DISTRIBUTION AND MORPHOMETRICS OF *NATALUS STRAMINEUS* FROM SOUTH AMERICA (CHIROPTERA, NATALIDAE)

Valdir Antonio Taddei[1]
Wilson Uieda[2]

ABSTRACT

Morphometric and distributional data and some observations on the biology of *Natalus stramineus* Gray, 1838 collected in eastern Bolivia and in northern, northeastern, central, and southeastern Brazil are presented. All new records, combined with the records of the species from Paraguay and Mato Grosso, significantly change the known distribution of *N. stramineus* in South America. The specimens from northeastern Brazil (Rio Grande do Norte, Ceará, Bahia) are smaller than those found in the northern (Pará), eastern (Espírito Santo, São Paulo) and central regions of the country (Distrito Federal, Goiás, Mato Grosso do Sul). *Natalus stramineus* specimens from the three latter regions are about the same size, but are larger than those from Santa Cruz, Bolivia. Their size is intermediate between those of central samples and northeastern Brazil samples. The type locality of this species is discussed.

KEYWORDS. Chiroptera, *Natalus,* systematics, morphometrics, distribution.

INTRODUCTION

At present, the monotypic family, Natalidae, includes three subgenera and five recognized species (KOOPMAN, 1993), but the specific or subspecific status of some taxa remains unclear. Recent detailed reviews of the taxonomic history of this family are presented by OTTENWALDER & GENOWAYS (1982) and by ARROYO-C. *et al.* (1997). The bats are most frequently found in the West Indies, including some islands of the coast of Venezuela. Two species of the subgenus *Natalus* (*Natalus stramineus* Gray, 1838 and *N. tumidirostris* Miller, 1900) are also found on the mainland. *Natalus stramineus* is known to be geographically distributed from northern Mexico to Venezuela, eastern Paraguay and eastern Brazil and throughout the Antilles (KOOPMAN, 1993; ARROYO-C. *et al.*, 1997; LÓPEZ-GONZÁLEZ *et al.*, 1998). There are few data available on the measurements of Brazilian specimens. RUSCHI (1951) provided external and cranial measurements of the holotype of *Myotis espiritosantensis* Ruschi, 1951 (= *Natalus stramineus,* according to PINE & RUSCHI, 1976) from the State of Espírito Santo (ES), Conceição da Barra, Gruta do Rio Itaúnas. GOODWIN (1959) reported one external and eight cranial measurements of three specimens from Natal, Rio Grande do Norte (RN) and one specimen from Lagoa Santa, Minas Gerais (MG). CARTER & DOLAN (1978) presented cranial measurements of the syntype (The Natural History Museum, London, not numbered), actually the BMNH 70.2324 holotype, an adult male kept in spirits with its skull removed, according to HANDLEY & GARDNER (1990). WILLIG (1983) reported the measurements of two males from Chapada do Araripe, Ceará (CE). HANDLEY & GARDNER (1990) presented some external measurements of the specimens kept in the British Museum, including the BMNH 70.2324, considered to be the holotype.

1. Laboratório de Chiroptera, Universidade para o Desenvolvimento do Estado e da Região do Pantanal, C.P. 2153, 79003-010 Campo Grande, MS, Brasil. (CNPq researcher)
2. Depto. Zoologia, Instituto de Biociências, Universidade Estadual Paulista, C.P. 502, 18618-000 Botucatu, SP, Brasil. (wuieda@ibb.unesp.br)

Natalus stramineus is a species poorly represented in collections probably due to the difficulty in collecting this bat with mist nets set in open areas. Most individuals were captured in caves, their natural day roost. We had the opportunity to examine *N. stramineus* material collected in Bolivia and in northern, northeastern, southeastern and central Brazil. The aims were to present new records, morphometric and distributional data on this species, including some observations about its biology.

MATERIAL AND METHODS

Sixty specimens, caught with hand nets and mist nets set in caves, were studied. The specimens, most of which preserved in fluid with their skull removed, were lodged in the following institutions: Diretoria de Vigilância Sanitária de Brasília and Instituto de Saúde de Brasília, Brasília (BRDF); Universidade Estadual Paulista, São José do Rio Preto, São Paulo (SJRP); Universidade para o Desenvolvimento do Estado e da Região do Pantanal, Campo Grande (CGMS); Museu de Zoologia, Universidade de São Paulo, São Paulo (MZSP).

