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CONSERVATION STATUS OF THE BUFF-BREASTED SANDPIPER: HISTORIC AND CONTEMPORARY DISTRIBUTION AND ABUNDANCE IN SOUTH AMERICA

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ABSTRACT.—We present historic and contemporary information on the distribution and abundance of Buff-breasted Sandpipers (*Tryngites subruficollis*) in South America. Historic information was collated from the literature, area ornithologists, and museums, whereas contemporary data were derived from surveys conducted throughout the main wintering range in Argentina, Uruguay, and Brazil during the austral summers of 1999 and 2001. Variable circular plot sampling was used to estimate population densities. During 1999, the highest concentration of Buff-breasted Sandpipers in Argentina was in southern Bahía Samborombón (General Lavalle District) and areas north of Mar Chiquita coastal lagoon. During 2001, the highest concentrations in Brazil were at Ilha da Torotama and Lagoa do Peixe National Park. During 1999 and 2001, the highest concentrations of Buff-breasted Sandpipers in Uruguay were found along three lagoons (Laguna de Rocha, Laguna de Castillos, and Laguna Garzón) bordering the Atlantic Ocean. Population densities (birds/ha) of Buff-breasted Sandpipers were 0.11 (95% C.I. = 0.04–0.31) in Argentina, 1.62 (0.67–3.93) in Brazil, and 1.08 (0.37–3.18) in Uruguay. High turnover rates at survey sites, due to the formation of large, mobile flocks, contributed to moderately large confidence intervals around our population density estimates. Nevertheless, compared with historic accounts of Buff-breasted Sandpipers, our survey data indicate the population size of this species has declined substantially since the late 1800s and contemporary information suggests the species has continued to decline during the past three decades. Buff-breasted Sandpipers were found almost exclusively in pasturelands and appear to depend heavily upon intensive grazing by livestock, which maintain suitable short grass conditions. We discuss the need for protection of critical areas and proper range management to ensure appropriate habitat remains available for the species, and provide suggestions for future research needs. *Received 12 March 2001, accepted 31 January 2002.*

Buff-breasted Sandpipers (*Tryngites subruficollis*) probably numbered in the hundreds of thousands at the turn of the Twentieth Century (Forbush 1912, Hudson 1920). Long term shorebird surveys in central and eastern Canada indicate that the population size may be as low as 15,000 today (Brown et al. 2001, Morrison et al. 2001). This decline is attributed to commercial hunting during the late 1800s and early 1900s during the species' migration across the central United States and to a lesser degree on the wintering grounds in South America (McIlhenny 1943, Myers 1980, Canevari and Blanco 1994). A further negative effect on the population occurred during the widespread conversion of short grass prairies to agriculture in the U.S. plains (Wetmore 1927, Lanctot and Laredo 1994). In 1999, the Buff-breasted Sandpiper was proposed and then included in Appendix I of the

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Convention on the Conservation of Migratory Species of Wild Animals—United Nations Environmental Program (1999). The species also is ranked as one of high concern in the U.S. (Brown et al. 2001) and Canadian (Donaldson et al. 2000) shorebird conservation plans. These certifications encourage the study, management, and conservation of the species.

Within this framework, we conducted the first population wide survey of the species. The natural history of the Buff-breasted Sandpiper required that such a survey be conducted on the wintering grounds. During the breeding season, individuals occur sporadically and in unpredictable numbers throughout the high Arctic (Troy and Wickliffe 1990, Lanctot and Laredo 1994, Lanctot and Weatherhead 1997). Similarly, Buff-breasted Sandpipers are broadly dispersed and are unpredictable in distribution during spring and fall migration in the central plains of the U.S. and Canada (Skagen 1997; J. G. Strauch, Jr. unpubl. data). In contrast, Buff-breasted Sandpipers winter in a relatively small region of Argentina, Uruguay, and Brazil (Belton 1994, Blanco et al. 1993, Lanctot and Laredo 1994). Here, they are restricted to coastal areas that provide a sanctuary for the species because flooding and soil salinity limit agricultural development and promote cattle grazing (Soriano 1991). Buff-breasted Sandpipers, in turn, benefit from cattle grazing because of their dependence upon short grass pastures for winter habitat.

Here we present historical and contemporary information on the abundance and distribution of Buff-breasted Sandpipers in South America. Next, we document the abundance and locations where Buff-breasted Sandpipers were seen during systematic surveys in Argentina, Uruguay, and Brazil during the austral summers of 1999 and 2001. Then, we discuss the need for protection of critical areas and proper range management to ensure appropriate habitat remains available for the species. Finally, we recommend future research needs for the conservation of the species.

METHODS

Wintering and migration range.—We delineated the potential wintering range of Buff-breasted Sandpipers by plotting the locations of historic species records onto base maps with ArcView GIS software (Environmental Systems Research Institute, Inc. 1992). Information was obtained from published and grey literature, by local contacts and ornithology list servers, and from museums. When geographic coordinates for a location were not provided in the primary source of information (person or reference), we found locations and determined coordinates from ornithological gazetteers available for each country. We also used the spelling of place names in the gazetteers when available. We defined the main wintering and migration range of the species based on the distribution and timing of these observations, previous knowledge of the species' habitat use (Blanco et al. 1993), and the distribution of habitat types in the Río de La Plata Grasslands (see maps in León et al. 1984, Soriano 1991). The main wintering range encompassed the area where Buff-breasted Sandpipers were observed frequently and in large numbers during austral summer months (November through February), and where there were large patches of suitable habitat. Buff-breasted Sandpipers occasionally occur outside this area during winter although suitable habitat is patchily distributed and scarce (due to agriculture and urban development), making sightings unpredictable and infrequent. The migration range spanned the area where sightings were recorded during austral spring (August through October) and fall migration (March through May), or areas visited only occasionally by the species. Although only historic observations were used to delineate the migration and wintering areas, we included more recent observations in our tables and figures as they provided additional contemporary information on the species. Historic observations where the month of the sighting was missing (7 of 133 localities) were not used to delineate winter and migration boundaries.

Survey design and protocol.—We conducted surveys during early December, 1999, in Argentina and Uruguay. After learning that Buff-breasted Sandpipers also were using portions of Brazil, we initiated a second year of surveys in early December 2001. These surveys were limited to only Uruguay and Brazil because funds were limited.

Because all the available literature indicated Buff-breasted Sandpipers used land with short vegetation, we focused our surveys on short-vegetated areas such as intensively grazed pastures and newly established agricultural fields (e.g., rice fields). Here, pastures typically refer to native grass areas or old agricultural fields with crop residue that are being grazed. Tall grass, tall emergent areas of marshes, and forested areas were avoided. Survey localities were restricted further to those areas that we could access by road or ranch trails, or by travel with 4-wheel drive vehicles.

In Argentina, we focused our surveys on a random sample of sites within the previously defined main wintering range (with an emphasis on the less-developed coastal areas; see Buff-breasted Sandpiper habitat use in Blanco et al. 1993). We delineated survey plots by drawing a grid over the map of the main wintering range. Each plot was approximately 12 × 12 km in

size. Upon visiting each plot, observers selected a specific ''locality'' to survey based on habitat suitability. Thus only a small portion of each plot was actually surveyed during our study. We also conducted replicate surveys at one locality (Estancia Medaland) every 2 days (seven surveys) throughout the survey period (1–13 December 1999) to estimate population turnover. Buff-breasted Sandpipers were known to frequent this locality yearly and densities were moderate to high (Myers 1980, Isacch and Martínez 1999).

In Brazil, we also constructed a 12 × 12 km grid over the main wintering range and randomly selected a sample of these plots to survey. We followed the protocol of sampling a locality within each plot as described above for Argentina. Survey localities were in high terrain areas (approximately 8–20 m asl) above Pleistocene age fossil dune barriers and lower terrain areas (approximately 0–8 m asl) located in Holocenic lacustrine terraces of more recent origin (Long 1989). Localities were located predominantly in pastures, and active and abandoned rice fields.

In Uruguay, our sampling approach varied between years. During 1999, we surveyed road accessible portions of a narrow fringe of lowland surrounding three coastal lagoons (Castillos, Rocha, and Garzón) bordering the Atlantic Ocean. Due to logistic constraints these locations were not chosen randomly, but rather were placed in locations where Buff-breasted Sandpipers historically had been recorded in high numbers. In 2001, we expanded our survey areas to the entire main wintering range, and sampled random locations within a 12 × 12 km grid of plots as described above for Argentina. Survey localities were in pastures within or adjacent to fresh and saltwater marshes, and active and abandoned rice fields.

Survey methods.—We used variable circular plot sampling (Reynolds et al. 1980, Buckland et al. 1993) to survey Buff-breasted Sandpipers in each country. We chose this methodology because (1) Buff-breasted Sandpipers are very cryptic and are easier to detect by observers standing still, (2) patchily distributed habitats could be surveyed more easily, and (3) vegetation characteristics could be measured and identified with a particular survey location (Buckland et al. 1993). The total number of survey locations (points) per locality varied from 1–16 (most had ≥5 points), depending upon the amount of suitable habitat. At each point, 1–2 observers recorded the number, the behavior, and the radial distance from detected birds to the observation point (to the nearest meter). We recorded birds ≤250 m of each point, and points were spaced approximately 500 m apart to ensure observations were independent. We collected data for at ≥5 min at each point; observations lasted longer when observers could not record all birds near the point within 5 min, i.e., when large flocks were present. Although the time observers counted birds at each point varied, we do not feel this negatively biased our likelihood of detecting Buff-breasted Sandpipers at survey points with short observation periods. Indeed, Buff-breasted Sandpipers rarely flew into our observation area (i.e., ≤250 m of a point) after we had initiated counting; it simply took longer to count all the birds at survey points with large numbers of birds. We also recorded Buff-breasted Sandpipers between points and throughout the survey locality while walking to and from survey start and stop points. We used a handheld GPS receiver (Garmin GPS 12) to determine geographical coordinates for each survey point and Buff-breasted Sandpiper sighting (accurate to ≤50 m). Observers searched near the survey point first, and less intensively as the distance from the point increased. We placed emphasis on detecting Buff-breasted Sandpipers, followed by other shorebirds, and finally other bird species. Data were collected primarily during the morning and early afternoon (07:00–15:00), but occasionally in the evening.

Density estimate calculations.—We used the program DISTANCE (ver. 3.5, Thomas et al. 1998, http://www.ruwpa.st-and.ac.uk/distance/) to determine densities and confidence intervals for Buff-breasted Sandpipers detected in each country. We used clusters (or groups) of Buff-breasted Sandpipers as our sample unit. Data from each country (and each year for Uruguay) were analyzed separately to determine the most robust detection function, mean cluster size, and density estimate. This approach proved to be more robust than combining observations across countries due to the different detection functions in each country. For those countries where Buff-breasted Sandpipers were not detected near the survey point (possibly due to birds moving away from the point as observers approached), we left truncated the distance data to avoid calculating a biased low density estimate (Buckland et al. 1993). Similarly, we right truncated the distance data to remove outliers that contributed little to the density estimate and made modeling of the detection function difficult. A series of models then were tested and assessed for adequacy using Akaike's Information Criterion and the goodness of fit test. We also regressed group size against detection distance to test whether larger groups of Buff-breasted Sandpipers were more likely to be seen at greater distances from the survey point. This regression analysis was nonsignificant in all cases, allowing us to use the mean cluster size in our subsequent analyses.

