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Nest characteristics of the Red-spectacled Amazon *Amazona pretrei* Temminck, 1830 (Psittacidae)

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RESUMO. **Características de nidificação do papagaio-charão *Amazona pretrei* Temminck, 1830 (Psittacidae).** Foram localizados 79 ninhos de *Amazona pretrei* no Rio Grande do Sul, identificando áreas de reprodução nas regiões dos Campos de Cima da Serra, Planalto Médio, Depressão Central, Serra do Sudeste e Alto Uruguai. Entre as 23 espécies vegetais arbóreas que o papagaio-charão utilizou em sua nidificação, três mostraram-se mais freqüentes, com 54,4 % das árvores-ninho: *Cupania vernalis* (Sapindaceae), *Sebastiania klotzschiana* (Euphorbiaceae) e *Nectandra lanceolata* (Lauraceae). Foram tomadas medidas da altura e diâmetro de cada árvore, enquanto dos ninhos obteve-se a orientação da abertura, o diâmetro do tronco, a altura em relação ao solo, os diâmetros da cavidade (internos e da abertura) e a profundidade. A variação dos resultados foi ampla na maioria desses ítens, sugerindo que os casais de *A. pretrei* nidificam em um amplo espectro de cavidades de árvores, desde que tenham dimensões mínimas capazes de permitir o acesso e abrigo dos papagaios. Aumentar o grau de proteção dos locais de nidificação do papagaio-charão e realizar campanhas de educação ambiental, são medidas que podem minimizar a pressão de captura de filhotes, uma das principais causas que ameaçam a sobrevivência da espécie.
PALAVRAS-CHAVE: *Amazona pretrei*, nidificação, ninhos, Psittacidae, Rio Grande do Sul.

ABSTRACT. Seventy-nine nests of *A. pretrei* were found in the state of Rio Grande do Sul (Brazil) in the physiographic regions known as Campos de Cima da Serra, Planalto Médio, Depressão Central, Serra do Sudeste and Alto Uruguai. Among the 23 species of trees used for nesting, the most frequent (54.4 % of the total) were *Cupania vernalis* (Sapindaceae), *Sebastiania klotzschiana* (Euphorbiaceae) and *Nectandra lanceolata* (Lauraceae). For each nest, the following data were recorded: height and diameter of the tree, orientation and height of the nest entrance, diameter of the trunk, entrance and cavity, and its depth. We found most of these measurements to show a broad variation, suggesting that *A. pretrei* can use a diverse array of nesting cavities provided they have a minimum size that allows access and shelter. To increase the protection of nesting sites and promote education programs are two strategies suggested to minimize the robbing of nestlings by poachers, one of the main threats to the species.
KEY WORDS: *Amazona pretrei*, breeding, nest sites, nesting, Psittacidae, Rio Grande do Sul.

Amazona pretrei Temminck, 1830 is a globally threatened parrot (Bernardes *et al.* 1990, Collar *et al.* 1992) occurring in southern Brazil (Schauensee 1966, Forshaw and Cooper 1978). Belton (1985) recorded it as occurring from 28°-31°S and between 50°30'-54°W, but that author believed it could be found beyond that limits. Collar *et al.* (1992) commented that the species seems to be currently restricted to Rio Grande do Sul state in Brazil, having occurred in small numbers in Argentina and, possibly, Paraguay, but with no proof of it ever ranging into Uruguay. The nomadic behavior of the species was confirmed by Martinez (1996), who proposed migratory routes between Rio Grande do Sul and Santa Catarina state, where the species is a non-breeding visitor and congregates from February to June, attracted by the abundant supply of seeds of the southern pine *Araucaria angustifolia* (Araucariaceae).

In Rio Grande do Sul, Sick (1996) recorded *A. pretrei* breeding in the regions known as Campos de Cima da Serra, Encosta Superior and Inferior do Nordeste, and Serra do Sudeste (nomenclature follows Fortes 1959). Silva (1981) added the Planalto Médio, Alto Uruguai and Serra do Sudeste regions (figure 1). Silva (1981) and Belton (1985) described two nests found in the Serra do Sudeste, one in a *Casearia* sp. (Flacourtiaceae) tree and