Dial calipers were used to obtain 9 external and 12 cranial selected measurements, which were rounded up to the closest 0.1 mm. Measurements of the forearm and metacarpals were taken from the dorsal side and included the carpals. The following cranial measurements were taken: greatest skull length, from the posteriormost projection of the occipital to the anterior edge of the inner incisors; condyloincisive length, from the posteriormost projection of the exoccipital condyles to the anterior edges of the inner incisors; condylocanine length, from the posteriormost projection of the exoccipital condyles to the anterior edge of the canine; length of the maxillary and mandibular toothrows, from the anterior edge of the canine to the posteriormost projection of the last molar; length of the mandible, from the posteriormost projection of the condyloid processes to the anterior edges of the incisors; width across cingula canines, across the labial cingulum of canines; width across molars, maximum width across of the vestibular faces of the molars; posorbital constriction, smaller distance obtained at the postorbital constriction; breadth of the braincase, greatest width across the braincase; zygomatic width and mastoid breadth, greatest width obtained across zygomatic arches and mastoid processes, respectively.

Standard statistics (mean, range, and standard deviation) were computed and, for a large sample, the mean measurements of males and females were compared by a t-test (SOKAL & ROHLF, 1969), significance level 0.05, in order to ascertain secondary sexual variation in size.

Material examined (34 ♂, 26 ♀). BRASIL, **Pará:** Medicilândia, ♂, 17.X.1988, E. Trajano col. (CGMS); Cachoeira do Espelho, Rio Xingu, ♀, 02.X.1986, L. K. Gordon col. (MZSP); **Ceará:** Crato, ♂, 28.I.1978, M. R. Willig col. (MZSP); **Bahia:** Itaetê, 6 ♂, 6 ♀, VI.1995, R. Gregorin col. (MZSP); **Distrito Federal:** Sobradinho, ♂, 28.XI.1996, A. Bredt col. (BRDF); **Goiás:** Goianésia, ♂, ♀, 28.III.1998; 2 ♂, ♀, 10.VI.2000, A. Bredt col. (BRDF); **Mato Grosso do Sul:** Paraíso, 15 ♂, 03.XI.1979, V. A. Taddei *et al.* col.; 10 ♀, 28.I.1979, V. Garutti *et al.* col. (SJRP); Rio Verde de Mato Grosso, ♂, 4 ♀, 07.IX.1993, C. A. Nobile col. (SJRP); **São Paulo:** Iporanga, 1 ♂, 28.III.1979, ♀, 10.V.1980, E. Trajano col. (MZSP). BOLÍVIA, **Santa Cruz:** Puerto Suarez, 4 ♂, 2 ♀, V.1983, W. Uieda col. (CGMS); ♂, 26.VI.1983, W. Uieda col. (SJRP).

RESULTS AND DISCUSSION

Morphometrics. All the 60 specimens examined and measured (tabs. I, II) had completely fused phalangeal epiphysis and were considered adults. In male samples, mean cranial measurements were generally higher than those in females, but the same did not occur with regards to external measurements. As the sample from Paraíso, Mato Grosso do Sul (MS) was sufficiently large, males (N=15) were tested against females (N=10) in order to detect statistically significant sexual variation. Only one external (tibia length) and nine cranial features (greatest skull length, condylobasal length, condylocanine length, maxillary toothrow length, mandibular toothrow length, mandible length, width across cingula canines, posorbital constriction, and zygomatic width) were larger in males than in females. This fact corroborates the findings of OTTENWALDER & GENOWAYS (1982) who also detected secondary sexual variation in size for *N. micropus* Dobson, 1880. Thus,

Table I. Means ± one standard deviation and range of selected external measurements of *Natalus stramineus*. Samples: Bolívia, 1, Santa Cruz, Puerto Suarez; Brazil, MS: 2, Paraíso, Rio Sucuriú; 3, Rio Verde de Mato Grosso, Serra de Maracajú; PA: 4, Medicilândia and Cachoeira do Espelho, Rio Xingú; CE: 5, Crato; BA: 6, Itaetê; DF-GO: 7; SP: 8, Iporanga; RN: 9, Natal (measurements from GOODWIN (1959); (N, sample size; SD, standard deviation; means for males and females of the sample 2 from Paraíso that are significantly different are marked with asterisks: *, P<0.05; ns, not significant).