RESULTS

Winter and migration range.—The first record of a Buff-breasted Sandpiper on the wintering grounds was in 1822 near Ipanema in São Paulo State in Brazil (Appendix 1, map location 72; Von Pelzeln 1870). Our search identified an additional 132 localities in South America where Buff-breasted Sandpipers had been detected at least once (Appendix 1, Figs. 1, 2). The largest number of localities was in Argentina (n = 48 or 36.1%), followed by Brazil with 30 (22.6%), and Uruguay and Peru with 11 (8.3%) each. Six other countries had

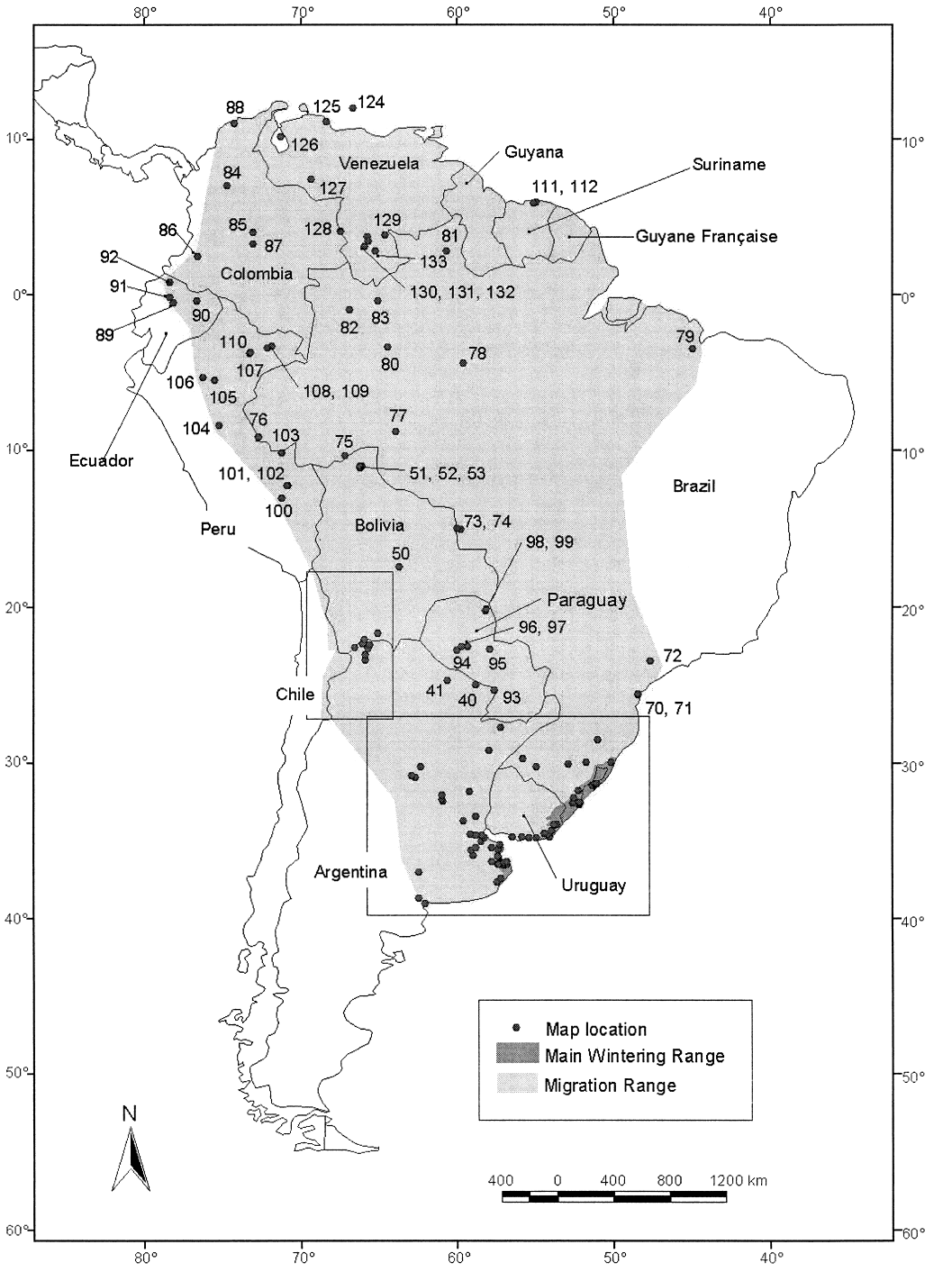

FIG. 1. Location of Buff-breasted Sandpiper sightings in South America, 1822–2000, and the main wintering and migration ranges. See Appendix 1 for attributes of the numbered locations. See Fig. 2 for the location and attribute numbers within the boxed areas.

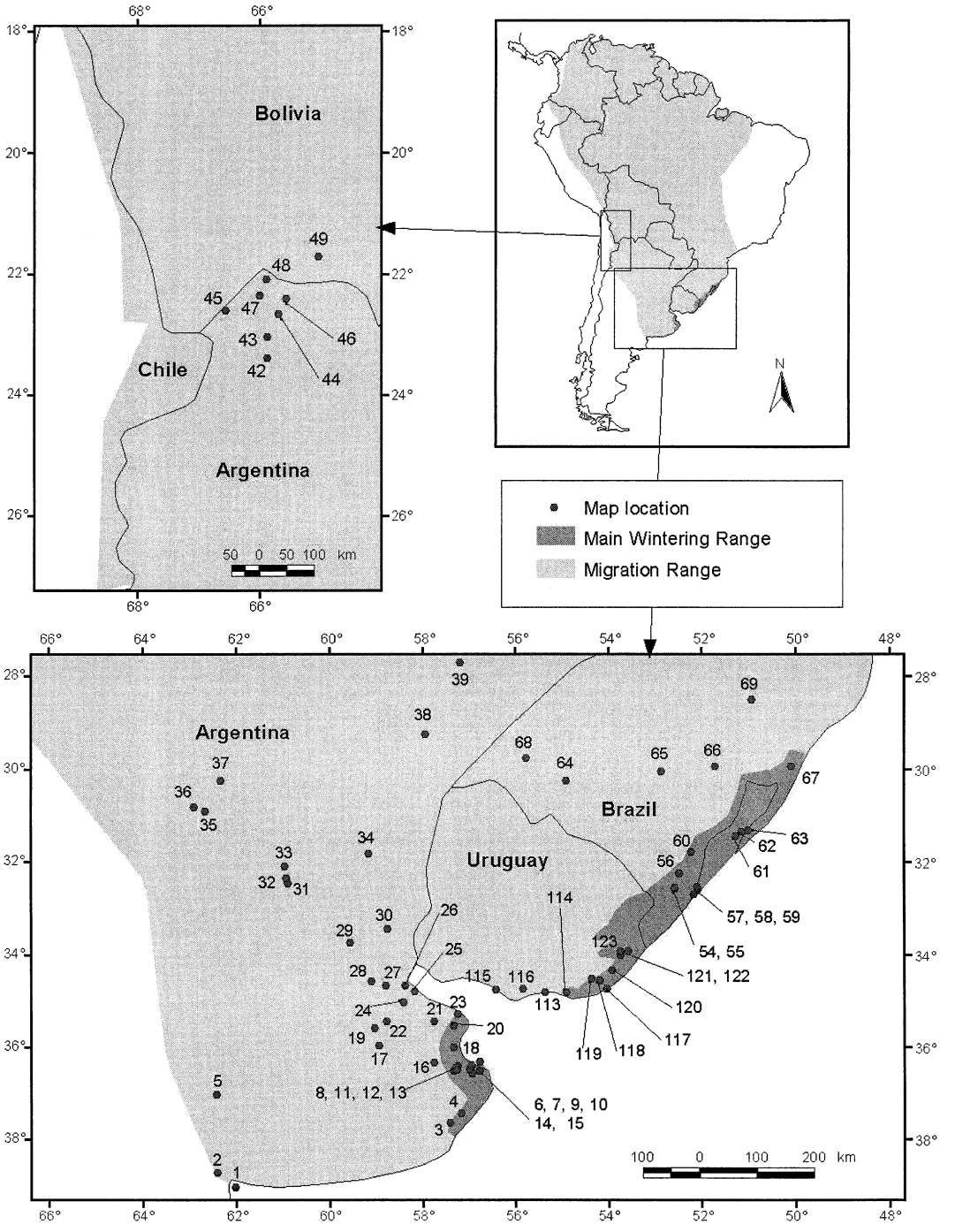

FIG. 2. Location of Buff-breasted Sandpiper sightings in the main wintering range of South America, 1822–2000. See Appendix 1 for attributes of numbered locations.

2–10 locations each (Appendix 1). Anecdotal reports indicate Buff-breasted Sandpipers are found in two of the three remaining countries of South America (Guyana and Guyane Française but not Chile), but information on exact locations was unavailable (Lanctot and Laredo 1994).

The year an observation occurred was recorded for 126 of the 133 localities (multiple observations were recorded at several localities). The largest percentage of observations occurred during 1992 and 1993 (n = 41, 24.4%), when surveys for Eskimo Curlews (*Numenius borealis*) were being conducted in Argentina and Uruguay (Blanco et al. 1993). Eighteen (10.7%) observations occurred prior to 1900, 21 (12.5%) between 1901 and 1938, 33 (19.6%) between 1943 and 1978, 32 (19.1%) between 1982 and 1991, and the remainder (n = 23, 13.7%) occurred between 1994 and 2000.

Seventy-five of the 133 localities included counts of the number of Buff-breasted Sandpipers (Appendix 1). Twenty-two localities included only subjective assessments of numbers such as present, common, and few. At 31 localities, the only information available was that a bird had been collected and a museum skin had been prepared. At the remaining five locations, the presence of museum skins and general information on the number of individuals present was recorded. The number of birds observed at each locality ranged from 1–2,000, but typically was <50. Thirteen groups of over 100 birds were documented, including 262 and 2,000 birds at Estancia Medaland (Argentina); 110 and 200 birds at Lagoa do Peixe (Brazil); ''hundreds'' at Estação Ecológica do Taim (Brazil); 500 birds at Hacienda La Corocora (Colombia); 140 birds at Bahía de Asunción (Paraguay); 143, 164, 216, and 225 birds at Laguna de Rocha and Arroyo La Palma (Uruguay); 210 at Bañado de las Maravillas (Uruguay); and 200 at Hato El Cedral (Venezuela; Appendix 1).

Historic information and more contemporary data indicate that the main wintering range of the species is within the coastal sectors of the Río de La Plata Grasslands (Soriano 1991), at the eastern portion of the flooding pampa of Argentina, and adjacent to large lagoon complexes in the coastal plain of Rio Grande do Sul of Brazil and Uruguay (Long 1989). The eastern portion of the flooding pampa is dedicated almost exclusively (>90%) to cattle ranching because flooding and salinity restrict agricultural development (León et al. 1984). Many recent records of Buff-breasted Sandpipers occurred in this area, primarily from San Miguel del Monte, General Lavalle region, Estancia Real Viejo, Estancia La Isolina, and Estancia Medaland (Appendix 1). The large concentrations of Buff-breasted Sandpipers from Uruguay and Brazil occurred in Laguna de Rocha and Bañados de las Maravillas in Uruguay; and from Estação Ecológica do Taim and Lagoa do Peixe in Brazil (Appendix 1).

Incidental sightings during winter also were reported in the remaining portions of the Río de La Plata Grassland (subregions of the rolling pampa, inland pampa, southern pampa, mesopotamic pampa). This area is characterized by extensive agriculture and human development. Smaller numbers also have been observed in saline lagoons of the Puna Ecoregion of Argentina and Bolivia, and the Central Trough of Rio Grande do Sul, Brazil.

The distribution of Buff-breasted Sandpiper sightings north of the wintering grounds indicates the species migrates through the Central Amazonia/Pantanal Flyway, crossing through the countries of Paraguay, Bolivia, Brazil, Peru, Colombia, Venezuela, and Suriname on their way north to the Central Flyway of North America (Fig. 1; see also Antas 1983). Migration south appears to occur along a similar route. Buff-breasted Sandpipers frequently were reported using sand bars along rivers in the interior portions of South America; most records are from the Amazonian sectors of Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela. The number of birds detected typically was small, although in a few cases the species was listed only as ''present.''

Contemporary distribution and abundance.—Results of the circular plot sampling are presented in Table 1. In Argentina, 5–7 people surveyed 32 localities (296 survey points) from 1–13 December, 1999. Buff-breasted Sandpipers were present on 10 of the 32 localities surveyed in Argentina (Fig. 3). We found the species in two distinct areas: southern Bahía Samborombón (General Lavalle District, localities 9, 12–17, and 19; Fig. 3) and north of Mar Chiquita coastal lagoon

TABLE 1. Buff-breasted Sandpiper sightings during variable circular plot sampling in Argentina, Uruguay, and Brazil. See Figures 3–5 for location of map numbers.

