazilian Atlantic forest (Evans et al. 2005), and Vinaceous Amazons in Argentina (our study).

In Argentina, Vinaceous Amazons do not occur regularly in any large protected areas (Saibene et al. 1996, Chebez et al. 1998, Di Giacomo 2005, our study). Although large protected forest tracts are important for conserving many bird species, they are not sufficient for conserving species that inhabit an agricultural matrix (Manning et al. 2004), as do Vinaceous Amazons in Argentina. The future of Vinaceous Amazons in Argentina is intricately linked to the farming area from San Pedro to Tobuna, where they share habitat with hundreds of subsistence farmers.

In the San Pedro-Tobuna area, there is an urgent need to protect remaining forest patches and nest trees and to stop nest poaching. To protect remaining forest, subsistence farmers need logistical and technical support to avoid

soil depletion and subsequent clearing of remaining forest patches for crops. To eliminate nest poaching, existing laws (prohibiting nest poaching and cutting of natural parana pines) must be enforced, and environmental education is urgently needed so that people understand why these laws exist. Finally, additional study of Vinaceous Amazons is needed to improve our understanding of their dispersal behavior, nest site requirements, and habitat preferences and suitability.

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Appendix 1. Locations where Vinaceous Amazons (*Amazona vinacea*) have been recorded in Argentina, Paraguay, and neighboring areas of Brazil, and locations where we searched for, but did not find, the species during our study.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
Highland Parana Pine Forest					
1. San Antonio (A-BE)	26°07′S 53°45′W	IML, as cited in Chebez 1992	1946	?	(1)
		D. Serra in litt.	1996–1997	56	0
		This study	2004	7	0
2. Bernardo de Irigoyen (A-BE)	26°15′S 53°39′W	This study	2002–2004	5	4
3. Intercontinental Property (A-BE)	26°15′S 53°51′W	Benstead et al. 1993	1993	17	5
		This study	2005	1	0
4. San Pedro-Tobuna area (A-SP)	26°38′S 54°08′W	MACN, IML, Navas and Bó 1988, LACM, as cited in Collar et al. 1992	1949–1959	?	(18)
		Eckelberry 1965	1959?	?	Present
		Chebez 1992 in litt. to Collar et al. 1992	1987	?	Present
		Proyecto Nauta in litt. to Nores and Yzurieta 1994	?	?	Present
		Giraudo et al. 1993	1991	?	6
		Krauczuk and Baldo 2004	2000–2002	63	60
		This study	1997–2005	620	163
5. RN Kuri-y (P-AP)	25°46′S 54°57′W	This study	2001	4	0
6. Southwest PP Urugua-í (A-BE)	26°03′S 53°47′W	This study	2005	8	0
7. Pozo Azul (A-SP)	26°21′S 54°09′W	This study	2004	5	0
8. PP Piñalito (A-SP)	26°25′S 53°50′W	This study	2003–2005	27	0
9. Forestal Belga (A-SP)	26°30′S 53°40′W	This study	2003	8	0
10. Piñal Seco (A-SP)	26°48′S 53°46′W	This study	2005	3	0
Lowland Semi-deciduous Forest					
11. RB Carapá (P-CAN)	24°16′S 54°22′W	This study	2000	4	12
12. RNP Itabó, Arroyo Pozuelo (P-CAN)	24°28′S 54°37′W	Hayes 1991 in litt. to Collar et al. 1992	1987	?	Many
		Ridgely 1991 in litt. to Collar et al. 1992	1991	?	30–35
		Lowen et al. 1995	1992–1995	40	80
		This study	2001–2002	119	167
13. Celos Parini (P-CAN)	24°19′S 54°47′W (our estimate)	R. Ridgely 1991 in litt. to ICBP	1977	?	8