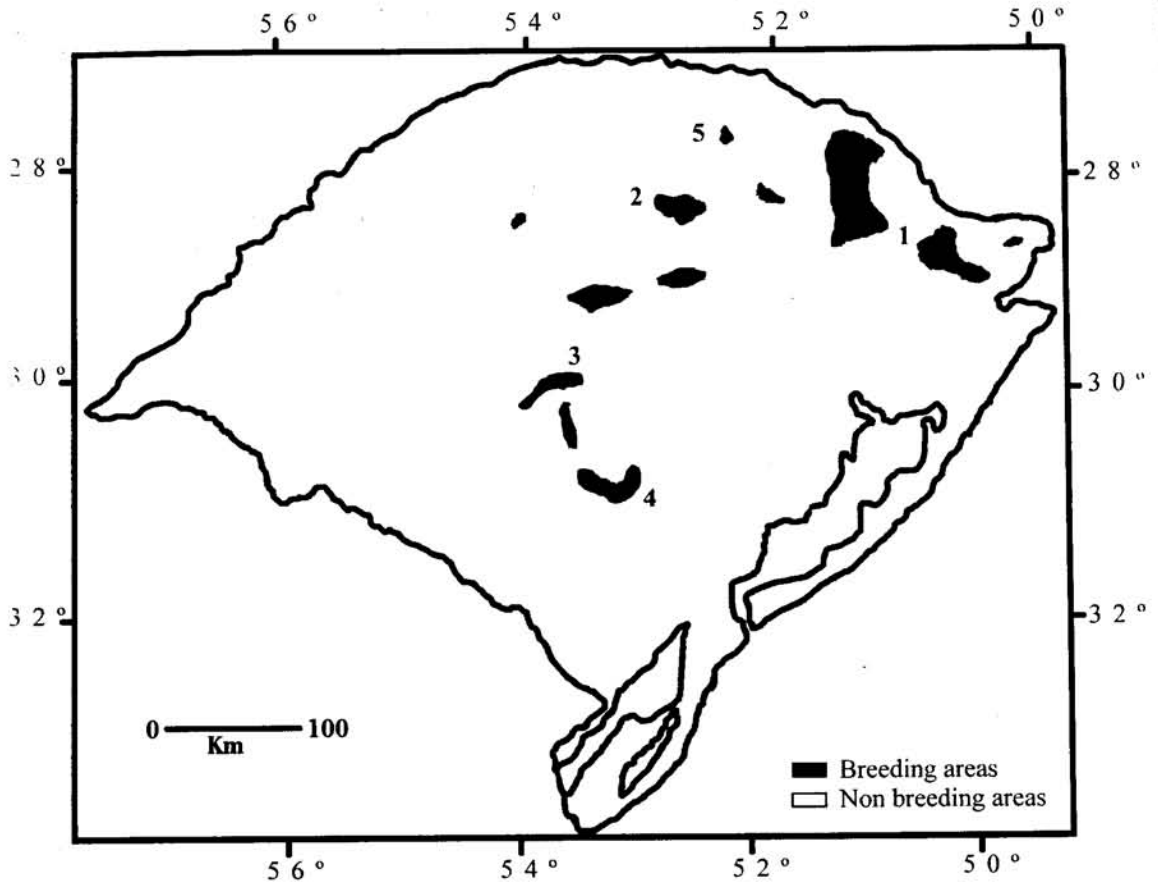

Figure 1. Breeding distribution of *A. pretrei* in Rio Grande do Sul state, southern Brazil. 1, Campos de Cima da Serra; 2, Planalto Médio; 3, Depressão Central; 4, Serra do Sudeste; 5, Alto Uruguai.

another in a *Quillaja brasiliensis* (Rosaceae), both nest cavities being 10 m high. In 1993, 18 nests were found in the Planalto Médio and Campos de Cima da Serra, where *Cupania vernalis* (Sapindaceae), *Sebastiana klotzchiana* (Euphorbiaceae) and *Nectandra lanceolata* (Lauraceae) are the commonest nesting trees (pers. obs.). Varty *et al.* (1994) discovered 51 nests in several localities in Rio Grande do Sul, and found a nest height ranging between 3 and 10 m from the ground. They also discovered that amazons used 27 tree species for nesting, with *Nectandra* sp. (Lauraceae), *Ocotea* sp. (Lauraceae), *Cupania vernalis* (Sapindaceae) and *Sebastiania* sp. (Euphorbiaceae) accounting for 50 % of the nest-cavity records.