Map number	Locality[a]	Latitude (S)	Longitude (W)
Argentina, 1999			
1	Vergara	35° 23′ 59″	57° 39′ 23″
2	Don Cipriano	35° 28′ 54″	57° 47′ 20″
3	W of Don Cipriano	35° 31′ 14″	57° 37′ 13″
4	Pipinas	35° 32′ 45″	57° 20′ 21″
5	Giribone	35° 37′ 24″	57° 38′ 36″
6	W of Libres del Sud	35° 39′ 00″	57° 38′ 25″
7	SE of Libres del Sud	35° 46′ 15″	57° 40′ 47″
8	Canal de las Escobas	35° 59′ 42″	57° 38′ 04″
9	Canal A (Ea. Santa Lucia)	36° 12′ 24″	57° 18′ 15″
10	Laguna del Junco	36° 15′ 41″	57° 34′ 01″
11	S of Santa Magdalena	36° 21′ 15″	57° 27′ 59″
12	Canal Sta. Clara	36° 24′ 07″	57° 15′ 02″
13	Reserva Campos del Tuyu	36° 24′ 32″	56° 50′ 43″
14	Ea. La Victoria	36° 24′ 55″	57° 18′ 47″
15	W of Ea. El Recuerdo	36° 26′ 12″	57° 23′ 13″
16	SW of General Conesa	36° 30′ 08″	57° 14′ 33″
17	Ea. La Isolina	36° 32′ 49″	56° 55′ 50″
18	S of Ea. Santa Catalina	36° 33′ 39″	57° 22′ 46″
19	E of Ea. El Tonetera	36° 33′ 55″	57° 05′ 28″
20	Close to Ea. Cari Lauquen	36° 38′ 52″	57° 11′ 36″
21	Ea. La Emestina	36° 40′ 31″	56° 51′ 40″
22	Route 56 surroundings	36° 45′ 09″	57° 16′ 33″
23	Ea. Las Trea Marías	36° 53′ 05″	57° 10′ 55″
24	Ea. San Jose	36° 55′ 53″	56° 49′ 40″
25	Colonia Tío Domingo	37° 02′ 08″	56° 57′ 43″
26	Ea. La Susana	37° 16′ 39″	57° 41′ 04″
27	N of Ea. Medaland	37° 24′ 22″	57° 09′ 58″
28	N of Nanuel Rucá	37° 31′ 37″	57° 36′ 49″
29	Ea. Mar Chiquita	37° 41′ 30″	57° 23′ 33″
30	W of El Dorado	37° 44′ 30″	57° 47′ 46″
31	El Cangrejal	37° 46′ 30″	57° 31′ 14″
32	Ea. Medaland[e]	37° 25′ 55″	57° 11′ 49″
Brazil, 2001			
1	Varzinha	30° 18′ 32″	50° 52′ 07″
2	Ponta do Anastácio	30° 27′ 47″	50° 40′ 50″
3	Bacopari	30° 33′ 04″	50° 26′ 43″
4	Lagoa da Figueira	30° 48′ 48″	50° 39′ 58″
5	Cristóvão Pereira	31° 05′ 56″	51° 01′ 44″
6	Lagoa do Peixe Nat. Park	31° 15′ 27″	50° 59′ 22″
7	S and within Lagoa do Peixe Nat. Park	31° 26′ 46″	51° 10′ 03″
8	Capão da Areia marsh	31° 33′ 21″	51° 17′ 22″
9	Ilha da Torotama	31° 55′ 35″	52° 10′ 58″
10	Saco da Mangueira	32° 06′ 52″	52° 08′ 09″
11	Granja 4 Irmãos	32° 17′ 47″	52° 31′ 46″
12	N of Banhado do Taim	32° 31′ 59″	52° 32′ 20″
13	arroio del Rei	32° 57′ 40″	53° 04′ 48″
14	Vargem Grande	33° 10′ 14″	53° 12′ 07″
15	Curral do Arroio	33° 17′ 18″	53° 25′ 15″
16	arroio do Pastoreio	33° 18′ 16″	53° 03′ 28″
17	W of Santa Vitória do Palmar	33° 27′ 40″	53° 25′ 43″
18	E of Santa Vitória do Palmar	33° 35′ 07″	53° 18′ 52″

TABLE 1. EXTENDED

Map number	Date	Survey points	Number on points[b]	Number between points[c]	Number at nearby sites[d]	Total
Argentina, 1999						
1	13 Dec 99	5	0	0	0	0
2	11 Dec 99	10	0	0	0	0
3	11 Dec 99	6	0	0	0	0
4	11 Dec 99	5	0	0	0	0
5	10 Dec 99	5	0	0	0	0
6	10 Dec 99	5	0	0	0	0
7	10 Dec 99	5	0	0	0	0
8	9 Dec 99	10	0	0	0	0
9	12 Dec 99	6	5	2	23	30
10	10 Dec 99	10	0	0	0	0
11	7 Dec 99	10	0	0	0	0
12	6 Dec 99	11	23	40	0	63
13	4 Dec 99	11	62	20	0	82
14	7 Dec 99	10	3	0	6	9
15	6 Dec 99	10	5	1	0	6
16	5 Dec 99	10	0	10	0	10
17	1 Dec 99	16	10	1	4	15
18	5 Dec 99	10	0	0	0	0
19	3 Dec 99	7	0	2	9	11
20	3 Dec 99	4	0	0	0	0
21	8 Dec 99	10	0	0	0	0
22	3 Dec 99	11	0	0	0	0
23	8 Dec 99	10	0	0	0	0
24	7 Dec 99	16	0	0	0	0
25	5 Dec 99	11	0	0	0	0
26	3 Dec 99	10	0	0	0	0
27	9 Dec 99	10	45	2	5	52
28	2 Dec 99	10	0	0	0	0
29	6 Dec 99	10	0	0	0	0
30	4 Dec 99	11	0	0	0	0
31	8 Dec 99	10	0	0	0	0
32	1 to 13 Dec 99	11	29.4	5.7	46.6	81.7
	Total	296	182	84	94	360
Brazil, 2001						
1	2 Dec 01	10	0	0	0	0
2	14 Dec 01	9	17	12	0	29
3	13 Dec 01	5	0	0	0	0
4	11 Dec 01	10	0	0	0	0
5	13 Dec 01	6	16	190	0	206
6	12 Dec 01	9	146	3	0	149
7	12 Dec 01	10	309	124	11	444
8	13 Dec 01	10	108	79	0	187
9	4 Dec 01	10	457	157	186	800[f]
10	3 Dec 01	10	4	0	0	4
11	5 Dec 01	10	0	0	0	0
12	6 Dec 01	12	97	25	16	138
13	7 Dec 01	10	0	0	0	0
14	8 Dec 01	10	0	0	0	0
15	8 Dec 01	10	0	0	0	0
16	7 Dec 01	10	5	31	0	36
17	9 Dec 01	10	72	16	0	88[f]
18	9 Dec 01	10	0	0	0	0
	Total	171	1231	637	213	2081

TABLE 1. CONTINUED

Map number	Locality[a]	Latitude (S)	Longitude (W)
Uruguay, 1999			
1	N of Laguna de Castillos	34° 13′ 13″	53° 55′ 10″
2	NE of Laguna de Castillos	34° 15′ 08″	53° 53′ 26″
3	E of Laguna de Castillos	34° 19′ 08″	53° 51′ 44″
4	SE of Laguna de Castillos	34° 19′ 50″	53° 51′ 11″
5	NE of Laguna de Rocha	34° 31′ 49″	54° 15′ 17″
6	N of Laguna de Rocha	34° 33′ 05″	54° 18′ 24″
7	N of Laguna de Rocha	34° 34′ 02″	54° 18′ 49″
8	E of Laguna de Rocha	34° 34′ 50″	54° 14′ 04″
9	NW of Laguna de Rocha	34° 37′ 18″	54° 24′ 38″
10	SE of Laguna de Rocha	34° 40′ 50″	54° 16′ 17″
11	W of Laguna de Rocha	34° 41′ 40″	54° 19′ 31″
12	W of Laguna de Rocha	34° 42′ 29″	54° 23′ 16″
13	S of Laguna Garzón	34° 47′ 34″	54° 33′ 25″
Uruguay, 2001			
1	Pta. Cachimbas	32° 42′ 24″	53° 17′ 45″
2	Pta. Catumbera	32° 50′ 18″	53° 19′ 36″
3	Zapata stream	32° 55′ 44″	53° 35′ 58″
4	Cebollatí surroundings	33° 14′ 01″	53° 42′ 26″
5	Picada de Techera	33° 20′ 32″	54° 07′ 45″
6	N of Laguna Negra	33° 54′ 18″	53° 44′ 00″
7	Castillos surroundings	34° 12′ 29″	53° 53′ 19″
8	E of Laguna de Castillos	34° 20′ 17″	53° 50′ 49″
9	W of Laguna de Castillos	34° 20′ 55″	53° 59′ 39″
10	NW of Laguna de Rocha	34° 35′ 35″	54° 19′ 30″
11	E of Laguna de Rocha	34° 39′ 04″	54° 15′ 03″
12	Ea. La Rinconada	34° 39′ 39″	54° 20′ 02″
13	E of Laguna Garzón	34° 45′ 34″	54° 31′ 42″
14	E of Laguna José Ignacio	34° 48′ 03″	54° 41′ 04″

[a] "Ea." refers to an estancia or ranch. Directions from a locality are capitalized single or double letters (e.g., E, NW). Otherwise localities refer to nearby towns, cities, or distinct geographic landmarks.
[b] Number of Buff-breasted Sandpipers detected within 250 meters of survey points.
[c] Number of Buff-breasted Sandpipers detected while walking between survey points.
[d] Number of Buff-breasted Sandpipers detected while walking to and from plot.
[e] Values for Ea. Medaland represent mean values over 7 surveys.
[f] Numbers represent minimum values as birds were flying around and could not be reliably counted between points.
[g] Mean values for Uraguay are used in this summary.

(localities 27 and 32; Fig. 3). We counted 360 Buff-breasted Sandpipers at these 10 localities. We detected most (182) birds on point surveys, with fewer individuals detected between points and between survey localities. Only once did we detect the majority of Buff-breasted Sandpipers after we completed a survey (locality 9). The total number of Buff-breasted Sandpipers detected at each locality varied from 0–82. The mean number of birds detected per point at each locality varied from 0–5.64, with the highest numbers at Reserve Campos del Tuyú, Estancia Medaland and Canal Sta. Clara. We calculated that 0.11 Buff-breasted Sandpipers/ha were present on the 31 localities in Argentina (excluding Estancia Medaland which was surveyed repeatedly; Table 2).