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
14. Catueté, Río Carapá (P-CAN)	24°11′S 54°41′W	Hayes and Granizo Tamayo 1992	1989	2	12.4/10 km
15. Yhú / Estancia Itá Pytá (P-CAAG)	24°59′S 55°59′W	Salvadori 1895, as cited in Hayes 1995	1893	?	(1)
		This study	2001	5	0
16. Caaguazú / Serranía de San Joaquín (P-CAAG)	25°26′S 56°02′W	AMNH, as cited in Collar et al. 1992	1930	?	(1)
		Silva 1989	1988	?	0
		This study	2002	18	0
17. RB Limoy (P-AP)	24°42′S 54°23′W	López 1992	1990	?	70
		N. Pérez in litt.	1988–2005	?	Present
		This study	2000	6	21
18. Itakyry (P-AP)	24°55′S 55°10′W	N. Pérez in litt.	?	?	Present
19. RB Itabó (P-AP)	25°02′S 54°42′W	N. Pérez in litt.	1988–2005	?	Present
		J. Vielliard in litt.	1991	?	45
		This study	2000	6	6
20. RB Pikiry (P-AP)	25°12′S 54°31′W	This study	2001	1	0
21. Hernandarias/RB Tati Yupi (P-AP)	25°20′S 54°40′W	Wege and Long 1995	About 1988	?	Common
		This study	2001	2	0
22. Ciudad del Este=Puerto Stroessner / Puerto Gibaja / Monumento Científico M. Bertoni / Puerto Bertoni (P-AP) / Puerto Iguazú (A-IG) / Foz do Iguaçu (Brazil)	25°33′S 54°37′W	Bertoni 1927, as cited in Collar et al. 1992	?	?	Present
		UMMZ, as cited in Hayes 1995	1940	40	(6)
		AMNH, as cited in Collar et al. 1992	1950	?	(2)
		Ridgely 1991 in litt. to Collar et al. 1992	1977	?	Present
		Silva 1988, 1989	1988	?	0
		This study	1997–2005	20	1*
23. Puerto Barra (P-AP)	26°00′S 54°60′W	Hayes in Collar et al. 1992	1989	?	4

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
24. Colonia Dorada (P-AP)	?	Bazán 1988 in litt. to Silva 1989	1978	?	8,000
		Silva 1988, 1989	1988	?	300
25. Comandacay (P-AP)	?	Nores and Yzurieta 1983, as cited in Collar et al. 1992	?	?	Present
26. Paranambú / Mouth of Río Ñacunday (P-AP) / Puerto Segundo / Arroyo Urugua-í km 10 (A-IG)	25°59′S 54°46′W	Various museums, as cited in Collar et al. 1992; MACN	1958–1961	?	(44+)
		Bazán 1988 in litt. to Silva 1989	1978	?	3,000
		Silva 1989	1988	?	0
		This study	2001, 2005	2	0
27. Capitán Meza (P-IT)	27°01′S 55°34′W	MACN, MLP	1939, 1948	?	(15)
28. Cordillera del Paraguay (P-?)	?	MACN	1923	?	(1)
29. Yaguarasapá (P-?)	?	Bertoni 1914; Bertoni 1927, 1939, as cited in Hayes 1995	1890–?	?	Many
30. PN Iguazú / Cataratas de Iguazú (A-IG) / PN do Iguaçú (Brazil)	25°41′S 54°26′W	MACN, Orfila 1938	1900	?	(1)
		MHNCI, as cited in Straube and Urben-Filho 2004	1948	?	(1)
		Eckelberry 1965	1959?	?	Daily
		Straneck in litt. to Chebez 1992	1983	?	1
		Ridgely 1981	?	?	0
		Chebez 1992	1980–1987	Many	0
		Silva 1989, Saibene et al. 1996, Chebez et al. 1998, Gil and Ciarmiello 2005	1980s–2000s	Many	0
		This study	1997–2003	158	0
31. Deseado (A-BE)	25°48′S 54°03′W	MLP, Navas and Bó 1988	1955	?	(1)
		Rey 2005a,b	Recent	Many	0
		This study	2001, 2005	17	0