The Projeto Charão, a research and environmental education program aimed to the conservation of *A. pretrei*, was created in 1991 and has been conducted by the non-governamental organization Amigos do Meio Ambiente (AMA) and the Grupo Ñhandú de Pesquisa em Vida Silvestre of the Universidade de Passo Fundo. From September 1992 to April 1995 the program located 79 nests of *A. pretrei*. Our objectives were to describe the breeding distribution of the species, nesting site characteristics and conservation actions needed on behalf of the species, including nest protection and provisions for nesting cavities.

METHODS

From September 1992 to April 1995 we made 38 field trips to the following regions of Rio Grande do Sul: Encosta Superior do Nordeste, Encosta Inferior do Nordeste, Planalto Médio, Alto Uruguai, Depressão Central, Campos de Cima da Serra, Serra do Sudeste, Missões and Campanha.

We used two methods in order to find *A. pretrei* nests. The first was to visit each physiographic region and to

select sampling areas. In these areas, we described and showed pictures of *A. pretrei* to persons living both in the country and in urban areas, aiming to find people who knew of nests or had captive amazons. During investigating of the sources of captive amazons we tried to identify the poachers and use them to locate forest patches and nesting trees used by breeding amazons. Another less biased method was to install observation sites in the forest from August to December, when the amazons breed, to follow their movements to the nesting trees.

For each nesting tree we found we recorded plant species, diameter at breast height (DBH) and total height (HEIG). For each nest we measured the diameter of the trunk (TDIA) at the height of the nest entrance, the maximum and minimum diameters of the nest cavity entrance (OPDI max. and min.), the internal entrance diameter (INDI), the nest cavity depth (DEP), the height of the nest entrance from the ground (NEHE) and the direction (compass bearing) that the nest entrance faced.

The highest nests were reached with the aid of climbing equipment, and measurements and observations were made with metric tapes, compass and binoculars. Botanical samples of each nesting tree were taken for identification in the herbarium of the Museu Zoobotânico da Universidade de Passo Fundo.

RESULTS AND DISCUSSION

We found breeding *A. pretrei* (figure 1) mostly in the range recorded for the species by Belton (1985), and some breeding localities further north that confirm Belton's suppositions.

The main breeding area of the species is the Planalto of Rio Grande do Sul in the physiographic region of the Campos de Cima da Serra, in the northeastern part of the state, especially in the municipalities of Barracão (27°47'S, 51°23'W), Lagoa Vermelha (28°09'S, 51°33'W), Esmeralda (28°04'S, 51°09'W), Vacaria (28°30'S, 51°54'W) and Bom Jesus (28°10'S, 50°27'W). Breeding localities were also found in the Planalto Médio, in the municipalities of Salto do Jacuí (29°05'S, 53°13'W), Júlio de Castilhos (29°13'S, 53°41'W), Cruz Alta (28°38'S, 53°36'W), Soledade (28°52'S, 52°31'W), Carazinho (28°18'S, 52°47'W), Santo Antônio do Planalto (28°24'S, 52°40'W), Passo Fundo (28°15'S, 52°24'W), Coxilha (28°07'S, 52°18'W), Pontão (28°04'S, 52°41'W) and Augusto Pestana (28°32'S, 53°54'W). In the Alto Uruguai region only isolated small areas were used by breeding *A. pretrei* in the municipalities of Erechim (27°38'S, 52°17'W), Trindade do Sul (27°33'S, 52°42'W) and São José de Ouro (27°47'S, 51°35'W).

In the Depressão Central region breeding localities were found in the municipalities of Formigueiro (29°59'S, 53°28'W), Vila Nova do Sul (30°22'S, 53°51'W), São Sepé (30°08'S, 53°25'W) and Santa Maria (29°40'S, 53°48'W), especially in forests of the Vacacaí river basin. The Serra do Sudeste, where Belton and Silva (Silva 1981) found the first recorded nests in 1979, was also found to be an important breeding region for *A. pretrei*, especially the municipalities of Santana da Boa Vista (30°53'S, 53°07'W), Piratini (31°15'S, 53°06'W), Caçapava do Sul (30°31'S, 53°30'W) and Encruzilhada do Sul (30°37'S, 52°27'W). These results on the breeding distribution of the red-spectacled amazon in Rio Grande do Sul confirm and provide additional records to previous information by Sick (1969), Silva (1981), Belton (1985) and Varty *et al.* (1994).

Most of the forest patches where we found the 79 nests of *A. pretrei* are characterized by anthropogenic impacts like cattle grazing and logging (table 1), as recorded in the Planalto Médio, Alto Uruguai, Depressão Central and Campos de Cima da Serra. We found that 50.0 % of the nests were in the forest edge (up to 20 m from the border), 47.3% inside the forest (more than 20 m from the border) and only 2.7 % were found in open areas.