In Brazil, 5–9 people surveyed 18 localities (171 survey points) from 2–13 December 2001. Buff-breasted Sandpipers were present on 10 of the 18 localities surveyed in Brazil (Fig. 4). We found the species primarily along the southern and western edge of Lagoa do

TABLE 1. CONTINUED, EXTENDED

Map number	Date	Survey points	Number on points[b]	Number between points[c]	Number at nearby sites[d]	Total
Uruguay, 1999						
1	19 Dec 99	5	0	0	0	0
2	19 Dec 99	5	44	18	6	68
3	19 Dec 99	5	8	14	48	70
4	19 Dec 99	5	58	20	0	78
5	17 Dec 99	5	48	19	0	67
6	16 Dec 99	5	110	77	0	187
7	18 Dec 99	3	3	19	17	39
8	18 Dec 99	6	0	7	0	7
9	18 Dec 99	8	1	2	0	3
10	17 Dec 99	1	1	0	0	1
11	17 Dec 99	4	69	0	0	69
12	17 Dec 99	3	33	0	0	33
13	16 Dec 99	4	59	5	0	64
	Total	59	434	181	71	686
Uruguay, 2001						
1	6 Dec 01	10	0	0	0	0
2	7 Dec 01	9	25	0	0	25
3	7 Dec 01	10	0	0	0	0
4	8 Dec 01	5	0	0	0	0
5	5 Dec 01	10	0	0	0	0
6	9 Dec 01	9	19	82	0	101
7	4 Dec 01	10	0	0	0	0
8	12 Dec 01	10	84	40	0	124
9	12 Dec 01	10	212	139	0	351
10	3 Dec 01	10	106	91	0	197
11	10 Dec 01	10	26	59	0	85
12	10 Dec 01	10	73	249	178	500
13	11 Dec 01	5	3	1	0	4
14	11 Dec 01	10	4	2	0	6
	Total	128	552	663	178	1393
	Total for all countries[g]	561	1906	1143	431	3480

Peixe (localities 5–8; Fig. 4), Ilha da Torotama (locality 9; Fig. 4), north of Banhado do Taim (locality 12; Fig. 4), and west of Santa Vitória do Palmar (locality 17; Fig. 4). We counted 2,081 Buff-breasted Sandpipers at these 10 localities. We detected 60% (n = 1,231) of the birds on point surveys, with the remainder detected between points and between survey localities. Twice we detected the majority of Buff-breasted Sandpipers after we completed a survey (localities 5 and 16). The total number of Buff-breasted Sandpipers detected at each locality varied from 0–800. The mean number of birds detected per point at each locality varied from 0–45.7, with the highest numbers at Ilha da Torotama and near Lagoa do Peixe National Park. We calculated that 1.62 Buff-breasted Sandpipers/ha were present on the 18 localities in Brazil (Table 2).

During the 1999 surveys in Uruguay, 2–4 people surveyed 13 localities (59 survey points) from 16–19 December 1999. Buff-breasted Sandpipers were present on 12 of 13 localities surveyed in Uruguay (Fig. 5). We found birds all around Laguna de Rocha (localities 5–12; Fig. 5), the northeast and east sides of Laguna de Castillos (localities 2–4; Fig. 5), and the south side of Laguna Garzón (locality 13; Fig. 5); we detected a total of 686 Buff-breasted Sandpipers at these 12 localities. The majority (434) was detected during point surveys, except at two localities where the majority was detected after the survey was completed (localities 3 and 7). The total num-

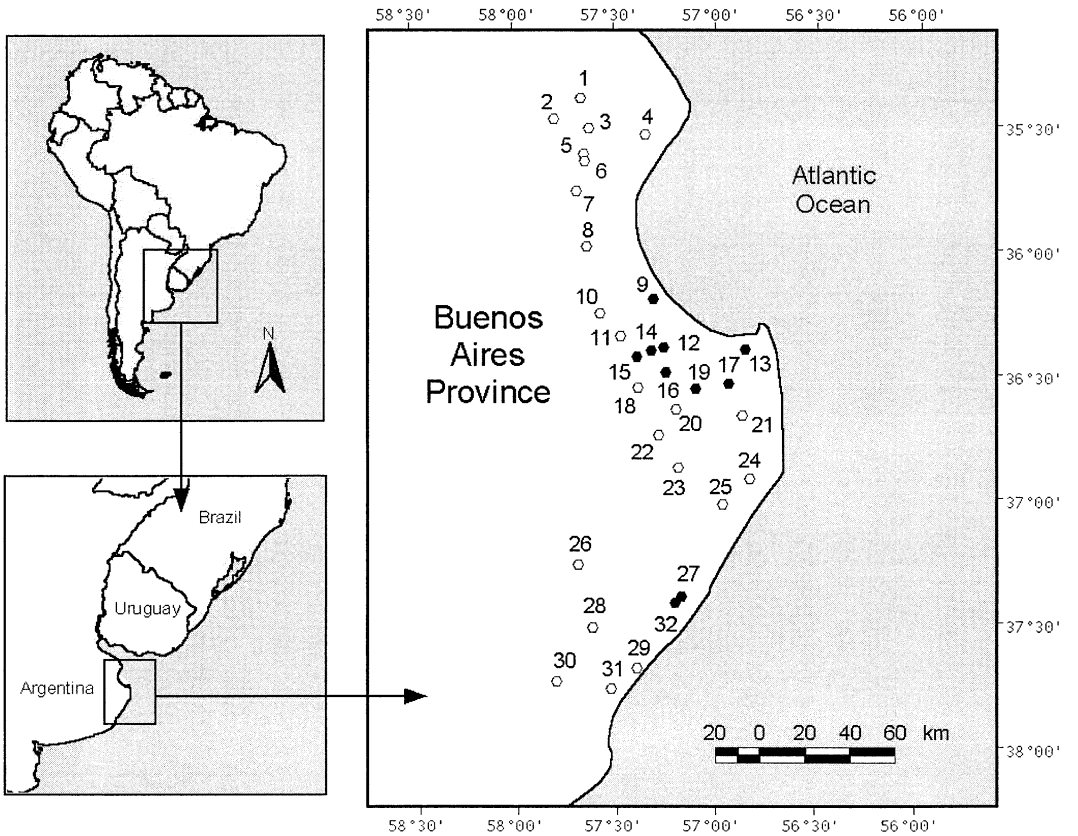

FIG. 3. Locations surveyed and presence (dark circles) of Buff-breasted Sandpipers on survey localities in Argentina during December 1999. See Table 1 for attributes of each locality.

ber of Buff-breasted Sandpipers detected at each locality varied from 0–187, with the highest numbers on the north and west sides of Laguna de Rocha, eastern edge of Laguna de Castillos, and south of Laguna Garzón. The density of Buff-breasted Sandpipers in Uruguay was higher than in Argentina and Brazil; 2.18 Buff-breasted Sandpipers/ha were present on the 13 localities in Uruguay (Table 2).

During 2001, we conducted surveys over a larger geographic area and in a random fashion throughout the main wintering area of

TABLE 2. Number of plots, survey points, and counts of Buff-breasted Sandpipers used in calculations of density for each country using the program DISTANCE.[a]

Country	Number of plots	Number of survey points	Number of clusters (number of individuals)	Mean ± SE cluster size	Detection range (m)[b]	Density (individuals/ha)	Density 95% C.I.
Argentina, 1999	31	285	62 (141)	2.27 ± 0.22	0 to 150	0.11	0.04–0.31
Brazil, 2001	18	171	344 (1202)	3.49 ± 0.40	25 to 220	1.62	0.67–3.93
Uruguay, 1999[c]	13	59	75 (405)	5.40 ± 0.75	20 to 210	2.18	0.89–5.31
Uruguay, 2001[c]	14	128	89 (531)	5.96 ± 1.26	10 to 235	1.08	0.37–3.18

[a] Number of points and individuals used in these analyses was lower than that reported in Table 1 because data were limited to birds observed within the detection range of each country.

[b] Determined by plotting the detection distance of all observations and then eliminating outliers that would make modeling the detection probability difficult (see Buckland et al. 1993).

[c] The different methods of selecting survey localities between years (see text) probably resulted in artificially high density estimates in 1999.

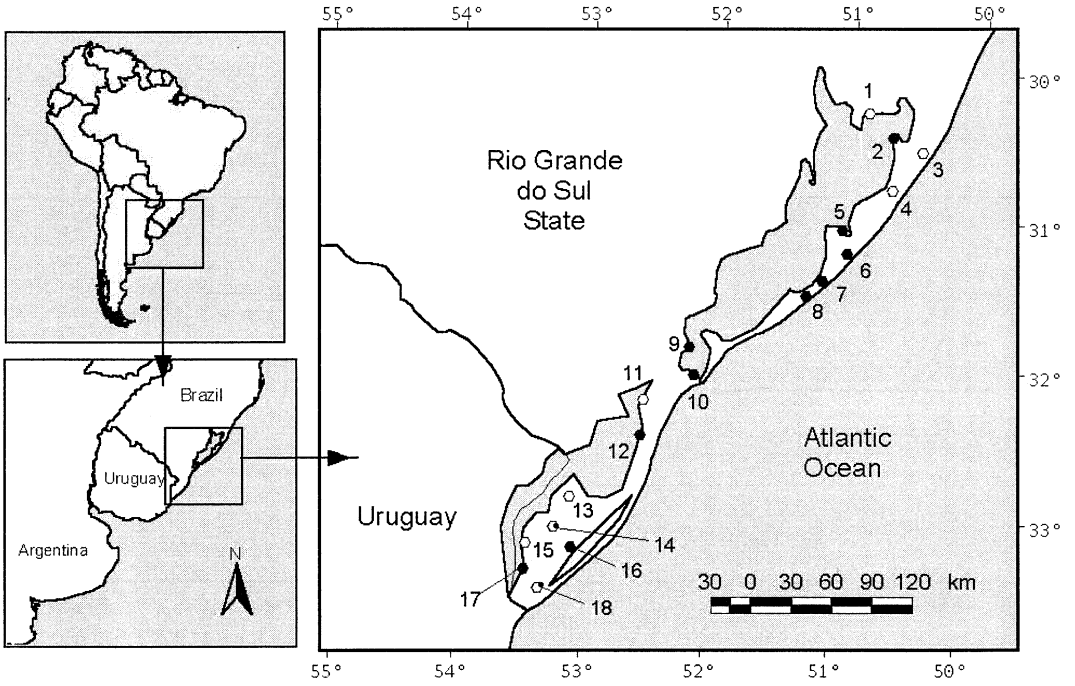

FIG. 4. Locations surveyed and presence (dark circles) of Buff-breasted Sandpipers on survey localities in Brazil during December 2001. See Table 1 for attributes of each locality.

Uruguay. Although the number of localities surveyed (14) was similar to that of 1999 (13), the number of survey points increased from 59 to 128. We conducted surveys approximately one week earlier during 2001 (3–12 December during 2001 compared to 16–19 December during 1999). Buff-breasted Sandpipers were present on 9 of 14 localities surveyed (Fig. 5). As during 1999, we found birds around Laguna de Rocha (localities 10–12; Fig. 5), Laguna de Castillos (localities 8 and 9; Fig. 5), and the south side of Laguna Garzón (locality 13; Fig. 5). These observations mirrored the historic distribution of the species (Fig. 2). We detected 1393 Buff-breasted Sandpipers at these nine localities. We detected 40% (552) during point surveys. The total number of Buff-breasted Sandpipers detected at each locality varied from 0–500, with the highest numbers on the north and west sides of Laguna de Rocha, and western and eastern edges of Laguna de Castillos. Our density estimate for Uruguay was lower in 2001 (1.08 individuals/ha; Table 2) than in 1999.

Turnover rates.—The number of Buff-breasted Sandpipers detected during seven surveys at Estancia Medaland varied from 9–302 birds (mean = 81.7 ± 99.1 SD, $n = 7$; Fig. 6) over a 13-day period in December 1999. Most of this variation was due to a flock of 266 Buff-breasted Sandpipers detected after the survey was completed on 13 December. When we limited the data to birds counted at survey points, the number of individuals ranged from 9–60 per survey, with a median of 33 and a mean of 29.4 (SD = 17.0, $n = 7$). The number of birds counted at survey points followed a binomial distribution, with an initial peak on the second and third surveys, and a second higher count on the sixth survey. The probability of detecting birds at a given point varied greatly. Three of the 11 survey points did not have Buff-breasted Sandpipers present on any survey day, whereas one point had birds present on 5 days. The mean number of Buff-breasted Sandpipers detected at each point varied from 0.0–14.1 across the seven surveys.