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
32. Campo Viera (A-OB)	27°23′S 55°02′W	M. Oleñuk 1985, pers. comm. to Chebez 1992	1921	?	Many (“millions”)
		Chebez 1987, 1992, 1994; Proyecto Nauta in litt. to Nores and Yzurieta 1994; Krauczuk 2005	1984–2006	Many	Several
		This study	2001, 2003	8	14
33. Eldorado (A-EL)	26°24′S 54°38′W	MLP, Navas and Bó 1988	1962–1963	?	(3)
		Keve and Kovacs 1973, as cited in Collar et al. 1992	1967	?	(1)
		This study	2002	75	0
34. Montecarlo (A-MO)	26°34′S 54°47′W	F. Kruse pers. comm. to Chebez 1992	1924–1925	?	Many (“thousands”)
		IML, Collar et al. 1992	1956	?	(2)
		Cabanne and Krauczuk 2005	?	?	0
35. Estancia Muxfeldt (P-AP)	25°51′S 54°51′W	This study	2001	10	0
36. Establecimiento San Jorge (A-IG)	25°50′S 54°15′W	This study	2005	10	0
37. Seccional Uruzú, PP Urugua-í (A-BE)	25°51′S 54°10′W	This study	2004–2005	8	0
38. RNP Yaguaroundí (A-GU)	26°42′S 54°16′W	This study	2004–2005	21	0
39. Area Experimental Guaraní (A-GU)	26°56′S 54°13′W	This study	2004–2005	20	0
40. PP Esmeralda (A-SP)	26°54′S 53°54′W	This study	2001–2005	30	0
41. PP Moconá (A-SP)	27°09′S 53°54′W	Giraudo et al. 1993	Around 1990	?	0
		This study	2005	14	0
42. Dos de Mayo (A-CAI)	27°00′S 54°40′W	This study	2002–2005	27	0
43. San Vicente (A-GU)	27°01′S 54°29′W	This study	2003–2005	6	0
44. Valle del Cuña Pirú (A-CAI)	27°06′S 54°59′W	This study	1998–2005	35	0
45. Aristobulo del Valle (A-CG)	27°05′S 54°47′W	This study	2002	4	0
Lowland Semi-deciduous Forest/Cerrado Scrubland					
46. Río Apa (P-CON)	22°10′S 57°55′W	Podtiaguin 1944	1939	?	Uncommon
		This study	2003	2	0

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
47. Estancia Centurión / Río Saité / Estancia San Luis / Arroyo Toro Paso (P-CON)	22°17'S 57°31'W	López 1992	1988–1989	?	Rare
		This study	1999, 2006	8	0
48. Serranía San Luis / Estancia Santa María de la Sierra / Arroyo Tagatiyamí (P-CON)	22°40'S 57°27'W	López 1992	1988–1989	?	Rare
		Robbins et al. 1999	1996	22	0
		This study	1999	7	0
49. RNB Mbaracayú / Estancia Jimenez (P-CAN)	24°07'S 55°26'W	P. Scharf 1992 in litt. to Brooks et al. 1993, in litt.	1990–1994	?	Many
		Madroño and Esquivel 1995	1994–1995	162	3 Occasions
		Lowen et al. 1996	1992, 1995	59	Rare
		This study	2000–2006	59	0
50. Mbaracayu Chino = Kue Tuvy (P-CAN)	24°17'S 55°22'W	This study	2000	5	0
51. Estancia Golondrina (P-CAAG)	24°35'S 55°18'W	Lowen et al. 1996	1992	10	0
		This study	2000	7	14
52. Retiro Satî (P-CON)	22°25'S, 57°15'W	This study	1999	7	0
53. Estancia Arroyo Blanco (P-AM)	22°28'S 56°09'W	This study	2000	9	0
54. Estancias Guyrá Campana and Alegría (P-SP)	23°31'S 56°23'W	This study	2002	11	0
55. Estancias Galive, Don Luis, and 75 (P-SP)	23°35'S 57°00'W	This study	2002	18	0
56. Laguna Blanca (P-SP)	23°49'S 56°18'W	This study	2000–2001	12	0
57. Yaguarete Forest (P-SP)	23°45'S 55°58'W	This study	2000	10	0
Lowland Semi-deciduous Forest / Campos					
58. Villarrica / Serranía de Ybyturuzú (P-GU)	25°45'S 56°26'W	AMNH, BMNH, as cited in Collar et al. 1992	1893, 1907	?	(3)
		This study	1999–2000	17	0