As shown in table 2, among the 23 tree species used by

Table 1. Number of *Amazona pretrei* nests found in each physiographic region (names follow Fortes 1959), their vegetation type and human disturbance levels.

Physiographic region	N° of nests (N=79)	Vegetation*
Encosta Superior do Nordeste	0	Mixed Evergreen Forest
Encosta Inferior do Nordeste	0	Seasonal Deciduous Forest
Planalto Médio	31	Mixed Evergreen Forest
Alto Uruguai	07	Seasonal Deciduous Forest
Depressão Central	06	Seasonal Deciduous Forest
Campos de Cima da Serra	20	Mixed Evergreen Forest
Serra do Sudeste	15	Savanna
Missões	0	Seasonal Deciduous Forest
Campanha	0	Steppe

* Follows RADAMBRASIL/IBGE - 1986

nesting amazons the most important were *Cupania vernalis* (Camboatá-vermelho, Sapindaceae) with 27 % of all occurrences (n = 21), *Sebastiania klotzchiana* (Branquilho, Euphorbiaceae) with 20 % (n = 16) and *Nectandra lanceolata* (Canela-branca, Lauraceae) with 7.6 % (n = 6). The family Sapindaceae accounted for 35 % of all nesting trees (n = 28), followed by the Euphorbiaceae (represented solely by *Sebastiania klotzchiana*) with 20 %, and the Lauraceae with 11.4 %. Our records of tree species used by nesting *A. pretrei* are similar to Varty *et al.* (1994). As with Silva (1981), Sick (1984), Belton (1985) and Varty *et al.* (1994), no nest was find in southern pines *Araucaria angustifolia* (Araucariaceae).

Most nests were found in live trees (92.4 %, n = 73) which, as recorded for the Blue-fronted Amazon *A. aestiva* (Sauad *et al.* 1991), belonged to species with few or no economic value for timber. Scherer-Neto (1989) and Martuscelli (1995) found that many (38 % and 67 %, respectively) nests of the Red-tailed Amazon *Amazona brasiliensis* were in dead trees. We found that 55.7 % (n = 44) of the cavities used by *A. pretrei* were in the main trunk, while 44.9 % (n = 35) were in limbs (figure 2).

Measurements of nesting tree and nest cavity characteristics typically showed wide variation (tables 2 and 3). Tree height ranged from 4.8 (a *Schinus* sp.) to 35 m (a *Parapiptadenia rigida*), with a mean of 13.2 m (s.d. = ± 4.5) with most trees (88 %) being 10-18 m. high. A significant correlation ($r = 0.8$, $p < 0.001$) was found between tree height and nest height from the ground, the latter ranging from 1.4 m (in a *Schinus* sp.) to 25.3 m (in a *Parapiptadenia rigida*), with most nests being between 4 and 10 m high. Nests were located an average of 6.9 ± 3.7 m from the ground. Martuscelli (1995) found that nest height ranged from 1 to 15 m for *A. brasiliensis*, while Sauad *et al.* (1991) recorded a range from 1.6 to 20 m for *A. aestiva*.

We found a significant correlation ($r = 0.56$, $p < 0.001$) between diameter at breast height (DBH) and tree height (HEIG), and also with nest height (NEHE) ($r = 0.52$, $p < 0.001$). Most nest trees had a DBH between 30 and 60 cm, ranging from 23.2 to 114.6 cm, with a mean of 46.4 ± 19.7 cm (n = 79). The results suggest that hollowed trees above 23.2 cm DBH offer conditions for nesting.

Trunk diameter at nest entrance height (TDIA) had a mean of 31.4 ± 8.2 cm, with a range from 8.6 to 54.4 cm, most nests (82.2 %) showing a 30 to 40 cm TDIA. The correlation between trunk diameter at nest entrance (TDIA) was significant ($r = 0.35$, $p < 0.001$) only with diameter at breast height (DBH).

With regard to nest entrance diameters we found a significant correlation between the minimum nest entrance diameter (OPDI min) and the minimum diameter of the nest cavity (INDI min) ($r = 0.36$, $p < 0.001$).