Habitat associations.—To determine habitat use by Buff-breasted Sandpipers we first excluded plots that were selected nonrandomly

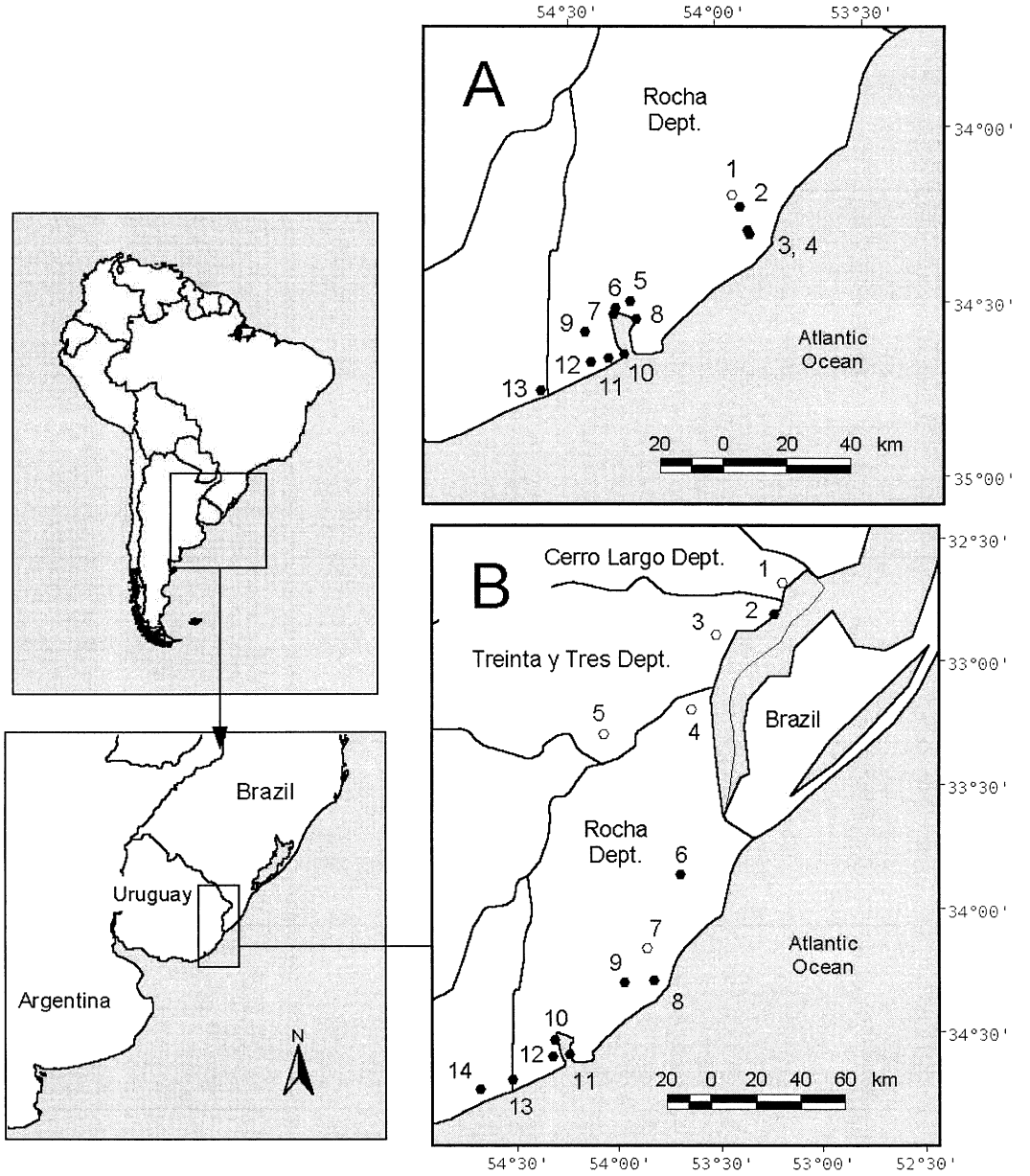

FIG. 5. Locations surveyed and presence (dark circles) of Buff-breasted Sandpipers on survey localities in Uruguay during (A) December, 1999, and (B) December, 2001. See Table 1 for attributes of each locality.

(plots from the 1999 survey in Uruguay) or repeatedly surveyed within a year (Estancia Medaland in Argentina). After excluding these areas, we detected Buff-breasted Sandpipers at 122 survey points (20.9% of 584 points) distributed in 28 localities (44.4% of 63 localities). We detected most Buff-breasted Sandpipers at survey points located in pasturelands (85.8%), whereas a smaller percentage were found in agriculture (6.7%) and abandoned fields (7.5%). The survey points where we detected Buff-breasted Sandpipers usually were grazed by livestock (90%), had relatively short vegetation (the dominant veg-

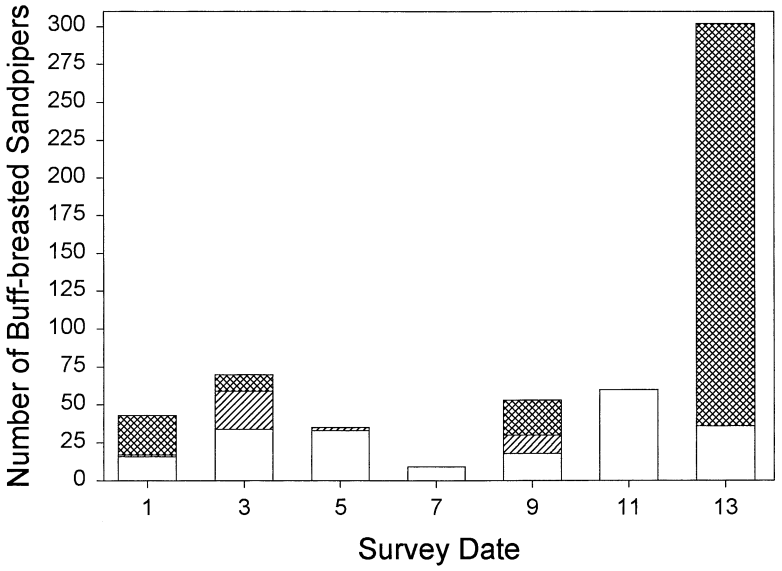

FIG. 6. Number of Buff-breasted Sandpipers detected at Estancia Medaland, Argentina, 1–13 December 1999. White areas represent birds counted at survey points, diagonal line areas represent birds counted between points, and checkered areas represent birds counted between survey locations.

etation for 90% of the points was <10 cm tall), and frequently were grazed intensively (the dominant cover type for 62% of points was vegetation 2–5 cm tall, representing >49% of ground cover).

In Brazil and Uruguay, we found Buff-breasted Sandpipers almost exclusively in heavily grazed grasslands along the margins of salt and freshwater lagoons on relatively recent terrain of Quaternary age. Although we sampled areas of seemingly suitable habitat on geologically older terrain, Buff-breasted Sandpipers were associated consistently with Holocenic coastal plains below the barrier of old dunes. These dunes were shaped during the last major marine transgression in southern Brazil and eastern Uruguay approximately 5,000–7,000 ybp. We occasionally found Buff-breasted Sandpipers in agricultural or abandoned fields (17.4% of all survey points that occurred in these countries).

In Argentina, we found Buff-breasted Sandpipers exclusively in pasturelands. Unlike Brazil and Uruguay, these pastures were part of large ranches and were not restricted to lagoon margins. Indeed, the amount of apparently suitable habitat in Argentina was much larger relative to Brazil and Uruguay, as pasturelands covered a large portion of the pampas. The geographic extent of the grasslands coincides with the old albufer region that borders Bahía Samborombón; this old albufer region appears to explain the main wintering distribution of the species in Argentina.

DISCUSSION

Contemporary abundance of Buff-breasted Sandpipers.—Brazil, followed by Uruguay (on average), and Argentina had the highest population densities of Buff-breasted Sandpipers. Density estimates ranged from 0.11 birds/ha in Argentina to 2.18 in Uruguay, both based on surveys from 1999. Because we conducted our surveys in habitats most likely to contain Buff-breasted Sandpipers, these density estimates probably represent the maximum densities for any area in their respective country. Unfortunately, a comparison among the four sample locations (country and year combinations) is hampered by several confounding factors. First, the location and number of plots varied between survey years in Uruguay. The higher density estimates for 1999 probably resulted from the nonrandom selection of survey sites that year. After comparing our data between years, it appears that our surveys during 1999 were conducted in areas with some of the higher densities of

Buff-breasted Sandpipers. Second, surveys were not conducted during the same year in all three countries. Accordingly, environmental differences among countries and years may have confounded our comparisons. For example, Argentina had record levels of rainfall during 2001, resulting in grasslands being flooded and unavailable to Buff-breasted Sandpipers (RBL and DEB unpubl. data). This flooding appeared to have reduced the number of Buff-breasted Sandpipers based on counts of birds at a few localities visited during both 1999 and 2001 (RBL and DEB unpubl. data). The decrease in habitat availability may have caused Buff-breasted Sandpipers to use other less appropriate areas in Argentina or return to Brazil and Uruguay in search of suitable winter habitat. This scenario would result in higher than normal densities in Brazil and Uruguay relative to other years. However, a comparison of a few sites in Uruguay and Brazil visited during both years of our study does not confirm this; some sites had more birds during 2001 and others had fewer (Table 1). It also is possible that our density estimates for each country are accurate, and that the higher densities in Brazil and Uruguay simply reflect suitable land area. Wintering range sizes depicted in Figure 2 and our knowledge of the countries indicate suitable land is more abundant in Argentina, possibly allowing birds to distribute more evenly and in lower densities across the landscape.

Flock movement within and between years.—The moderately large confidence intervals around our population density estimates reflect the large variation in Buff-breasted Sandpiper numbers detected at the surveyed localities. This variation is especially apparent for Estancia Medaland (Fig. 6). Buff-breasted Sandpiper numbers varied from 9–302 birds during the seven surveys conducted at the estancia. The large influx of Buff-breasted Sandpipers (266 birds) on 13 December suggests this species aggregates in large flocks that move frequently. We also observed large flocks in Uruguay and Brazil at a few localities, and large flocks were present in the historic data (Appendix 1). In addition, we regularly observed flocks away from survey points. If birds were missed during surveys for either of these reasons, the population density would be underestimated. The DISTANCE program partially compensates for this problem by correcting for cluster size and the probability of detecting birds. Nevertheless, additional study is needed to determine how the species aggregates throughout the austral summer, the timing and level of movement by Buff-breasted Sandpipers across their wintering range, and the scale at which surveys must be conducted to ensure accurate population estimates can be made.

Changes in historic distribution and abundance of Buff-breasted Sandpipers.—Our surveys found Buff-breasted Sandpipers throughout most of their historic wintering range. The species was conspicuously absent, however, from areas just south of the city of Buenos Aires. This region has undergone extensive urban development and contains little suitable habitat today. Interior portions of the pampas also have become less desirable for Buff-breasted Sandpipers as ranch lands have been converted to agriculture (Oesterheld 1993). We found no evidence to support Wetmore's (1927) suggestion that a southern wintering range near the mouths of Colorado and Negro rivers in northern Patagonia exists. Our surveys did allow us to record more accurately the distribution of birds within the historic wintering range. For example, we observed Buff-breasted Sandpipers along the border between Brazil and Uruguay (localities 16 and 17, Fig. 4; locality 2, Fig. 5B). Belton (1994) indicated Buff-breasted Sandpipers were in this area but provided no definitive locations.

The number of Buff-breasted Sandpipers detected during our surveys appeared to be far below historic levels. Indeed, W. H. Hudson, in Buenos Aires Province in 1868, reported ''. . . flocks of about one to two or three hundred, flying low and very swiftly due north, flock succeeding flock at intervals of about 10 or 12 min; and this migration continued for [at least] three days . . . '' (Hudson 1920). This single observation greatly surpasses the 360 birds detected by our team during 13 days of surveys in Argentina. Information from the migration routes and breeding grounds also suggests Buff-breasted Sandpipers have declined. Singley (1893), McIlhenny (1943), and Forbush (1912) listed the species as very common in the meat markets of Texas, Louisiana, and Massachusetts during the mid to late 1800s. The species also was described as an

''abundant summer resident'' on its breeding grounds at Point Barrow, Alaska, during 1880 (Murdoch 1885). Recent reports from all these locations indicate the species occurs rarely and/or sporadically (McIlhenny 1943, Forbush 1978, Johnson and Herter 1989, Lanctot and Weatherhead 1997). Unfortunately, systematic surveys were not conducted on the wintering grounds during the late 1800s, making comparisons to our survey density estimates impossible.

