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DISTRIBUTION, RELATIVE ABUNDANCE, AND HABITAT USE OF FOUR SPECIES OF NEOTROPICAL SHOREBIRDS IN URUGUAY

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Resumen. – Distribución, abundancia relativa y uso de hábitat de cuatro especies de chorlos Neotropicales en Uruguay. – Uruguay, debido a su ubicación al sur-este de América del Sur alberga una gran cantidad de especies de chorlos y playeros Nearticos y Neotropicales. Aquí se describe la distribución, abundancia relativa, uso del hábitat y estacionalidad del Chorlito de Collar (*Charadrius collaris*), Chorlito Doble Collar (*C. falklandicus*), Chorlito Pecho Canela (*C. modestus*), y Chorlo Cabezón (*Oreopholus ruficollis*) en Uruguay. Se analizó información de la literatura, colecciones científicas y bases de datos de programas de monitoreo regionales, complementado con observaciones de los autores. El Chorlito de Collar fue la especie mas ampliamente distribuida. Se encuentra presente durante todo el año y fue encontrado principalmente en playas arenosas y dunas de arena a lo largo de la costa marina y los ríos y arroyos interiores. Su actividad reproductiva fue registrada entre Noviembre y Febrero. Las otras tres especies son "visitantes de invierno" provenientes de la Patagonia y se encuentran presentes en el país principalmente durantes el otoño e invierno (Abril–Setiembre). El Chorlo de Doble Collar habita las playas arenosas y marismas de los Departamentos de la costa sur de Uruguay desde San José hasta Rocha, donde descansa y se alimenta. Las mayores abundancias del Chorlito Pecho Canela y del Chorlo Cabezón fueron observadas en los pastizales pastoreados del sur y norte del país, frecuentemente asociados a otras especies de aves. El Chorlo de Pecho Canela también fue observado en playas y marismas y, según la información disponible, es la especie que presenta los grupos más numerosos. Este estudio actualiza el conocimiento sobre la distribución y el estatus de cuatro especies de chorlos (Charadriinae) en Uruguay, y se espera que estimule futuras investigaciones sobre este taxa poco conocido.

Abstract. – Due to its location in southeastern South America, Uruguay harbors numerous species of Nearctic and Neotropical shorebirds. Here we described the distribution, relative abundance, habitat use, and seasonality of the Collared Plover (*Charadrius collaris*), the Two-banded Plover (*C. falklandicus*), the Rufous-chested Dotterel (*C. modestus*) and the Tawny-throated Dotterel (*Oreopholus ruficollis*) in Uruguay. We analyzed information from the literature, scientific collections, and databases from regional census programs and complemented these sources with our own personal observations. The Collared Plover was the most widely distributed species. It is present year round and it was found principally in sandy beaches and sand dunes along the sea coast, and along inland rivers and streams. Its breeding activity has been documented between November and February. The other three species are winter migrants from Patagonia and are present in the country mainly during fall and winter (April–September). The Two-banded Plover inhabits Uruguay's southern coasts from San José to Rocha Departments, using sandy beaches and mudflats as foraging and roosting areas. The largest concentrations of both Rufous-chested and Tawny-

throated dotterels were observed in grazed grasslands in southern and northern Uruguay, frequently in association with other bird species. The Rufous-chested Dotterel also inhabited beaches and mudflats and, according to the available data, it is the species found in largest groups. This study updates the knowledge on distribution and status of four Charadriinae shorebirds in Uruguay, and we hope it will stimulate further research of these little-known taxa. *Accepted 29 October 2007*.

Key words: Charadriinae, distribution, relative abundance, habitat use, Uruguay.