Many cavity-nesting birds show a preference for a certain orientation (i.e. compass bearing) with regard to nest entrance (Saunders 1979). Nevertheless the results for

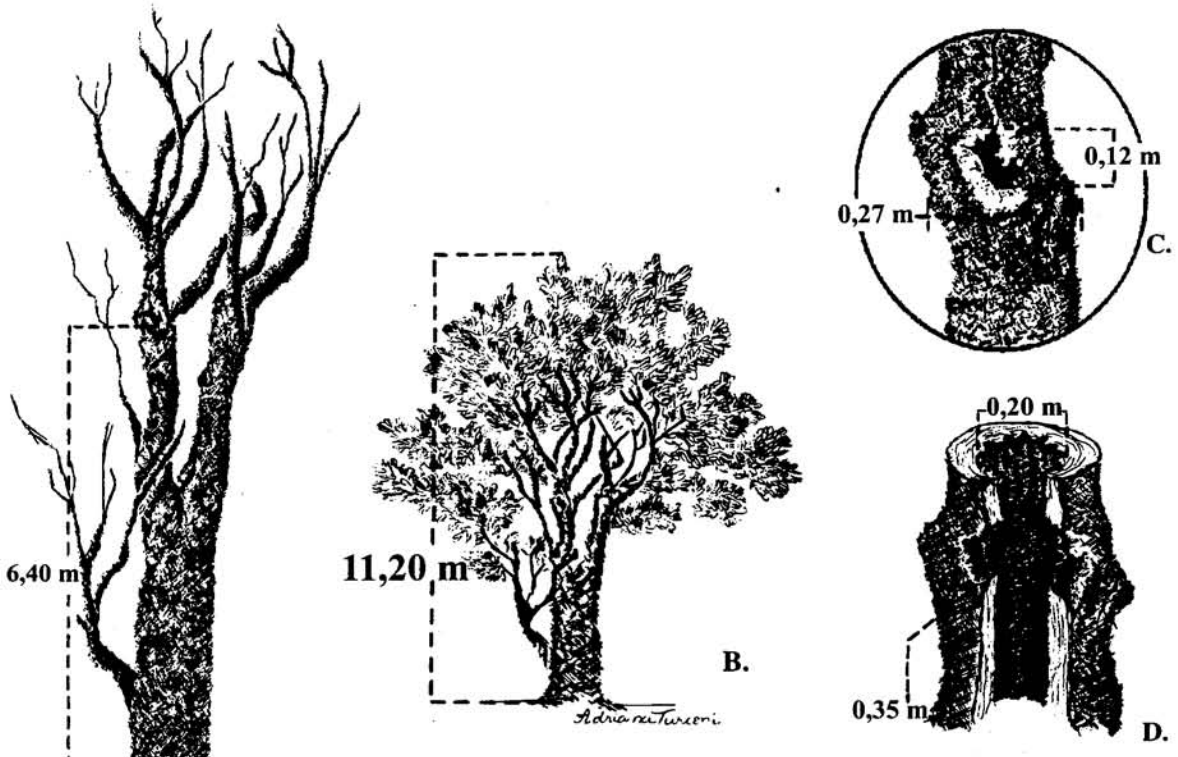

Figure 2. *Amazona pretrei* nest in *Cupania vernalis* (Camboatá-vermelho). A and B = general view of the tree, C = nest entrance, D = longitudinal cut and inside of the nest

Table 2. Average measurements of nest-trees and nesting cavities used by *Amazona pretrei* in Rio Grande do Sul, Brazil.