Contemporary changes in Buff-breasted Sandpiper abundance.—Several lines of evidence suggest the population of Buff-breasted Sandpipers is continuing to decline. A comparison of population numbers on the wintering grounds at Estancia Medaland, Argentina, between 1973 and the 1990s suggests the species has decreased greatly. Myers (1980) estimated that ≤2,000 Buff-breasted Sandpipers used this area during the austral summers of 1973 and 1974, whereas population surveys between 1996 and 2000 indicated that no more than 200 birds used this area (Isacch and Martínez 1999; JPI and M. Martínez unpubl. data).

Information from the breeding grounds also suggests a decline in population size. A comparison of Buff-breasted Sandpiper densities at 38 plots near Creswell Bay, Somerset Island (Nunavut, Canada), showed a significant decrease in densities from 1995 and 1997 to 2001 (P. Latour and J. Bart unpubl. data). Information from two migration sites also confirms this decline. L. Morris (pers. comm.) observed thousands of Buff-breasted Sandpipers near Benedict, Nebraska, during the mid-1980s, but now observes <100 each year. D. Dekker (pers. comm.) reports a similar decline from the 1970s to early 1990s near Beaverhill Lake, Edmonton, Alberta. Unfortunately, insufficient data are available from the broader Maritimes Shorebird Survey (covering sites in eastern Canada) and the International Shorebird Survey (covering sites in the eastern and central U.S.) to test for an increase or decrease in Buff-breasted Sandpiper numbers (J. Bart unpubl. data). Although it is possible that the decline in bird numbers described above are a result of birds shifting their winter, migration, and breeding distributions, these data suggest caution should be used when managing the species until additional trend data can be gathered.

South American migration.—The distribution of Buff-breasted Sandpiper sightings suggests that the species migrates through the central portions of South America on its way to and from the wintering range in Argentina, Uruguay, and Brazil (see also Antas 1983). The paucity of Buff-breasted Sandpiper sightings in the interior regions of South America may be due, in part, to a lack of observers (but see Hayes et al. 1990, Stotz et al. 1992). Suitable habitat probably is limited, however, as shorebirds appear to be restricted to river floodplains exposed during the dry seasons and cattle ponds and casual water in newly cleared areas of forest (Hayes and Fox 1991, Stotz et al. 1992). These variable habitat conditions might require Buff-breasted Sandpipers to make a direct flight over the Amazonia regions in some years (Terborgh 1989), especially during the northward migration when water levels tend to be high. It seems unlikely that Buff-breasted Sandpipers use the eastern and western coasts of South America during migration as ornithologists have studied these areas thoroughly and found few (e.g., Wilson et al. 1998, Rodrigues 2000). It is possible that some individuals migrate along the coasts making few landings.

Important sites and their protection/management.—We identified several important areas in each country for wintering Buff-breasted Sandpipers. In Argentina, we verified the continued importance of Estancia Medaland as a major wintering site (Myers 1980), and discovered the pasturelands in southern Bahía Samborombón. Vast ranches within the latter area accounted for 63% of the total number of Buff-breasted Sandpipers detected in Argentina. In Uruguay and Brazil, our surveys indicated intensively grazed pasturelands near several of the lagoon systems had large numbers of Buff-breasted Sandpipers. Indeed, some of the largest groups of Buff-breasted Sandpipers ever recorded were detected at Ilha da Torotama and Lagoa do Peixe National Park in Brazil, and Laguna de Rocha and Laguna de Castillos in Uruguay.

Most of the sites identified as being key wintering areas in this study are privately owned and few are legally protected, although these areas are unlikely to be converted to ag-

riculture because of flooding and saline conditions near the coast. However, these areas are likely to be flooded should global warming lead to higher water levels. Land management practices in unprotected areas farther inland are subject to change with global and regional economic constraints. Indeed, Oesterheld (1993) reported large fluctuations in the proportion of land devoted to cropping and ranching in the Río de la Plata Grassland during the past 20–30 years. These changes appear to be directly related to the price of grain and beef.

Other forms of development, such as mines and pine plantations in Brazil, construction of roads and buildings for tourism in Brazil and Uruguay, and the subdivision of ranches in Argentina, also may have a negative effect on the species (Sagrera 1999; G. Maurício pers. comm., GAB and JPI unpubl. data). So far, pine plantations are restricted mostly to upland areas within Brazil, and seedlings have been unable to become established in suitable Buff-breasted Sandpiper habitat because of livestock grazing. During the past year, biologists were able to negotiate the location of an approximately 8,000-ha mine project south of Lagoa do Peixe, Brazil, to habitats not used by Buff-breasted Sandpipers. Further, this mine site is to be approved under the condition that the Capão da Areia marsh be protected and added to the Lagoa do Peixe National Park (GAB unpubl. data). Both areas currently are used extensively by Buff-breasted Sandpipers. Control of tourism in Uruguay appears less certain, and the effect of subdividing estancias on Buff-breasted Sandpiper habitat in Argentina is unknown.

The value of livestock pastures to Buff-breasted Sandpipers is dependent upon appropriate ranch management. The introduction and movement of livestock at a local and regional level may indirectly have strong within- and among-year effects on the distribution and abundance of Buff-breasted Sandpipers. For example, pastures where grazing has only recently begun may not be suitable for Buff-breasted Sandpipers, but in a few weeks these same pastures might be of the correct vegetation height. Observations at a limited number of sites visited during both years of our study confirmed this. Areas with intensive grazing in 1999 had Buff-breasted Sandpipers present but these same areas had no birds when grass heights were higher in 2001 (and vice versa). Additionally, pastures may never become suitable if livestock are moved too frequently among pastures (to minimize overgrazing), introduced too late in the austral summer, or removed altogether. The latter scenario may be particularly common when land is acquired by conservation agencies and the livestock are removed to benefit other wildlife species. While advocating protection of areas for all wildlife, we believe a portion of these areas should be managed to maintain pasturelands. Ideally, these areas should be managed so that parcels of land with short vegetation are available throughout the austral summer to accommodate early-, mid-, and late-wintering Buff-breasted Sandpipers. Such a grassland management plan will benefit other Nearctic (e.g., American Golden-Plovers, *Pluvialis dominica*) and Patagonian migratory shorebirds (e.g., Rufous-chested Dotterel, *Charadrius modestus*; Tawny-throated Dotterel, *Oreopholus ruficollis*) that also use these areas (JPI and M. Martínez unpubl. data).

In Brazil and Uruguay, Buff-breasted Sandpipers also are vulnerable to the loss of suitable habitat that is quite limited and restricted geographically. Our observations suggest Buff-breasted Sandpipers use a very limited area, stretching over a very narrow zone of recent terrain at ocean shores and around some coastal lagoons. While generally grazed by livestock, the natural vegetation in these areas appears to have evolved a low structural profile whose height may not be dictated by grazing; plant growth may be restricted instead by flooding and saline conditions. This habitat specialization, in contrast to the more general habitat use exhibited by other upland shorebirds (RBL et al. unpubl. data), may have led the Buff-breasted Sandpiper to evolve high site fidelity, which may explain the large aggregations observed in some of these areas. Until more is known about the dependency of Buff-breasted Sandpipers on these unique habitats, care must be taken to monitor and preserve these areas.

The absence of Buff-breasted Sandpipers from many areas within Argentina that appeared to have suitable vegetation cover suggests that the landscape (e.g., spatial arrangement of wetlands and grasslands) or other environmental conditions (e.g., soil moisture and

compaction, fire frequency) may be inappropriate for the species. Alternatively, the species may exhibit high site fidelity to particular wintering sites, making these sites especially critical for protection. Observations across years from Estancia Medaland (Isacch and Martínez 1999; JPI unpubl. data) and Bahía Samborombón (DEB and M. Beade unpubl. data) in Argentina, Laguna de Rocha, and Laguna de Castillos in Uruguay (this study), and Banhado do Taim, Ilha do Torotama, and Lagoa do Peixe in Brazil (Resende and Leeuwenberg 1987; this study; GAB, JBA, and RAD unpubl. data), suggest particular wintering sites are used consistently from year to year. It also is possible that the available winter habitat in Argentina greatly surpasses the land needed by the current number of Buff-breasted Sandpipers, and factors away from the wintering grounds are preventing the species from increasing to previous levels.

Future research needs.—Additional research is needed on the wintering grounds to determine whether the distribution and abundance of Buff-breasted Sandpipers detected in our study is representative, or whether these patterns are likely to vary among years or with changes in weather patterns and economic conditions. Additional information on site tenacity, and local and regional movements within the wintering grounds, would help interpret our survey results and indicate the relative importance of sites with high numbers of birds. Further surveys on the species main wintering range would provide valuable trend information, and surveys where Buff-breasted Sandpipers are seen occasionally during winter (e.g., Puna Ecoregion in western Argentina and southern Bolivia, and the Rio Grande do Sul's central trough in Brazil) would help document the importance of these areas on a regional and national level. A study of the restricted coastal areas in Uruguay and Brazil is needed to determine if livestock grazing affects these native grasslands or whether the composite plant species are structurally stunted due to flooding, high salinity, or poor soil conditions. Such a study would be appropriate for Lagoa do Peixe National Park where such grasslands exist and cattle are slated for removal in the near future.

Currently, we are using satellite imagery and image analysis software to determine the amount of suitable habitat within the main wintering range in Argentina, Uruguay, and Brazil. We then will extrapolate population density estimates for each country to the suitable habitat area (stratified by quality) to generate an overall population estimate for the species. This estimate is crucial for determining the conservation status of the species.

Besides pasturelands, Buff-breasted Sandpipers relied on old and new rice fields in Brazil and Uruguay. These areas may expose the species to herbicides and pesticides. Indeed, RAD and M. I. Burger (unpubl. data) found that Buff-breasted Sandpipers and other Nearctic waders used rice fields at a time when agrochemicals were being applied aerially. Three adult Buff-breasted Sandpipers died from feeding on planted rice seeds treated illegally with Furadan 4F in Texas in 1983 (Flickinger et al. 1986), and pesticide exposure has been implicated in the decline of other upland species (e.g., Upland Sandpipers, *Bartramia longicauda*) in South America (White 1988). Natural grasslands in the Río de La Plata Grassland are being plowed increasingly and replaced by sown pastures supplemented with fertilizers and other agrochemicals (Oesterheld 1993). These practices also are economically driven and may change across years. Buff-breasted Sandpipers also may be exposed to agrochemicals along their migration route in the U.S. Here the species frequents altered habitats such as golf courses, sod fields, airport runways, cemeteries, and newly planted rice fields that are subject to herbicide and pesticide applications (Gotthardt and Lanctot 2002).

Virtually no information is available on the species migration in South America. Research is needed to determine if important regional stopover sites exist (e.g., Bahía de Asunción, Lesterhuis and Clay 2001) so they can be protected and included in the Western Hemisphere Shorebird Reserve Network (WHSRN 1993). This will require the cooperation of biologists in many countries and a concerted effort to look for this species during spring and fall migration. We are hopeful that the WHSRN, which identifies and gives protection to stopover sites used by migratory shorebirds in the Americas, will facilitate this. Research in the U.S. and Canada, where the species migrates and breeds, also may be needed

to determine if the species' decline is occurring because of problems during other parts of their annual cycle (see above). We are optimistic that the recent listing of the species in the U.S. (Brown et al. 2001) and Canadian (Donaldson et al. 2000) shorebird conservation plans will spur international cooperation toward these ends.

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APPENDIX. Buff-breasted Sandpiper records in South America from 1822 to 2000. See Figures 1 and 2 for locations of map numbers. Names and coordinates taken from ornithological gazetteer for each country when not provided by original reference (see Paynter 1982, 1985, 1989; Paynter and Traylor 1977, 1981, 1991; Paynter et al. 1975; Rand and Paynter 1981; Stephans and Traylor 1983, 1985). Observations are ordered by country and then latitude.