Sample	Males			Females		
Number	N	Means ± SD	Range	N	Means ± SD	Range
			Length of forearm			
1	5	38.44 ± 1.57	36.7 – 40.3	2	39.25 ± 0.77	38.7 – 39.8
2	15	39.50 ± 0.68 ns	38.3 – 40.5	10	39.16 ± 1.03	37.6 – 40.5
3	1	38.60	-	4	38.80 ± 0.70	37.9 – 39.5
4	1	39.40	-	1	40.40	-
5	1	39.00	-	-	-	-
6	6	38.83 ± 0.96	37.1 – 39.9	6	39.03 ± 0.28	38.7 – 39.5
7	4	38.42 ± 1.03	37.1 – 39.3	2	38.15 ± 0.91	37.5 – 38.8
8	1	39.90	-	1	38.80	-
9	1	37.30	-	2	37.10 ± 0.14	37.0 – 37.2
			Length of third metacarpal			
1	5	37.56 ± 0.53	36.8 – 38.0	2	37.85 ± 1.06	37.1 – 38.6
2	15	38.77 ± 0.50 ns	38.1 – 40.0	10	38.91 ± 0.76	37.9 – 40.1
3	1	37.20	-	4	38.40 ± 0.93	37.0 – 39.0
4	1	39.00	-	1	39.60	-
7	4	38.12 ± 1.25	36.3 – 39.1	2	38.25 ± 0.21	38.1 – 38.4
8	1	38.90	-	1	36.70	-
			Length of first phalanx (digit III)			
1	5	16.42 ± 0.69	15.8 – 17.6	2	15.95 ± 0.91	15.3 – 16.6
2	15	17.34 ± 0.30 ns	16.9 – 17.8	10	17.11 ± 0.47	16.4 – 18.0
3	1	16.10	-	4	16.87 ± 1.30	15.0 – 17.8
4	1	16.70	-	1	17,00	-
7	4	16.67 ± 0.94	15.5 – 17.7	2	16.35 ± 0.07	16.3 – 16.4
8	1	16.50	-	1	15.70	-
			Length of fourth metacarpal			
1	5	37.82 ± 0.54	37.3 – 38.6	2	38.00 ± 1.27	37.1 – 38.9
2	15	39.11 ± 0.77 ns	38.2 – 40.8	10	38.83 ± 1.03	37.2 – 40.3
3	1	37.10	-	4	38.37 ± 0.73	37.3 – 38.9
4	1	37.80	-	-	-	-
7	4	37.62 ± 0.78	36.5 – 38.3	2	38.25 ± 0.77	37.7 – 38.8
8	1	38.20	-	1	36.90	-
			Length of first phalanx (digit IV)			
1	5	9.98 ± 0.24	9.8 – 10.4	2	9.85 ± 0.35	9.6 – 10.1
2	15	10.29 ± 0.26 ns	10.0 – 10.9	10	10.18 ± 0.34	9.5 – 10.7
3	1	9.00	-	4	10.42 ± 0.57	9.6 – 10.9
4	1	10.20	-	1	10.70	-
7	4	10.00 ± 0.21	9.8 – 10.3	2	9.90 ± 0.14	9.8 – 10.0
8	1	10.40	-	1	10.40	-
			Length of fifth metacarpal			
1	5	37.16 ± 0.47	36.4 – 37.6	2	37.40 ± 0.99	36.7 – 38.1
2	15	38.61 ± 0.75 ns	37.4 – 40.0	10	38.31 ± 0.95	36.8 – 39.5
3	1	36.30	-	4	37.30 ± 0.95	36.0 – 38.3
4	1	38.50	-	1	39,10	-
7	4	37.25 ± 0.93	35.9 – 38.0	2	37.30 ± 1.13	36.5 – 38.1
8	1	38.50	-	1	36.60	-
			Length of first phalanx (digit V)			
1	5	9.72 ± 0.58	9.0 – 10.5	2	9.75 ± 0.49	9.4 – 10.1
2	15	10.04 ± 0.39 ns	9.6 – 11.0	10	9.79 ± 0.37	9.2 – 10.2
3	1	9.10	-	4	10.20 ± 0.54	9.4 – 10.6
4	1	9.50	-	1	10.00	-
7	4	9.57 ± 0.28	9.4 – 10.0	2	9.40 ± 0.14	9.3 – 9.5
8	1	10.40	-	1	10.50	-
			Length of tíbia			
1	5	21.54 ± 1.15	20.2 – 23.4	2	20.0 ± 0.70	19.5 – 20.5
2	15	` 21.54 ± 0.69 *	20.0 – 22.5	10	20.94 ± 0.46	20.4 – 21.8
3	1	21.60	-	4	21.57 ± 0.67	20.7 – 22.2
4	1	21.30	-	1	22.60	-
7	3	20.72 ± 0.93	19.5 – 21.5	2	20.05 ± 0.77	19.5 – 20.6
8	1	20.50	-	1	20.00	-