INTRODUCTION

Uruguay lies in southeastern South America, a region which is rich in shorebirds species, most of them migrants coming from North and South America (Myers & Myers 1979, Vooren & Chiaradia 1990, Azpiroz 2003, Blanco *et al.* 2004). In general, there is a gap of information on the ecology of many shorebirds species in the world, and this is particularly true for those from South America (Piersma *et al.*1997). Knowledge of Neotropical shorebirds species has increased in the last years, especially in Argentina (e.g., Isacch & Martínez 2003a, 2003b; Blanco *et al.* 2004, 2006; Isacch *et al.* 2005). In Uruguay, however, only limited information on the biology of these species is available (e.g., Teague 1955, Gerzenstein 1965, Gore & Gepp 1978, Azpiroz 2003, Blanco *et al.* 2004, Alfaro & Clara 2007).

Neotropical Charadriinae plovers are represented, in Uruguay, by one resident, the Collared Plover (*Charadrius collaris*), and three migrants, the Two-banded Plover (*Charadrius falklandicus*), the Rufous-chested Dotterel (*Charadrius modestus*), and the Tawny-throated Dotterel (*Oreopholus ruficollis*) (Azpiroz 2003). Rufous-chested Dotterel and Tawny-throated Dotterel have populations that breed in Argentina and Chile during the austral summer and migrate north afterwards, following the Atlantic coast, and up to Uruguay and southern Brazil (Gore & Gepp 1978, Vooren & Chiaradia 1990). The Two-banded Plover has resident populations in southern South America and southern Brazil, and migrant populations that breed in southern Argentina and the Falklands Islands, and then move north up to Central Chile on the Pacific coast, and up to Buenos Aires Province, Uruguay and southern Brazil along the Atlantic coast (Gore & Gepp 1978, Vooren and Chiaradia 1990, Wetlands International 2006).

Some information on the distribution, relative abundance, habitat use and seasonality of these four species in Uruguay is available (Teague 1955, Gerzenstein 1965, Gore & Gepp 1978, Azpiroz 2003, Blanco *et al.* 2004), but no thorough analysis has been conducted. Updated data on the biology of these shorebirds would help trigger more in-depth studies, and are also a key to any conservation-oriented activities. In order to provide a clear picture of basic aspects of the biology of these species in Uruguay, we compiled historical and recent published information and coupled this with data from our own field work, the latter concentrated mainly in wetlands of southern Maldonado and Rocha Departments, and native grasslands of southwestern Salto Department.

STUDY AREA AND METHODS

Study area. Uruguay is located between 30º09' to 34º56'S, and 53º 06' to 58º21'W, and shares borders with Brazil to the east and Argentina to the west (Fig. 1). Geographically, it is characterized by extensive slightly rolling plains with a mean altitude of 120 m (Chebataroff 1979). It has a temperate-subtropical climate with well defined seasons and a mean temper-