Map location	Country	Province/state/department	Locality	Latitude	Longitude (W)
1	Argentina	Buenos Aires	Isla Bermejo-Bahía Blanca	S 39° 01′	62° 01′
2	Argentina	Buenos Aires	General Daniel Cerri	S 38° 42′	62° 24′
3	Argentina	Buenos Aires	Albufera Mar Chiquita	S 37° 38′	57° 24′
4	Argentina	Buenos Aires	Estancia Medaland	S 37° 26′	57° 10′
5	Argentina	Buenos Aires	Guaminí (near)	S 37° 02′	62° 25′
6	Argentina	Buenos Aires	Camino Real Viejo-La Isolina	S 36° 35′	56° 56′
7	Argentina	Buenos Aires	Camino Estancia El Palenque	S 36° 33′	56° 56′
8	Argentina	Buenos Aires	General Conesa	S 36° 31′	57° 20′
9	Argentina	Buenos Aires	Estancia El Tuyú	S 36° 31′	56° 46′
10	Argentina	Buenos Aires	Cañada ‘‘El Palenque’’	S 36° 29′	56° 59′
11	Argentina	Buenos Aires	Canal Sta. Clara	S 36° 24′	57° 15′
12	Argentina	Buenos Aires	Canal 1	S 36° 26′	57° 17′
13	Argentina	Buenos Aires	Route No. 11 (Gral. Conesa - Gral. Lavalle)	S 36° 30′	57° 16′
14	Argentina	Buenos Aires	General Lavalle	S 36° 24′	56° 57′
15	Argentina	Buenos Aires	Punta Rasa	S 36° 19′	56°46′
16	Argentina	Buenos Aires	Dolores	S 36° 20′	57° 45′
17	Argentina	Buenos Aires	Rosas - FCS	S 35° 58′	58° 56′
18	Argentina	Buenos Aires	Bahía Samborombón	S 36° 00′	57° 20′
19	Argentina	Buenos Aires	Laguna las Flores Grande	S 35° 35′	59° 02′
20	Argentina	Buenos Aires	Pipinas	S 35° 32′	57 ° 20′
21	Argentina	Buenos Aires	Chascomús	S 35° 27′	57° 45′
22	Argentina	Buenos Aires	San Miguel Monte	S 35° 27′	58° 47′
23	Argentina	Buenos Aires	Camino Punta Indio Verónica	S 35° 17′	57° 15′
24	Argentina	Buenos Aires	San Vicente	S 35° 01′	58° 25′
25	Argentina	Buenos Aires	Estancia Plátanos	S 34° 47′	58° 11′
26	Argentina	Buenos Aires	Barracas al Sud	S 34° 39′	58° 22′
27	Argentina	Buenos Aires	Moreno	S 34° 39′	58° 48′
28	Argentina	Buenos Aires	Río Luján	S 34° 34′	59° 06′
29	Argentina	Buenos Aires	Bañados Río Arrecifes	S 33° 44′	59° 34′
30	Argentina	Entre Ríos	Ceibas	S 33° 26′	58° 45′
31	Argentina	Santa Fe	Maciel	S 32° 27′	60° 54′
32	Argentina	Santa Fe	Monje	S 32° 21′	60° 56′
33	Argentina	Santa Fe	Arocena	S 32° 05′	60° 58′
34	Argentina	Entre Rios	Paso de la Laguna	S 31° 49′	59° 10′
35	Argentina	Córdoba	Laguna Mar Chiquita	S 30° 54′	62° 40′
36	Argentina	Córdoba	Campo de Mare	S 30° 49′	62° 54′
37	Argentina	Córdoba	Terraplén Bañados Río Dulce	S 30° 15′	62° 20′

APPENDIX. EXTENDED

Map location	Count[a]	Month[b]	Year	Reference[c]
1	7, 7	10, 12	1991	Belenguer et al. 1992
2	6	12	1994	Delhey et al. 2001
3	present	??	??, 1982	Chani 1986, M. Martínez pers. comm.
4	4, 11, 14, 68, 262, 2000	1, 11, 12	1974, 1992, 1993	Myers and Myers 1979, Blanco et al. 1993
5	small flocks	3	1921	Wetmore 1927
6	50	12	1996	R. Fraga pers. comm.
7	1, 2, 6, 30	1, 10, 12	1987, 1988	Blanco et al. 1988, C. Laredo pers. comm., M. Rumboll pers. comm.
8	1, 3, 4	10	1987, 1992	Blanco et al. 1993, C. Laredo pers. comm., F. Moschione pers. comm.
9	2	10	1992	Blanco et al. 1993
10	present, 5, 18	1, 2	1987, 1989, 1992	Wetlands International, DEB unpubl. data, C. Laredo pers. comm., R. Stranek pers. comm.
11	3, 8, 15	10, 12	2000	DEB unpubl. data
12	5	12	2000	DEB unpubl. data
13	50	12	2000	DEB unpubl. data
14	1, 2, 7, 10, 22, 23, 53 and 1 skin	3, 10, 11	1902, 1920, 1992, 1993	Wetmore 1927, Blanco et al. 1993, MACN Collection, M. Babarskas pers. comm.
15	present	3	1994	A. Di Giacomo pers. comm.
16	38	3	1993	Blanco et al. 1993
17	2 skins	2	1926, 1927	MACN Collection
18	present	??	1993	Vila et al. 1994
19	30	spring	1972	C. Laredo pers. comm., J. Rodríguez Mata pers. comm.
20	8, 39	3, 12	1992, 1993	Blanco et al. 1993
21	present, 4	2, 3	1866, 1993	Dabbene 1920, Blanco et al. 1993
22	53	3	1993	Blanco et al. 1993
23	6	10	1989	C. Laredo pers. comm., F. Moschione pers. comm.
24	1	??	??	T. Narosky pers. comm.
25	present, 1 skin	3	1914, 1916	Dabbene 1920, MACN Collection
26	present, 1 skin	6, 12	1899, 1901, 1904	Dabbene 1920, FML and MACN Collections
27	1 skin	2	1876	Dabbene 1920, BM(NH) Collection
28	present	2	??	Hellmayr and Conover 1948
29	1 skin	3	1915	MACN Collection
30	1	2	1989	E. Abadie pers. comm.
31	few	3	1989	C. Laredo pers. comm., M. de la Peña pers. comm.
32	small group	5	1985	M. de la Peña pers. comm.
33	some	3	1986	de la Peña 1988
34	18	1	1992	C. Laredo pers. comm.
35	1	4	1978	Nores et al. 1983
36	2	12	1992	Blanco et al. 1993
37	13	2	1993	Wetlands International unpubl. data

APPENDIX. CONTINUED

Map location	Country	Province/state/department	Locality	Latitude	Longitude (W)
38	Argentina	Corrientes	Estancia Curipicay	S 29° 14′	57°56′
39	Argentina	Corrientes	Estancia San Juan Poriahu	S 27° 42′	57°11′
40	Argentina	Formosa	Misión Tacaaglé	S 24° 58′	58°47′
41	Argentina	Formosa	Las Lomitas (25 km South-southwest)	S 24° 43′	60°36′
42	Argentina	Jujuy	Laguna Guayatayoc	S 23° 23′	65°52′
43	Argentina	Jujuy	Laguna Río Miraflores	S 23° 02′	65°52′
44	Argentina	Jujuy	Laguna Runtuyoc	S 22° 39′	65°41′
45	Argentina	Jujuy	Laguna Vilama	S 22° 36′	66°45′
46	Argentina	Jujuy	Laguna Cangrejillos	S 22° 24′	65°34′
47	Argentina	Jujuy	Laguna de los Pozuelos	S 22° 21′	66°00′
48	Argentina	Jujuy	Cieneguilla	S 22° 05′	65°53′
49	Bolivia	Tarija	Lagunas de Tajzara	S 21° 42′	65°02′
50	Bolivia	Santa Cruz	Buena Vista	S 17° 27′	63°40′
51	Bolivia	El Beni	Tumi Chucua	S 11° 08′	66°10′
52	Bolivia	El Beni	Riberalta	S 10° 59′	66°06′
53	Bolivia	Pando	Victoria	S 10° 59′	66°10′
54	Brazil	Rio Grande do Sul	Arroio Taim mouth	S 32° 34′	52°35′
55	Brazil	Rio Grande do Sul	Estação Ecológica do Taim	S 32° 33′	52°35′
56	Brazil	Rio Grande do Sul	Granja Quatro Irmãos	S 32° 14′	52°29′
57	Brazil	Rio Grande do Sul	Praia do Cassino	S 32° 11′	51°14′
58	Brazil	Rio Grande do Sul	Lagoa dos Patos mouth	S 32° 10′	52°10′
59	Brazil	Rio Grande do Sul	Rio Grande	S 32° 02′	52°06′
60	Brazil	Rio Grande do Sul	Banhado do Pontal da Barra	S 31° 47′	52°14′
61	Brazil	Rio Grande do Sul	Bojuru Lighthouse surroundings	S 31° 26′	51°17′
62	Brazil	Rio Grande do Sul	Banhado Capão da Areia	S 31° 20′	51°09′
63	Brazil	Rio Grande do Sul	Lagoa do Peixe	S 31° 18′	51°00′
64	Brazil	Rio Grande do Sul	Rio Santa Maria	S 30° 15′	54°55′
65	Brazil	Rio Grande do Sul	Rio Jacuí	S 30° 03′	52°52′
66	Brazil	Rio Grande do Sul	Pólo Petroquímico, Triunfo	S 29° 56′	51°43′
67	Brazil	Rio Grande do Sul	Tramandaí (5 km northeast)	S 29° 56′	50°06′
68	Brazil	Rio Grande do Sul	Rio Ibirapuitã	S 29° 45′	55°46′
69	Brazil	Rio Grande do Sul	Vacaria surroundings	S 28° 30′	50°56′
70	Brazil	Paraná	Balneário Atami	S 25° 36′	48°23′
71	Brazil	Paraná	Pontal do Sul	S 25° 35′	48°22′
72	Brazil	São Paulo	Lagoa do Portão, Ipanema	S 23° 26′	47°36′
73	Brazil	Mato Grosso	Campos do Encanto, Vila Bela da Santíssima Trindade	S 15° 03′	59°44′
74	Brazil	Mato Grosso	Vila Bela da Santíssima Trindade	S 15° 00′	59°57′
75	Brazil	Acre	Plácido de Castro	S 10° 20′	67°11′
76	Brazil	Acre	São João	S 09° 09′	72°40′
77	Brazil	Rondônia	Porto Velho	S 08° 46′	63°54′
78	Brazil	Amazonas	Borba	S 04° 24′	59°35′
79	Brazil	Maranhão	Baixada Maranhense	S 03° 28′	44°53′
80	Brazil	Amazonas	Tefé Airport	S 03° 22′	64°25′
81	Brazil	Roraima	Boa Vista Airport	N 02° 49′	60°40′