Table II. Means ± one standard deviation and range of selected cranial measurements of *Natalus stramineus*. Samples: Bolívia, 1, Santa Cruz, Puerto Suarez; Brazil, MS: 2, Paraíso, Rio Sucuriú; 3, Rio Verde de Mato Grosso, Serra de Maracajú; PA: 4, Medicilândia and Cachoeira do Espelho, Rio Xingú; CE: 5, Crato; BA: 6, Itaetê; DF-GO: 7; RN: 9, Natal (measurements from GOODWIN, 1959); (N, sample size; SD, standard deviation; means for males and females of the sample from Paraíso that are significantly different are marked with asterisks: *, P<0.05; **, P<0.01; ns, not significant).

Sample	Males			Females		
Number	N	Means ± SD	Range	N	Means ± SD	Range
			Greatest length of skull			
1	5	16.66 ± 0.13	16.5 – 16.8	2	16.25 ± 0.21	16.1 – 16.4
2	15	16.89 ± 0.19 **	16.5 – 17.2	10	16.57 ± 0.21	16.3 – 16.9
3	1	16,80	-	4	16.67 ± 0.17	16.5 – 16.9
4	1	16.80	-	-	-	-
5	1	16.30	-	-	-	-
6	1	16.20	-	1	16.00	-
7	2	16.85 ± 0.07	16.8 – 16.9	2	16.45 ± 0.07	16.4 – 16.5
9	1	15.90	-	2	15.95 ± 0,35	15.7 – 16.2
			Condylobasal length			
1	5	15.02 ± 0.23	14.8 – 15.4	2	14.75 ± 0.07	14.7 – 14.8
2	15	15.34 ± 0.14 **	15.1 – 15.6	10	15.10 ± 0.23	14.8 – 15.4
3	1	15.30	-	4	15.02 ± 0.12	14.9 – 15.2
4	1	15.20	-	-	-	-
5	1	15.00	-	-	-	-
6	1	14.50	-	1	14.30	-
9	1	14.60	-	2	14.70 ± 0.14	14.6 – 14.8
			Condylocanine length			
1	5	14.52 ± 0.22	14.3 – 14.9	2	14.15 ± 0.07	14.1 – 14.2
2	15	14.82 ± 0.11 **	14.7 – 15.0	-	14.56 ± 0.19	14.3 – 14.9
3	1	14.70	-	4	14.52 ± 0.18	14.4 – 14.8
4	1	14.80	-	-	-	-
			Length of maxillary toothrow			
1	5	6.80 ± 0.10	6.7 – 6.9	2	6.60 ± 0.14	6.5 – 6.7
2	15	6.94 ± 0.11 **	6.7 – 7.1	10	6.78 ± 0.06	6.7 – 6.9
3	1	6.90	-	4	6.77 ± 0.0 5	6.7 – 6.8
4	1	7.00	-	-	-	-
5	1	6.70	-	-	-	-
6	1	6.60	-	1	6.50	-
7	2	6.85 ± 0.07	6.8 – 6.9	2	6.65 ± 0.07	6.6 – 6.7
9	1	6.65	-	2	6.55 ± 0.07	6.5 – 6.6
			Length of mandibular toothrow			
1	5	7.24 ± 0.08	7.1– 7.3	2	7.05 ± 0.07	7.0 – 7.1
2	15	7.20 ± 0.12 *	7.0– 7.5	10	7.10 ± 0.11	7.0 – 7.3
3	1	7.30	-	4	7.15 ± 0.10	7.0 – 7.2
4	1	7.40	-	-	-	-
			Length of mandible			
1	5	11.66 ± 0.13	11.6 – 11.9	2	11.45 ± 0.21	11.3 – 11.6
2	15	11.94 ± 0.14 *	11.7 – 12.2	10	11.73 ± 0.23	11.5 – 12.2
3	1	11.90	-	4	11.75 ± 0.17	11.6 – 12.0
4	1	11.80	-	-	-	-
			Width across cingula canines			
1	5	3.86 ± 0.08	3.8 – 4.0	2	3.55 ± 0.07	3.5 – 3.6
2	15	4.05 ± 0.07 **	3.9 – 4.1	10	3.76 ± 0.06	3.7 – 3.9
3	1	3.90	-	4	3.70 ± 0.08	3.6 – 3.8
4	1	4.10	-	-	-	-
5	1	4.00	-	-	-	-
6	1	3.80	-	1	3.70	-
7	2	3.95 ± 0.07	3.9 – 4.0	2	3.75 ± 0.07	3.7 – 3.8
9	1	3.50	-	2	3.50 ± 0.14	3.4 – 3.6
			Width across molars			
1	5	5.40 ± 0.18	5.1 – 5.6	2	5.30 ± 0.14	5.2 – 5.4
2	15	5.63 ± 0.11 ns	5.4 – 5.8	10	5.60 ± 0.08	5.5 – 5.7