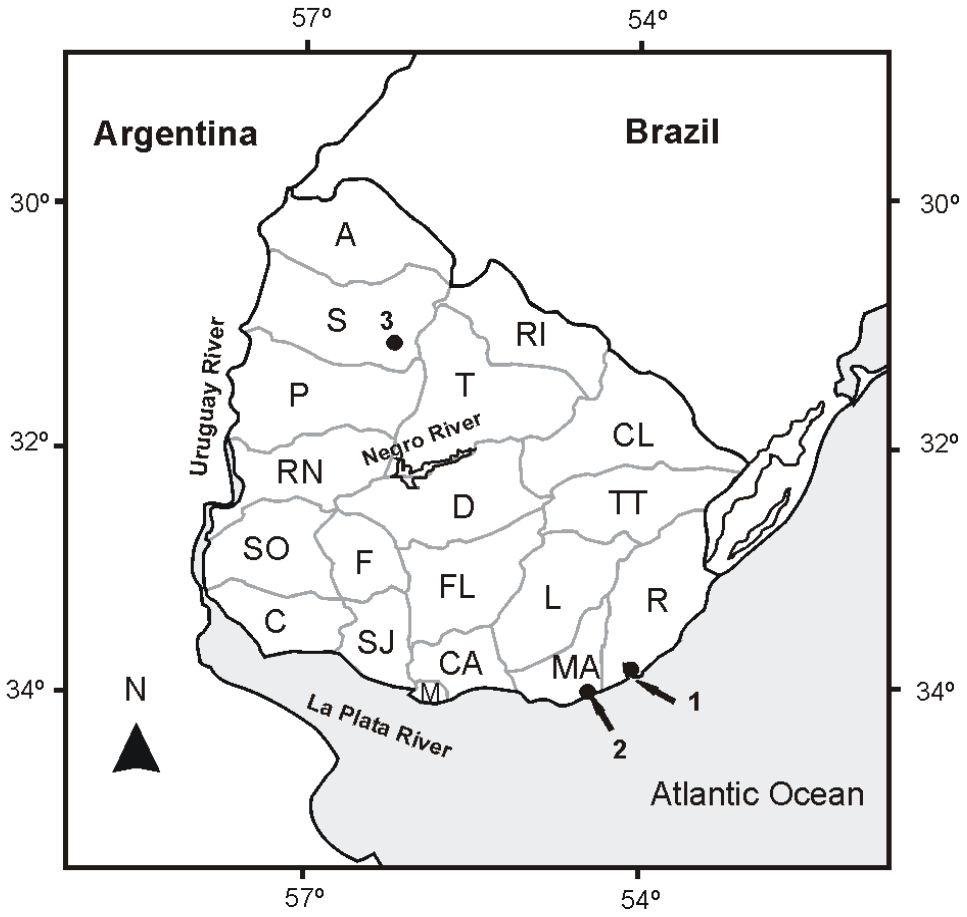

FIG. 1. Map of Uruguay showing the 19 Departments, the main Rivers and location of Rocha Lagoon (1), José Ignacio Lagoon (3) and Cuchilla de Arerunguá (3). A = Artigas, S = Salto, P = Paysandú, RN = Río Negro, SO = Soriano, C = Colonia, SJ = San José, F = Florida, FL = Flores, D = Durazno, CA = Canelones, M = Montevideo, MA = Maldonado, L = Lavalleja, R = Rocha, TT = Treinta y Tres, CL = Cerro Largo, T = Tacuarembó, and RI = Rivera.

ature of 16ºC in the south of the country (Chebataroff 1979).

Systematic shorebird counts were conducted in southeastern and northern Uruguay. The Rocha Lagoon (34º33'S, 54º22'W), one of the main study sites, is a coastal water body located in Rocha Department, 10 km west of La Paloma (Fig. 1). At its southern end, there is a sandbar that may intermittently separate the lagoon from the sea; during the winter, however, it generally remains open, due to natural or human-related activities, generating an estuarine system with a strong salinity gradient (Pintos *et al.* 1988, Conde *et al.* 2000). The study sites included the portion of the sandbar which is under strong sea influence, generating a typical mudflat with shallow water and salt marshes (34º40'S, 54º16'W), and the coastal grasslands along the flooding plains south-west of the lagoon, Estancia La

TABLE 1. Number of records and localities per species. His/Rec localities means that we have historical and recent data of the same site.

Species	Number of records	Number of localities	Localities			Sources				
			Historical	Recent	Historical/ Recent	Literature	Scientific collections	Wetlands database	Pers. com.	Authors records
Collared Plover	166	85	23	64	2	6	34	24	29	73
Two-banded Plover	110	31	10	21		4	15	17	7	67
Rufous-chested Dotterel	126	47	17	34	4	6	22	22	5	71
Tawny-throated Dotterel	35	27	16	11		2	17	1	4	11

Rinconada (34°40'S, 54°18'W). Other study sites in this region are the southern section of José Ignacio Lagoon (34°50'S, 54°40'W) and Esteros del Arroyo Maldonado (34°54'S, 54°53'W), in Maldonado Department, and Bañado de los Indios (33° 56'S, 53°40'W) along Route 14, km 487–488, in Rocha Department. The former is a coastal lagoon with similar characteristics to those of Rocha Lagoon, and the latter are wetlands with diverse aquatic plant communities and fresh water marshes (PROBIDES 1999). Research in northern Uruguay was conducted in grasslands surroundings of Cuchilla de Arerunguá (31°28'S 56°40'W) in Salto Department. The natural grasslands of this region are used for livestock production and most of the fields surveyed have never been tilled or developed (Sturm 2001, Azpiroz pers. observ.).