Species*	HEIG (m)	DBH (cm)	NEHE (m)	TDIA (cm)	DEP (cm)	OPDI (cm)	INDI * (cm)	Families (N = 17)	Nest trees (N = 79) N	%
Cupania vernalis	12.3	41.6	7.0	32.4	64.2	21.4 x 11.7	21.7 x15.6	Sapindaceae	21	26.6
range	7.5 - 16.7	23.23 - 54.11	2.4 - 12.2	20.69 - 46.79	10.0 - 175.0	10.0 x 6.0				
50.0 x 20.0	12.0 x 6.0									
43.0 x 32.0										
standard deviation	2.43	8.67	2.46	7.84	45.42	11.6 - 4.36	8.49 - 5.99			
Sebastiania klotzschiana	12.0	36.0	5.0	30.0	116.3	69.8 x 13.9	22.9 x 14.6	Euphorbiaceae	16	20.3
range	8.0 – 14.3	26.41 - 40.1	2.73 -7.8	22.0 - 38.19	6.0 - 340.0	13.0 x 5.0	12.0 x 6.0			
						278.0 x30.0	70.0 x 22.0			
standard deviation	2.01	5.53	1.63	5.06	86.09	78.81 - 7.90	13.46 - 4.33			
Nectandra lanceolata	13.5	77.4	7.4	42.3	55.7	19.3 x15.0	22.3 x 20.0	Lauraceae	06	7.6
range	11.0 - 15.0	31.83-114.58	5.22 - 10.0	28.01 - 54.43	23.0 - 120.0	15.0 x 7.0	20.0 x 24.0			
						28.0 x 23.0	17.0 x 23.0			
standard deviation	1.76	31.70	1.90	13.35	55.71	7.5 - 8.0	2.0 - 3.0			
Ruprechtia laxiflora	13.5	39.0	6.3	2.,5	114.8	27.9 x 19.1	21.1 x 20.3	Polygonaceae	04	5.1
range	11.0 - 16.5	31.51 - 42.01	3.22 - 8.22	15.91 - 30.23	33.0 - 260.0	8.5 x 7.5	12.5 x 10.0			
						50.0 x 35.0	40.0 x 40.0			
standard deviation	2.83	5.0	2.68	6.46	100.86	19.43 - 11.75	12.3 - 13.57			
Matayba elaegnoides	12.9	47.3	6.2	34.8	78.0	31.3 x 10.5	18.5 x 14.3	Sapindaceae	04	5.1
range	11.6 - 13.8	34.37 - 49.01	4.75 - 8.33	27.69 - 42.97	45.0 - 170.0	10.0 x 5.0	16.0 x 12.0			
						80.0 x 18.0	21.0 x 17.0			
standard deviation	0.92	10.07	1.68	6.3	61.36	32.75 - 5.56	2.38 - 2.06			
Allophylus edulis	10.7	28.4	4.5	22.6	198.0	90.7 x 13.7	16.7 x 12.0	Sapindaceae	03	3.8
range	8.80 - 12.50	25.78 - 31.83	2.30 - 6.98	8.59 - 30.23	56.0 - 358.0	17.0 x 13.0	14.0 x 10.0			
						142.0 x 14.0	21.0 x 14.0			
standard deviation	2.61	3.09	2.35	12.14	151.80	65.42 - 0.57	3.78 - 2.0			
Lithraea brasiliensis	14.4	55.6	8.5	31.3	32.3	54.3 x 11.3	17.7 x 14.7	Anacardiaceae	03	3.8
range	13.30 - 16.14	37.24 - 87.21	7.65 - 9.56	31.83 - 35.01	27.0 - 40.0	23.0 x 6.0	14.0 x 14.0			
						70.0 x 20.0	20.0 x 15.0			
standard deviation	1.5	27.49	0.98	4.0	6.80	27.13 - 7.57	3.21 - 0.57			
Parapiptadenia rigida	30.0	82.1	17.9	-	-	-	-	Leguminosae	02	2.5
range	25.0 - 35.0	82.12 - 82.12	10.5 - 25.3	-	-	-	-			
standard deviation	7.07	0	10.46	-	-	-	-			

Table 2. Continued.