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Table II. Cont.

Sample Number	Males N	Means ± SD	Range	Females N	Means ± SD	Range
3	1	5.60	-	4	5.62 ± 0.05	5.6 – 5.7
4	1	5.60	-	-	-	-
5	1	5.50	-	-	-	-
6	1	5.50	-	1	5.40	-
7	2	5.65 ± 0.07	5.6 – 5.7	2	5.55 ± 0.07	5.5 - 5.6
9	-	-	-	1	5.50	-
			Posorbital constriction			
1	5	3.28 ± 0.13	3.2 – 3.5	2	3.05 ± 0.07	3.0 – 3.1
2	15	3.3 ± 0.07 *	3.2 – 3.4	10	3.23 ± 0.08	3.1 – 3.4
3	1	3.20	-	4	3.22 ± 0.05	3.2 – 3.3
4	1	3.50	-	-	-	-
5	1	3.20	-	-	-	-
6	1	3.30	-	1	3.20	-
		.25 ± 0.07	3.2 – 3.3	2	3.25 ± 0.07	3.2 – 3.3
9	1	3.10	-	2	3.10 ± 0.14	3.0 – 3.2
			Zygomatic width			
1	5	8.52 ± 0.22	8.3 – 8.8	2	8.50 ± 0.28	8.3 – 8.7
2	15	8.79 ± 0.14 **	8.6 – 9.0	10	8.64 ± 0.08	8.5 – 8.7
3	1	8.70	-	4	8.57 ± 0.20	8.4 – 8.8
4	1	8.70	-	-	-	-
5	1	8.50	-	-	-	-
6	1	8.40	-	1	8.20	-
7	2	8.75 ± 0.07	8.7 – 8.8	1	8.60	-
9	-	-	-	1	8.70	-
			Breadth of braincase			
1	5	8.22 ± 0.08	8.1 – 8.3	2	8.05 ± 0.21	7.9 – 8.2
2	15	8.38 ± 0.13 ns	8.1 – 8.6	10	8.27 ± 0.13	8.1 – 8.5
3	1	8.10	-	4	8.17 ± 0.12	8.0 – 8.3
4	1	8.30	-	-	-	-
7	2	8.35 ± 0.07	8.3 – 8.4	2	8.15 ± 0.07	8.1 – 8.2
9	1	7.90	-	2	7.90 ± 0.42	7.6 – 8.2
			Mastoid breadth			
1	5	7.52 ± 0.23	7.2 – 7.8	2	7.35 ± 0.07	7.3 – 7.4
2	15	7.78 ± 0.12 ns	7.5 – 7.9	10	7.71 ± 0.08	7.6 – 7.9
3	1	7.50	-	4	7.50 ± 0.14	7.4 – 7.7
4	1	7.80	-	-	-	-

geographic and morphometric variations should be separately analized in males and females.