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
59. Villa Lutecia = Teyú Cuaré (A-SI) / Santa Ana / Loreto / Santo Pipó / Campo San Juan (A-CA)	27°17′S 55°33′W	MACN, IML, Menegaux 1918, Orfila 1938, Chebez 1992, Collar et al. 1992	1910–1932	?	(15)
		Chebez 2005	Recent	Many	0
		This study	2005	3	0
60. Bonpland / Cerro Azul (A-CA)	27°29′S 55°29′W	IML, Collar et al. 1992	1912	?	(2)
		This study	2001, 2005	4	0
61. San Javier (A-SJ)	27°53′S 55°08′W	White 1882	1881	?	Incredible numbers
62. Concepción (A-CO)	27°59′S 55°31′W	White 1882	1881	?	Incredible numbers
		This study	2003–2004	10	0
63. P-MI		Podtiaguin 1944	?	?	Present
64. P-CAAZ		Podtiaguin 1944	?	?	Present
65. Cerro Acahay (P-PA)	25°55′S 57°10′W	This study	2000	2	0
66. PN Ybycuí (P-PA)	26°05′S 56°48′W	Hayes and Scharf 1995	1987–1994	28	0
		Lowen et al. 1996	1995	4	0
		This study	2002	3	0
67. Estancia Tapytá / PN Caaguazú (P-CAAZ)	26°14′S 55°58′W	Lowen et al. 1996	1995	11	0
		This study	2000–2006	77	0
68. PN San Rafael (P-IT)	26°24′S 55°43′W	Lowen et al. 1996	1995	6	Local report
		A. Madroño in litt.	1998	15	0
		This study	2000–2002	60	Local report
		A. Esquivel in litt.	2003–2006	108	Possibly 4
Brazil					
69. Río Piquirí (B-PA)		Straube et al. 1996, A. Urben-Filho in litt.	1950s	?	(1)
70. Río Guaraní (B-PA)		Straube et al. 2004	Modern	?	Present
71. Foz do Río Jordao (B-PA)		Straube et al. 2005	1996	34	Present
72. UHE Segredo (B-PA)		Straube et al. 2005	1991–1992	56	Present
73. Parque Estadual das Araucarias (B-SC)		V. Piacentini in litt.	2004	?	Various

continued

Appendix 1. Continued.

Location[a]	Coordinates	Source[b]	Year	Search effort (days)	Number observed (collected)
74. São Miguel do Oeste (B-SC)		Bege 1991 in litt. to Collar et al. 1992	1980	?	Present
75. Parque Estadual do Turvo (B-RGS)		Albuquerque per Varty 1992 pers. comm. to Collar et al. 1992, Bencke et al. 2003	Modern	?	Occasional
76. Reserva Indigena de Nonoai / Río da Varcea (B-RGS)		Albuquerque per Varty 1992 pers. comm. to Collar et al. 1992	Modern	?	Present
77. Reserva do Asentamento Rural de Braga (B-RGS)		G. Bencke in litt.	2002	?	4

[a]Locality numbers correspond to Fig. 1. Provinces, states and departments: (Paraguay) P-CON- Concepción, P-AM- Amambay, P-SP- San Pedro, P-CAN- Canindeyú, P-CAAG- Caaguazú, P-AP- Alto Paraná, P-GU- Guairá, P-PA- Paraguarí, P-IT- Itapúa, P-MI- Misiones, P-CAAZ- Caazapá, P-?- department unknown; (Misiones, Argentina) A-IG- Iguazú, A-BE- Belgrano, A-EL- Eldorado, A-MO- Montecarlo, A-SP- San Pedro, A-GU- Guaraní, A-OB- Oberá, A-SI- San Ignacio, A-CA- Candelaria, A-CAI- Cainguás, A-SJ- San Javier, A-CO- Concepción; (Brazil) B-PA- Paraná, B-SC- Santa Catarina, and B-RGS- Rio Grande do Sul.

[b]IML = specimen collection at the Instituto Miguel Lillo, MACN = collection at the Museo Argentino de Ciencias Naturales Bernardino Rivadavia, AMNH = collection at the American Museum of Natural History, MAS = collection at the Museo Provincial Antonio Serrano, and MLP = collection at the Museo de La Plata. The phrase "in litt." (in litteris) means "in correspondence" and refers to unpublished information communicated in writing.

*Probably an escaped cage bird.