Distribution, relative abundance and habitat use. In order to determine the relative abundance and seasonality of the study species within such areas, census at sites in southeastern and northern Uruguay were conducted.

Matilde Alfaro (MAl) studied the seasonality and habitat use of *Charadrius* spp. at Rocha Lagoon (34°37'S; 54°17'W), one of the main areas used by these species in Uruguay. Shorebird counts were conducted along a 1.5-km line transect parallel to Rocha Lagoon's sandbar every 15 days during 2006 except in June. Adrián Azpiroz (AA) did monthly counts at José Ignacio and Rocha lagoons and at Bañado de los Indios from January 1998 to December 1999 and more sporadically during 2000 and 2001. AA also conducted surveys every two months in grassland habitat in southeastern Salto department, from July 2004 to December 2005. Thierry Rabau (TR) and Martin Abreu (MAb) conducted sporadic censuses, mainly at José Ignacio Lagoon from 1991 to 2006 and at Esteros del Arroyo Maldonado from 1993 to 2006, and at Rocha Lagoon from 2003 to 2006, respectively. All the authors have been involved in additional shorebird censuses during the last several years, mainly as part of the Neotropical Waterbirds Census organized annually by Wetlands International.

To determine the most frequently used type of habitat by each of the species we used the information obtained in all the surveys and calculated the percentage of species that was observed in each habitat. In the cases when one individual or a group of individuals were observed using more than one type of habitat in one occasion, the individual or the group were considered using both types of habitats.

Distribution maps for each species were created by plotting historical and recent species records onto base maps of Uruguay. Information was obtained from the literature (Durnford 1876, Alpin 1894, Wetmore 1926, Teague 1955, Gore & Gepp 1978, González *et al.* in press.), specimens of scientific collections (MNHN-National Museum of Natural History and ZVC-Vertebrate Zoology Collection at the University of the Republic of Uruguay), Wetlands International data base (2004–2006), and observations by the authors and others. For each record, the following data were obtained when possible: location, date, numbers, habitat type, and activity (breeding, resting and/or feeding). For those cases in which geographical coordinates were not provided, we located the site and determined coordinates using 1:20,000 scale maps of the country.

RESULTS

A total of 437 records distributed among 136 localities from 1876 to 2007 were compiled (Table 1). Records obtained between 1876 and 1989 were considered as historical, and those from 1990 to 2007 as recent; this distinction was done because, since 1990, records of these species in Uruguay signifi-

TABLE 2. Maximum numbers of the four species by Department in Uruguay from 1893 to 2007. Numbers between brackets indicate the month where the species was registered.

Departments	Number of sites studied	Collared Plover 1921–2007	Two-banded Plover 1919–2007	Rufous-chested Dotterel 1876–2006	Tawny-throated Dotterel 1956–2006
Artigas	6	21 (2, 3, 12)	—	—	—
Canelones	12	16 (1, 4, 6-8, 10, 11)	9 (1, 4, 5)	18 (3-5, 8)	1 skin (5)
Cerro Largo	1	2 (10)	—	—	—
Colonia	3	3 skin (1, 7)	1 (4)	5 skin (4, 7)	4 skin (4, 7, 8)
Durazno	1	1 skin (3)	—	—	—
Flores	4	—	—	—	7 skin (5, 6, 8)
Florida	3	—	—	—	40 (5, 6)
Lavalleja	3	22 (6)	—	178 (6)	5 (6)
Maldonado	26	55 (1, 2, 4, 5, 7, 10-12)	472 (1-12)	924 (4-8)	27 (7)
Montevideo	6	11 (4-8)	9 (2, 4, 5, 7)	5 (4, 5, 7)	—
Paysandú	2	5 (2, 11)	—	—	—
Rio Negro	3	23 (3, 10, 12)	—	—	—
Rivera	0	—	—	—	—
Rocha	41	187 (1-12)	109 (1-9, 11, 12)	1283 (4-8)	145 (5-8)
Salto	5	—	—	310 (7)	109 (5, 7)
San José	6	22 (1, 2, 7, 9, 10, 12)	65 (2, 7, 8)	105 (2, 4-8)	34 (7, 8)
Soriano	2	—	—	1 skin, present (3, 4)	—
Tacuarembo	9	30 (1, 10-12)	—	—	—
Treinta y Tres	3	10 (11)	—	—	—