The mean measurements of one external (forearm length) and eight cranial features, reported by GOODWIN (1959), of a male and two females from Natal, RN, (sample 9 in tabs. I, II), revealed that the specimens from Pará (PA), Distrito Federal (DF), Goiás (GO), MS, São Paulo (SP) and Bolivia are, on the average, larger than those from northeastern Brazil, currently known as *N. stramineus natalensis* Goodwin,1959. WILLIG (1983) included two specimens from Chapada do Araripe (CE), in the subspecies *N. stramineus natalensis* "because morphometric comparison with the type specimen indicates correspondence".

The *N. stramineus* specimens from PA, DF, GO, MS, and SP are similar in size. Some external and cranial measurements of specimens from Puerto Suarez, Bolivia (fig. 1), Crato, CE and Itaetê, BA are intermediate between the specimens from central Brazil and those from Natal, RN. However, some samples are not large enough to allow the performance of statistical analysis to determine whether geographic variation occurs. The cranial measurements of the specimens from northern (PA) and central (DF, GO, MS) Brazil agree very well with those of the holotype (greatest skull length: 16.6; condyloincisive length: 15.2; maxillary toothrow length: 7.2; mandibular toothrow length: 7.5; width across cingula

Fig. 1. *Natalus stramineus* from Puerto Suarez, Santa Cruz, Bolívia. (Photo: W. Uieda)

canines: 4.0; width across molars: 5.8; posorbital constriction: 3.2; braincase breadth: 8.2; zygomatic width: 8.6; and mastoid breadth: 7.6) presented in CARTER & DOLAN (1978).

As pointed out by PINE & RUSCHI (1976), *Myotis espiritosantensis* Ruschi, 1951 is a junior synonym of *Natalus stramineus*. According to these authors, the specimens from Espírito Santo, due to their geographic localization, would be expected to be *N. stramineus natalensis.* However they are apparently too large for the species so they suggested to denominate them *N. stramineus espiritosantensis* (Ruschi). Some of the external and cranial measurements reported by RUSCHI (1951) were: forearm length: 40.0; third metacarpal length: 38.0; first phalanx length (digit III): 17.0; tibia length: 22.0; greatest skull length: 18.5; maxillary toothrow length: 8.0; mandible length: 13.0. The accuracy of some cranial measurements should be discussed, because they are too large when compared with the external measurements and the means of other Brazilian samples of the species. Thus, some cranial measurements taken from the *M. espiritosantensis* (RUSCHI, 1951:4) skull drawing, with bar scale, are more compatible with the external dimensions. For instance, greatest skull length: 16.6; maxillary toothrow length: 6.5 to 7.0; mandible length: 12.6. Based on these data, it is possible to state that the *M. espiritosantensis* (= *N. stramineus*) holotype is morphometrically similar to specimens of *N. stramineus* from central Brazil. Thus, some *N. stramineus* cranial measurements are smaller in individuals from a northeastern area (RN, CE, and BA); about the same size in the specimens from northern (PA), eastern (ES, SP) and central (DF, GO, MS) Brazil which, on their turn, are larger than those found in the individuals from Santa Cruz, Bolivia, which are intermediate in size between the central Brazil and northeastern samples.

Fig. 2. Updated geographic distribution of *Natalus stramineus* in South America with seven new records from Brazil (1, 9, 10, 11, 12, 14, and 15) and one from Bolivia (13). The records are: 1, Medicilândia (PA); 2, rio Xingú (PA); 3, São João do Piauí (PI); 4, Crato (CE); 5, Aripuanã (MT); 6, Itaetê (BA); 7, Conceição da Barra (ES); 8, Itacarambi (MG); 9, Colinas do Sul (GO); 10, Goianésia (GO); 11, Padre Bernardo (GO); 12, Sobradinho (DF); 13, Puerto Suarez (Bolívia); 14, Rio Verde de Mato Grosso (MS); 15, Paraíso (MS); 16, Lagoa Santa (MG); 17, Concepción (Paraguay); 18, Iporanga (SP).