APPENDIX. CONTINUED, EXTENDED

Map location	Count[a]	Month[b]	Year	Reference[c]
38	flock	??	1973	J. Hutton pers. comm.
39	2	9	1997	R. Fraga pers. comm.
40	2 skins	11	1925	Munchen Museum, cited in Laubmann 1930
41	1	1	1992	C. Laredo pers. comm., F. Moschione pers. comm.
42	2, 3, 5	2, 11	1992, 1993	C. Laredo pers. comm.
43	1	9	1991	Laredo 1996
44	12, 16, 23	1, 2, 12	1992, 1993	C. Laredo pers. comm.
45	9	9	1991	Laredo 1996
46	8, 15	1, 11	1992, 1993	C. Laredo pers. comm.
47	5, 7, 10, 13, 14, 19	1–3, 9, 12	1989, 1991–1993	Laredo 1996, C. Laredo pers. comm.
48	3, 5, 13	2, 3, 12	1988, 1992, 1993	Narosky 1988, C. Laredo pers. comm.
49	7	3	1992	C. Laredo pers. comm.
50	2 skins	10	1916	MACN and CM Collections
51	1 skin	10	1972	LSUMZ Collection
52	1, 2	9, 10	1937	Gyldenstolpe 1945
53	2	10	1937	Glydenstolpe 1945
54	3	2	1995	Wetlands International unpubl. data
55	??, hundreds	9–12, 1–3	1982, 1990–1992	Mähler et al. 1996, Voss 1990
56	10, 12, 1	10–12	1998	RAD unpubl. data
57	16	2	1995	Wetlands International unpubl. data
58	19	??	??	A. Witeck pers. comm.
59	1 skin	??	<1899	von Ihering 1899
60	range 1–32	1, 2, 9–12	1994	G. Maurício pers. comm.
61	10	9	1998	G. Maurício and GAB unpubl. data
62	16, 68	9	1998	G. Maurício and GAB unpubl. data
63	1, 1, 1, 5, 110, 200	1, 3, 4, 10	1972, 1974, 1988, 1997	Resende and Leeuwenberg 1987, WHSRN 1993, C. Laredo pers. comm., P. Collins and R. Jessop pers. comm., MN and MCN collections
64	28	1	1992	C. Laredo pers. comm.
65	22	1	1992	C. Laredo pers. comm.
66	4	10	1989	Belton 1994
67	1	8	1973	MCN Collection
68	13	1	1992	C. Laredo pers. comm.
69	3	8	1975	Belton 1994
70	alone/pairs	9	1993	Bornschein et al. 1997
71	alone/pairs, 2 skins	9–11	1993	Bornschein et al. 1997, MN Collection
72	present	11	1822	von Pelzeln 1870
73	2	11	2000	J. F. Pacheco pers. comm.
74	present	10	1826	von Pelzeln 1870
75	1 skin	9	1951	Pinto and de Camargo 1954, MZUSP Collection
76	5	8	1997	J. F. Pacheco pers. comm.
77	1	11	1954	Pinto 1964, MZUSP Collection
78	present	4	1830	von Pelzeln 1870
79	present	11	1985	Roth and Scott 1987
80	1	9	1994	J. F. Pacheco pers. comm.
81	3	9	1987	Stotz et al. 1992

APPENDIX. CONTINUED

Map location	Country	Province/state/department	Locality	Latitude	Longitude (W)
82	Brazil	Amazonas	Marabitanas	N 00° 58′	66° 51′
83	Brazil	Amazonas	Tapurucuará	S 00° 24′	65° 02′
84	Colombia	Antioquía	Remedios	N 07° 02′	74° 41′
85	Colombia	Meta	Hacienda Mozambique (near)	N 04° 00′	73° 02′
86	Colombia	Cauca	Popoyán	N 02° 27′	76° 36′
87	Colombia	Meta	Hacienda La Corocora	N 03° 16′	73° 03′
88	Colombia	Magdalena	Ciénaga	N 11° 01′	74° 15′
89	Ecuador	Napo/Pichincha	Volcan (Cerro) Antisana	S 00° 30′	78° 08′
90	Ecuador	Napo	Limóncocha	S 00° 25′	76° 38′
91	Ecuador	Pichincha	Carapungo	S 00° 09′	78° 22′
92	Ecuador	Imbabura	Hacienda Paramba	N 00° 49′	78° 21′
93	Paraguay	Central	Bahía de Asunción	S 25° 20′	57° 35′
94	Paraguay	Boquerón	Villa Hayes (320 km Northwest)	S 22° 47′	59° 57′
95	Paraguay	Presidente Hayes	Puerto Pinasco (west of)	S 22° 43′	57° 50′
96	Paraguay	Presidente Hayes	Estancia Campo María (Laguna Salada)	S 22° 32′	59° 18′
97	Paraguay	Presidente Hayes	Laguna Capitán	S 22° 32′	49° 41′
98	Paraguay	Alto Paraguay	Bahía Negra	S 20° 14′	58° 10′
99	Paraguay	Alto Paraguay	Estancia Doña Julia	S 20° 07′	58° 05′
100	Peru	Cuzco	Cosñipata	S 13° 04′	71° 11′
101	Peru	Madre de Dios	Río Manu and Río Madre de Dios (near Boca Manu)	S 12° 15′	70° 50′
102	Peru	Madre de Dios	Río Manu	S 12° 16′	70° 51′
103	Peru	Ucayali	Balta	S 10° 08′	71° 13′
104	Peru	Ucayali	Pucallpa (59 km west)	S 08° 24′	75° 12′
105	Peru	Loreto	Chamicuros	S 05° 30′	75° 30′
106	Peru	Loreto	Jeberos [or Xeberos]	S 05° 17′	76° 13′
107	Peru	Loreto	Iquitos	S 03° 46′	73° 15′
108	Peru	Amazonas	Orosa	S 03° 26′	72° 08′
109	Peru	Loreto	Pebas	S 03° 20′	71° 49′
110	Peru	Loreto	Isla de Iquitos	N 03° 43′	73° 12′
111	Suriname	Unknown province in coastal zone	Coastal inland wetlands (sector VI)	~N 05° 06′	~54° 55′
112	Suriname	Commewijne	Mariënburg	N 05° 53′	55° 03′
113	Uruguay	Maldonado	Balneario Solís	S 34° 48′	55° 22′
114	Uruguay	Maldonado	San Carlos	S 34° 48′	54° 55′
115	Uruguay	San José	Playa Penino	S 34° 45′	56° 25′
116	Uruguay	Canelones	Laguna (Cañada) del Cisne	S 34° 44′	55° 50′
117	Uruguay	Rocha	Balneario Las Garzas	S 34° 44′	54° 24′
118	Uruguay	Rocha	Laguna de Rocha and Arroyo La Palma	S 34° 33′	54° 11′
119	Uruguay	Rocha	Laguna de Rocha (mouth)	S 34° 31′	54° 22′
120	Uruguay	Rocha	Refugio Laguna Castillos	S 34° 20′	53° 55′

APPENDIX. CONTINUED, EXTENDED

Map Location	Count[a]	Month[b]	Year	Reference[c]
82	present	3	1831	von Pelzeln 1870
83	4	3	1963	MPEG Collection
84	1	2	1905	BM(NH) Collection
85	sightings	2	??	Hilty and Brown 1986
86	uncommon	12	??	Hilty and Brown 1986
87	c. 500	2, 3	1977	Hilty and Brown 1986
88	2 skins	9	1898	AMNH Collection, Hellmayr and Conover 1948
89	2 skins	9	1991	ANSP Collection
90	1	9	1976	LSUMZ Collection
91	present	7	??	Hellmayr and Conovor 1948
92	1 skin	4	1889	AMNH Collection, Hellmayr and Conover 1948
93	Range = 1–140, n = 60, mean = 4.8 and 11.9 in 80's and 2000, respectively	1–4, 9–12	1987–1989, 2000	Hayes and Fox 1991, Hayes et al. 1990, A. Hivekovics and R. Clay pers. comm.
94	2 skins	9	1973	MVZ Collection, cited in Hayes et al. 1990
95	1 and 1 skin	4, 9	1920, 1931	Wetmore 1927, AMNH Collection
96	6	9, 11	2000	R. Clay pers. comm.
97	5	10	2000	R. Clay pers. comm.
98	1	9	1997	R. Clay pers. comm.
99	1 skin	9	1984	Hayes et al. 1990, MNHNP Collection
100	1 skin	9	1868	BM(NH) Collection
101	present	8–10	??	B. Walker pers. comm.
102	3, 3	10, 11	1983, 1989	Bolster and Robinson 1990, Begazo 1990
103	1	9	1964	LSUMZ Collection
104	1 skin	10	1971	AMNH Collection
105	2 skins	9	1867	BM(NH) Collection
106	1 skin	10	1866	BM(NH) Collection
107	4 skins	9	1878	Hellmayr and Conover 1948, BM(NH) and SMF Collections
108	12 skins	9	1926	AMNH, ANSP, and FML Collections, Bond 1955
109	1 skin	8	1866	Hellmayr and Conover 1948, BM(NH) Collection
110	1 skin	9	1985	ANSP Collection
111	tens to maximally a few hundreds	9–11, 3–5	1967, 1975	Jong and Spaans 1984
112	present, 1, 2 and skin(s?)	5, 8–11	1963, 1966–1969	Leiden Museum, cited in Haverschmidt 1972
113	present	2	1969	Gore and Gepp 1978
114	>80	3	1975	Gore and Gepp 1978
115	1 skin	11	1960	MNHNM Collection
116	6 skins	9, 10	1952, 1958	MNHNM Collection
117	1 skin	??	1959	MNHNM Collection
118	31, 40, 143, 216, 225	2, 11	1991–1993	Devesa et al. 1992, Blanco et al. 1993, Wetlands International unpubl. data
119	47, 164	1	1992	Wetlands International unpubl. data
120	35	2	1993	Wetlands International unpubl. data

APPENDIX. CONTINUED

Map location	Country	Province/state/ department	Locality	Latitude	Longitude (W)
121	Uruguay	Rocha	Laguna Negra and Bañado Santa Teresa	S 34° 00′	53° 45′
122	Uruguay	Rocha	Bañado de las Maravillas	S 33° 55′	53° 35′
123	Uruguay	Rocha	Bañado de los Indios	S 33° 55′	53° 45′
124	Venezuela	Dependencia Federal	Isla Gran Roque, Parque Nacional Archipelago de Los Roques	N 11° 58′	66° 40′
125	Venezuela	Falcón	Boca de Mangle, San Juan de los Cayos	N 11° 09′	68° 23′
126	Venezuela	Zulia	Lagunillas	N 10° 08′	71° 16′
127	Venezuela	Apure	Hato El Cedral	N 07° 25′	69° 19′
128	Venezuela	Amazonas	San Fernando de Atabapo	N 04° 03′	67° 28′
129	Venezuela	Amazonas	Simarawochi, Alto Río Metacuni	N 03° 49′	64° 36′
130	Venezuela	Amazonas	Culebra, Rio Cunucunuma	N 03° 44′	65° 45′
131	Venezuela	Amazonas	La Esmeraldo	N 03° 25′	65° 40′
132	Venezuela	Amazonas	El Merey, Caño Casiquiare	N 03° 05′	65° 55′
133	Venezuela	Amazonas	Misión Ocamo	N 02° 47′	65° 12′

[a] Individual counts are listed where possible, otherwise more general indications of the number of birds is given. ''Skin'' refers to a study skin in a museum collected from this locality.

[b] January = 1, February = 2, etc.

[c] Abbreviations for museums include Academy of Natural Sciences of Philadelphia (ANSP), American Museum of Natural History (AMNH), Carnagie Museum of Natural History (CM), Field Museum of Natural History, Chicago (FMNH), Forschungsinstitut Senckenberg, Frankfurt am Main (SMF), Fundación Miguel Lillo (FML), Louisiana State University Museum of Natural Science (LSUMZ), Museo Argentino de Ciencias Naturales ''Bernardino Rivadavia'' (MACN), Museo Nacional de Historia Natural de Montevideo (MNHNM), Museo Nacional de Historia Natural del Paraguay (MNHNP), Museu de Ciências Naturais (MCN), Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu Nacional (MN), Museu Paraense Emilio Goeldi (MPEG), Museum of Vertebrate Zoology (MVZ), and The Natural History Museum (BM(NH)). Museum contacts are listed in the acknowledgments.

APPENDIX. CONTINUED, EXTENDED

Map location	Count[a]	Month[b]	Year	Reference[c]
121	9	1	1992	Wetlands International 1999
122	17, 210	1, 7	1991, 1992	Wetlands International 1999
123	40	1	1992	Wetlands International 1999
124	2	10	2000	D. Ascanio pers. comm.
125	3 skins	9	1966	Estación Biológica Rancho Grande Collection
126	3 (2 collected)	5	1920	Phelps and Phelps 1958, FMNH Collection
127	23, 32, 200	4, 5	2000	A. Chartier pers. comm., G. Rodríguez pers. comm., D. Willis pers. comm.
128	7 skins	3	1943	Phelps and Phelps 1958, W. H. Phelps Collection
129	1 skin	4	1972	W. H. Phelps Collection
130	1 skin	3	1983	W. H. Phelps Collection
131	4 skins	3	1929	AMNH Collection
132	1 skin	4	1929	AMNH Collection
133	1 skin	4	1978	W. H. Phelps Collection