Species*	HEIG (m)	DBH (cm)	NEHE (m)	TDIA (cm)	DEP (cm)	OPDI (cm)	INDI * (cm)	Families (N = 17)	Nest trees (N = 79)	
									N	%
Eugenia pungens	7.1	34.7	5.7	25.5	157.5	31.5 x 9.0	-	Myrtaceae	02	2.5
range	7.0 - 7.2	34.37 - 35.01	5.0 - 6.35	25.46 - 25.46	95.0 - 220.0	8.0 x 8.0	15.0 x 15.0			
						55.0 x 10.0	15.0 x 15.0			
standard deviation	0.14	0.45	0.95	0	88.38	33.23 - 1.41	-			
Schinus sp.	6.4	36.6	2.3	37.4	21.5	37.5 x 12.0	14.3 x 11.0	Anacardiaceae	02	2.5
range	4.8 - 8.0	31.19 - 42.01	1.44 - 3.2	32.78 - 42.01	14.0 - 29.0	14.0 x 8.0	13.5 x 8.0			
						61.0 x 16.0	15.0 x 14.0			
standard deviation	2.26	7.65	1.24	6.52	10.6	33.23 - 5.65	1.06 - 4.24			
Ateleia glazioviana	20.5	52.5	15.1	26.0	90.0	13.8 x 10.3	17.0 x 13.5	Leguminosae	02	2.5
range	16.0 - 25.0	52.52 - 52.52	14.1 - 16.0	22.91 - 29.13	84.0 - 96.0	12.5 x 8.0	17.0 x 13.0			
						15.0 x 12.5	17.0 x 14.0			
standard deviation	6.36	0	1.34	4.39	8.48	1.76 - 3.18	0 - 0.70			
Ocotea cf pulchella	15.8	44.4	7.4	-	40.0	100.0 x10.0	14.0 x 10.0	Lauraceae	02	2.5
range	14.5 – 17.01	42.33 - 46.47	7.20 - 7.61	-	-		-			
standard deviation	1.77	2.92	0.28	-	-	-	-			
Capsicodendron dinisii	11.0	30.2	4.1	29.0	42.5	66.0 x 9.5	20.0 x 7.0	Canelaceae	02	2.5
range	10.0 - 12.04	27.21 - 33.10	2.81 - 5.46	28.64 - 29.28	30.0 - 55.0	52.0 x 7.0	19.0 x 6.0			
						80.0 x 12.0	21.0 x 8.0			
standard deviation	1.44	4.16	1.87	0.45	17.67	19.79 - 3.53	1.41 - 1.41			
Salix humboldtiana	24.0	98.7	15.0	30.2	35.0	11.0 x 8.0	18.0 x 17.0	Salicacea	01	1.3
Siloaneae sp.	20.0	95.5	7.4	52.5	0.8	50.0 x 12.0	18.0 x 10.0	Elaeocarpaceae	01	1.3
Prumus selowii	12.3	35.7	8.0	31.2	0.3	11.0 x 16.0	24.0 x 16.0	Rosaceae	01	1.3
Plantanus sp.	8.0	35.0	5.6	23.9	140.0	45.0 x 13.0	18.0 x 14.0	Plantanaceae	01	1.3
Nectandra megapotamica	13.0	76.4	8.8	25.5	0.6	40.0 x 15.0	20.0 x 15.0	Lauraceae	01	1.3
Cordia trichotoma	23.0	79.6	17.0	25.5	0.6	25.0 x 8.0	15.0 x 13.0	Boraginaceae	01	1.3
Ilex brevicuspis	8.3	29.0	4.9	36.3	0.8	104.0 x17.0	28.0 x 26.0	Aquifoliaceae	01	1.3
Xylosma sp.	13.0	54.1	4.8	42.7	0.9	81.0 x 17.5	32.0 x 20.0	Flacourtiaceae	01	1.3
Quillaja brasiliensis	13.3	34.4	6.3	29.9	0.5	179.0 x12.0	17.5 x 12.5	Rosaceae	01	1.3
Unidentified	15.5	59.2	7.6	29.9	0.6	61.0 x 15.0	17.5 x 16.0		01	1.3

(HEIG) total height; (DBH) diameter at breast height; (NEHE) height of the nest entrance from the ground; (TDIA) diameter of the trunk at the height of the nest entrance; (DEP) nest depth; (OPDI) maximum and minimum diameters of the nest cavity entrance; (INDI) internal diameter the nest cavity.

Table 3. Range, means and standard deviations of measurements taken from nesting trees and nest cavities used by *Amazona pretrei*. Abreviations are the same as in table 2.

Measurements	Min-Max	Mean	Standard Deviation
HEIG (m)	4.8 - 35.0	13.2	4.5
DBH (cm)	23.2 - 114.6	46.4	19.7
DTN (cm)	8.6 - 54.4	31.4	8.2
NEHE (m)	1.4 - 25.3	7.0	3.7
DEP (cm)	6.0 - 358.0	84.6	71.7
OPDI max (cm)	8.5 - 278.0	48.2	51.4
OPDI min (cm)	5.0 - 35.9	12.6	6.2
INDI max (cm)	12.0 - 70.0	20.7	8.7
INDI min (cm)	6.0 - 40.0	15.1	5.6

A. pretrei showed no preference for a given orientation, nest openings being almost equally distributed among the possible bearings (east 18.91 % (n = 14), northeast 16.21 % (n = 12), northwest 14.86 % (n = 11), west 12.16 % (n = 9), south 10.81 % (n = 8), north 9.45 % (n = 7), southwest 9,45% (n = 7) and southwest 8,10% (n = 6). Similarly, Sauad *et al.* (1991) studying *A. aestiva* nests, and Guedes (1993) with Hyacinthine Macaws *Anodorhynchus hyacinthinus*, found the nest opening orientations to be randomly distributed.