GRAY (1838), describing *Natalus stramineus*, specifically stated that the type locality was unkown. CABRERA (1958) restricted the type locality of this species to Lagoa Santa, MG, Brazil. GOODWIN (1959) disagreed with CABRERA (1958) and, on the basis of measurements and cranial features, stated that the holotype of *N. stramineus* agreed so exactly with the specimens from Lesser Antilles "that they can be confidently identified as the typical form". He observed that the measurements and cranial features of the specimens from Brazil, Venezuela, Trinidad, Central America, and Mexico definitely ruled

out the possibility that Gray's type could come from any of these localities, restricting the type locality to Antigua, British West Indies, Lesser Antilles. GOODWIN (1959) observed that "While the specimen from Lagoa Santa in the Museum Lundi has not been seen by this author, Winge's (1893) drawing of the skull, reproduced natural size, corresponds so closely in measurements and characteristics to the type that it can be confidently referred to as *natalensis*. Winge's drawing, however, does show the palate as fractionally extended farther posteriorly than in Natal specimens". Thus, the specimens from Lagoa Santa apparently differ morphologically from those from Natal and, regarding cranial measurements, it appears to be a small representative of central and southeastern Brazil populations. Recently, HANDLEY & GARDNER (1990) reviewed the critical specimens of the British Museum and concluded that the specimen examined by GRAY (1838) and described as *Natalus stramineus* was an adult male in spirits (BMNH 70.2324) and they believed, as did GOODWIN (1959), that it came from the Lesser Antilles (restricted type locality, Antigua). The authors reported that "We are not aware of any South American populations clearly assigned to *N. stramineus* except for the widespread Brazilian population GOODWIN (1959) named *N. stramineus natalensis"*. The specimens examined in the present study apparently constitute new source of information on morphometrics and distribution of this species in South America and type locality needs to be further discussed.

GOODWIN (1959) recognized four subspecies and Varona (1974), *apud* ARROYO-C. *et al.*, (1997) proposed six subspecies, being *N. stramineus natalensis* (eastern Brazil from Natal, RN, to Lagoa Santa, MG) the only occurrence in Brazil. PINE & RUSCHI (1976) considered that the specimens from Espírito Santo are apparently large for the species and "it seems appropriate to designate them as *Natalus stramineus espiritosantensis* (Ruschi)." As formely reports suggest there are at least two subspecies of *N. stramineus* in South America, further discussions about the type locality of this species are necessary.

Habitat and interspecific association. The bats of the genus *Natalus* have been reported to inhabit caves, mines and tunnels in association with a variety of bat species. The localities where *N. stramineus* was collected in Bolivia and Brazil show that it prefers caves as shelters and sometimes occur in association with a great variety of species. In Paraíso Cave, MS, it was found roosting with *Pteronotus parnellii* (Gray, 1843) (Mormoopidae), *Lonchorhina aurita* Tomes, 1863*, Carollia perspicillata* (Linnaeus, 1758), and *Desmodus rotundus* (E. Geoffroy, 1810) (Phyllostomidae) and in Rio Verde Cave, with *D. rotundus.* In Paraíso Cave, resting *Natalus* specimens were observed hung separately in the ceiling of the cave rather than forming tight clusters, as noted by GOODWIN (1970) for this species and *Natalus major* Miller, 1902 and *N. micropus* Dobson, 1880, as well. It is probable that tight clusters may be found in large *Natalus* colonies as observed by GOODWIN (1970).

RUSCHI (1951) listed the following species in association with *Myotis espiritosantensis* (= *Natalus stramineus*): *L. aurita, Macrophyllum* Gray, 1838 [= *Macrophyllum macrophyllum* (Schinz, 1821)], *Micronycteris megalotis* (Gray, 1842), *Anoura geoffroyi* Gray, 1838*, Glossophaga soricina* (Pallas, 1766, *Lonchoglossa ecaudata* [= *Anoura caudifera* (E. Geoffroy, 1818)], *Lonchophylla mordax* Thomas, 1903*, Tonatia brasiliense* (Peters, 1866) (= *Carollia perspicillata*, after PINE & RUSCHI, 1976), *Hemiderma perspicillatum* (= *Carollia perspicillata*?). In caves located in Medicilândia, (PA), TRAJANO & MOREIRA (1991) observed *N. stramineus* sharing the same roost with *L. aurita*, *D. rotundus*, *Carollia* sp., *P. parnellii* and other unindentified emballonurid and vespertilionid bats. In Piauí (Luiz Dino Vizotto, personal commun.) *Pteronotus gymnonotus* Natterer, 1843*, P. parnellii*, and *P. personatus* (Wagner,