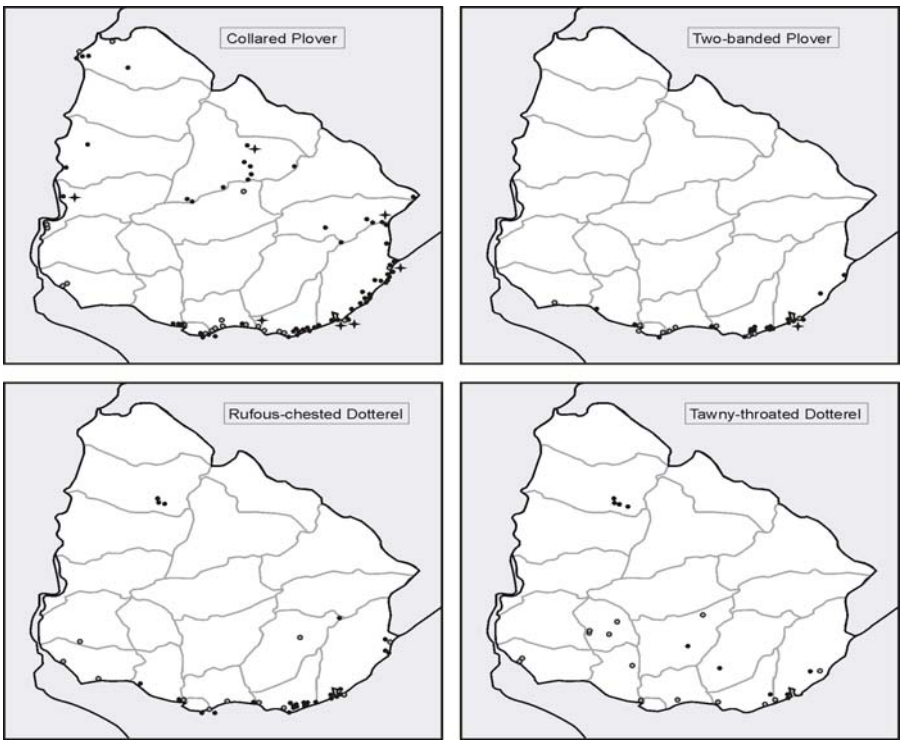

FIG. 2. Distribution maps of the studied species showing the specific location where it was registered (dots). Grey dots are the historical locations (1876–1989) and black dots the recent (1990–2007). Dots with a close star sign indicate a breeding location.

cantly increased and became more frequent, possibly due to an increasing general interest in ornithology. Tables 1 and 2 provide a summary of these data. Although localities are distributed throughout the country, a significant number of them concentrate in Rocha and Maldonado Departments (Table 2). The level of information for each record varied: 99.2% provided geographic coordinates, 99.7% the date, 92% the type of habitat, 77% the number of individuals, and 32% activity information.

We classified habitat data in six categories: 1) Pasture lands, which included two types of grazed grasslands: coastal grasslands, located in the flooding plains of coastal lagoons, and La Plata River, and inland grasslands, 2) Rice land, areas of rice monoculture, 3) Sandy beaches, along the coast and along inland rivers, 4) Sand dunes, sand mounds with or without sparse vegetation, 5) Mudflats, estuarine environments, either brackish or fresh water marshes, and 6) Rocky points, marine environments generally situated at both sides of a beach and composed by rocks, sand and shell deposits from marine invertebrates.