Another nest characteristic which showed wide variation was depth: we found nests ranging from 6 cm in a *Sebastiania klotzchiana* to 358 cm in an *Allophylus edulis* (Table 3). Mean depth was 84.6 ± 71.7 cm, with 64% of the nests being deeper than 50 cm. Nest depth (DEP) showed significant correlations with the minimum nest entrance diameter (OPDI minimum; $r = 0,38$, $p < 0.001$) and with tree diameter at breast height (DBH; $r = -0.32$, $p < 0.001$). Among other *Amazona* evidence of selection of nest sites by their depth is still wanting, as in the case of *Amazona brasiliensis*, which uses cavities ranging from 0.2 to 4.2 m (Scherer-Neto, 1989; Martuscelli, 1995).

The results of the measurement analysis of 79 nests suggest the wide range of the main nest characteristics are a result of the size, tree architecture and qualitative characteristics of the nest-trees trunks. They also suggest *A. pretrei* is not selecting nests with narrowly defined characteristics but rather using most cavities available in its habitat provided they are large enough to allow nesting (Table 3).

From 79 nests, 63.3% had their nestlings stolen in the previous nesting period. Poaching resulted in damage to 31.6% of the nests, as poachers commonly cut the nest tree at its base or at nest entrance level to get the nestlings.

We also found that 3.8% of the nests were occupied by owls, *Otus choliba* and *Otus sanctaecatarinae*, and by bees during the amazon's breeding season. Sick (1984) records that many tree cavities usable by parrots are occupied by bees, wasps and ants, and there is competition with small mammals like opossums and marmosets.

Natural predation of *Amazona pretrei* nestlings by the toucan *Ramphastos toco* was recorded once (1.3% of all studied nests) in the Serra do Sudeste, where this fact is well-known to the country people. *Ramphastos toco* is also considered a nest predator of the parrot *Myiopsitta monachus* in that region. A nest monitored in the Planalto Médio region, not included in this analyses, was depredated by a white-eared opossum *Didelphis albiventris* in October 1994. Only 19% of the nests located in this study were successful in producing fledglings.

In 1993, in a ranch at the Salto do Jacuí municipality, Planalto Médio, a *A. pretrei* nest was found in a very rotten trunk that the amazons had used for three consecutive years. Natural decomposition caused one entire face of the trunk to fall, this being repaired by us and the nest protected and followed by the landowner, who reported its successful use by a amazon couple during the same year. Lindsey (1992) found two out of ten repaired *A. vittata* nests to have been successful.

We found that over most of the specie's breeding range poachers take all the nestlings they find (usually 2 to 4 per nest, very rarely 5). Otherwise, in southern Rio Grande do Sul many poachers believe it is necessary to leave at least a nestling in the nest so the amazon pair will return for the next breeding season.

The Lagoa Vermelha municipality region and its environs is one of the main areas where *A. pretrei* nestlings are poached and sold. By contacting poachers and other people acquainted with the activity we were able to estimate that the minimum number of stolen nestlings is surprisingly high: 300 to 500 per year. So, only in this region many youngsters are not recruited into the population, which is under risk of lack of recruitment and an unbalanced aging.

The adequate management of the forests by the landowners to assure their continuing regeneration would increase the availability of nest sites for *A. pretrei*. This could be achieved by excluding sapling-destroying cattle from forest patches and by allowing a larger number of trees to reach a size usable by nesting amazons. We aim, in the long term, to calculate the replacement rates of the senile trees with nest cavities. In the short term the objective is to

work in the properties currently known to be breeding areas for *A. pretrei* in order to conserve trees with cavities and to increase the degree of protection these habitats receive, especially in the period before the nestlings leave the nest (November to December) to protect them from poachers.

To reduce poaching, which is a serious threat to the population of *A. pretrei*, we recommend an urgent and widespread environmental education work aimed to the specie's conservation, and rigorous inspection of vehicles by the authorities along the roads crossing the region, especially in the December to February period when middlemen and traffickers go to the breeding areas to buy nestlings from the poachers.

The capture of *A. pretrei* nestlings is one of the main causes threatening the species with extinction, both by interrupting the biological cycle of the individuals taken to captivity, and by the damage the poachers cause to the nest cavities and trees when stealing the nestlings. To protect the nestlings and the nests is complex process which involves a greater degree of public awareness and the conscious to not buy wild animals.

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