1843) are found in the same roost as *N. stramineus*. TRAJANO (1985) reported *C. perspicillata* and *D. rotundus* associated with *Natalus* in a cave in the upper valley of Ribeira river, south SP; TRAJANO & GIMENEZ (1998) recorded *Peropteryx macrotis* (Wagner, 1843), *P. kappleri* Peters, 1867 (Emballonuridae), *Chrotopterus auritus* (Peters, 1856), *Micronycteris* **aff.** *minuta* (Gervais, 1856), *Phylloderma stenops* Peters, 1865, *Tonatia bidens* (Spix, 1823), *G. soricina, Lionycteris spurrelli* Thomas, 1913, *C. perspicillata, Platyrrhinus lineatus* (E. Geoffroy, 1810), *D. rotundus* and *Diphylla ecaudata* Spix, 1823 (Phyllostomidae), at Olhos d'Água Caves, northern MG, and GREGORIN & MENDES (1999) listed *P. macrotis, C. auritus, G. soricina, L. spurrelli, L. mordax, C. perspicillata, Artibeus jamaicensis* Leach, 1821, *P. lineatus, D. rotundus* and *D. ecaudata* in association with *N. stramineus* in a cave at Chapada Diamantina, BA. Therefore, at least 22 species of bats were known to harbour together with *N. stramineus* in Brazil, two Emballonuridae, three Mormoopidae and 17 Phyllostomidae.

Distribution. The geographical distribution of *N. stramineus* in Brazil has been long known to include only eastern Brazil, from RN to MG (GOODWIN, 1959). Ruschi's paper on the bats of Espírito Santo were overlooked for many years until PINE & RUSCHI (1976) elucidated the identities of some species and discussed controversial information on the natural history of the batfauna. *Myotis espiritosantensis* Ruschi, 1951 (= *N. stramineus*) from rio Itaúnas, município de Conceição da Barra (18º34'S, 39º46'W), ES, appears to be the second record for the species in southeastern Brazil. TRAJANO (1982) mentioned the species from Iporanga (24º34'S, 48º42'W), SP, that is the southernmost record of *Natalus* in Brazil, and TRAJANO & GIMENEZ (1998) recorded the species from Itacarambi (15º07'S, 44º10'W), northern Minas Gerais. In northeastern Brazil, besides Natal, the species was found from São João do Piauí (08º10'S, 45º15'W), PI (Luiz Dino Vizotto, personal commun.), Chapada do Araripe, Crato (07º27'S, 39º12'W), CE (WILLIG, 1983), and Chapada Diamantina, Itaetê (12º56'S, 41º06'W), BA (GREGORIN & MENDES, 1999). In northern Brazil, there are two references: MOK *et al.* (1982) listed *N. stramineus* from Aripuanã (09º11'S, 60º38'W), northwestern of Mato Grosso, and TRAJANO & MOREIRA (1991), from Medicilândia, central Pará.

The specimens now examined are from Medicilândia (03º12'S, 52º12'W) and Cachoeira do Espelho, Xingú river (03º39'S, 52º23'W), PA, northern Brazil; Floresta Nacional do Araripe, Crato (07º27'S, 39º12'W), CE, and Poço Encantado, Chapada Diamantina, Itaetê (12º56'S, 41º06'W), BA, northeastern Brazil; Gruta da Saúva, Sobradinho (15º32'S, 47º52'W), DF, Lapa do Fuzil, Goianésia (15º28'S, 49º00'W), GO, Paraíso (19º03'S, 52º58'W) and Rio Verde de Mato Grosso (18º59'S, 54º48'W), MS, mid-western Brazil; Caverna Gurutuva, (24º32'S, 48º39'W) and Caverna Santana (24º32'S, 48º42'W), Iporanga, SP, southestern Brazil, and from Puerto Suarez (18º58'S, 57º48'W), Santa Cruz, Bolivia. Additional records came from mid-western Brazil: Padre Bernardo (15º18'S, 48º11'W) and Colinas do Sul (14º16'S, 47º48'W), GO (Angelika Bredt, personal commun.). All the new records of *N. stramineus* presented here, combined with the records of the species from Departamento Concepción (22º40'S, 57º20'W) in Paraguay (LÓPEZ-GONZALEZ *et al.*, 1998) and from Aripuanã, MT (MOK *et al*., 1982), extend its geographic range to Amazonian basin, through mid-western Brazilian Cerrado to eastern Bolivia and eastern Paraguay, and change the known distribution of the species in South America (fig. 2).

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