The Collared Plover was recorded in 14 departments, mainly along the margin of rivers, streams, lagoons and on the Atlantic coast (Fig. 2). Although it was observed in the six of the defined habitat types, most records were obtained in sandy beaches and sand dunes (Table 3). Its breeding activity spans from November to February, when it uses sandy beaches and dunes, sometimes (four records) in association with Yellow-billed Terns (*Sterna*

TABLE 3. Percentage of individuals of each species found in each of the six environments. Unknown means the percentage of individuals that was registered without a specific indication of the environment.

Species	Habitats							
	Sand dunes	Sandy beaches	Mudflats	Rocky points	Pasture lands	Rice lands	Unknown	Number of registered individuals
Collared Plover	24,40%	66%	12,60%	1,40%	3%	6%	2,80%	569
Two-banded Plover	—	82%	70,60%	—	0,40%	—	3,70%	1231
Rufous-chested Dotterel	0,10%	2%	44,30%	0,03%	75%	0,03%	0,20%	4000
Tawny-throated Dotterel	—	0,20%	6,60%	—	92%	—	1%	485

superciliaris). Breeding was recorded in seven out of 85 localities: Balneario Solís, Maldonado Department (34º47'S, 55º23'W); Uruguay River, Río Negro Department (32º48'S, 58º05'W); Rocha Lagoon sandbar, La Paloma (34º40'S, 54º09'W), La Coronilla beach (33º53'S, 53º30'W, Rocha), and Cebollatí River (31º51'S, 55º29'W), all in Rocha Department; and Tacuarembó Grande River, Tacuarembó Department (31º51'S, 55º29'W, Fig. 2). Numbers reported varied from 1 to 37 but, in 73% of the cases, the number of individuals was between 1 and 4. The highest concentrations were observed in Verde Island (33º56'S, 53º29'W) (37, Aug 2005), Rocha Lagoon sandbar (20, Feb 2006) and La Coronilla beach (35, Jul 2005) in Rocha; Uruguay River, Rio Negro (32º43'S, 58º08'W) (20, Dec 2006); and in rice fields of Estancia La Rinconada, Lavalleja (33º28'S, 54º12'W) (17, Jun 2005).

The Two-banded Plover was distributed in the five southern Departments (Colonia, San José, Montevideo, Canelones, Maldonado and Rocha), mainly in sandy beaches and mudflats over the coast of the La Plata River and the Atlantic Ocean (Fig. 2, Table 3). The highest numbers were found in mudflats of José Ignacio Lagoon (310, Jul 2004) and Rocha Lagoon sandbar (92, Jun 1999). Late spring and summer records probably reflect the occurrence of oversummerers (Table 2). However, there is also a single record of breeding activity at Rocha Lagoon, where a pair with a fledgling was observed on 1 December 1998. Given the substantial field work done at this locality, the latter record probably reflects a very unusual event and not the existence of a resident population of this species in southeastern Uruguay. Surveys done at Rocha Lagoon sandbar during 1998 and 2006 show highest numbers recorded between late March and late August (Fig. 3).

The Rufous-chested Dotterel was observed in nine departments but most of the records were obtained in the five coastal ones (Table 2, Fig. 2). It was registered in all the habitat types, but more frequently in pasture lands and mudflats (Table 3). Maximum individual records were obtained in coastal grasslands of southwestern Rocha Lagoon (34º40'S, 54º17'W) (820, Jul 2006) and José Ignacio Lagoon (264, Jul 2006), and in inland grasslands of Estancia La Rinconada, Lavalleja (33º28'S, 54º12'W) (178, Jun 2005) and Cuchilla de Arerunguá, Salto (31º36'S, 56º51'W) (150, Jul 2005) Departments. This species was recorded from April to August, but there were two historical records from March (Durnford 1876, Alpin 1894) (Table 2). In Rocha Lagoon sandbar, it appears between May and August, usually in low numbers (Fig. 3).

The Tawny-throated Dotterel is the species with the fewest records, most of them historical (Table 1). Records were distributed

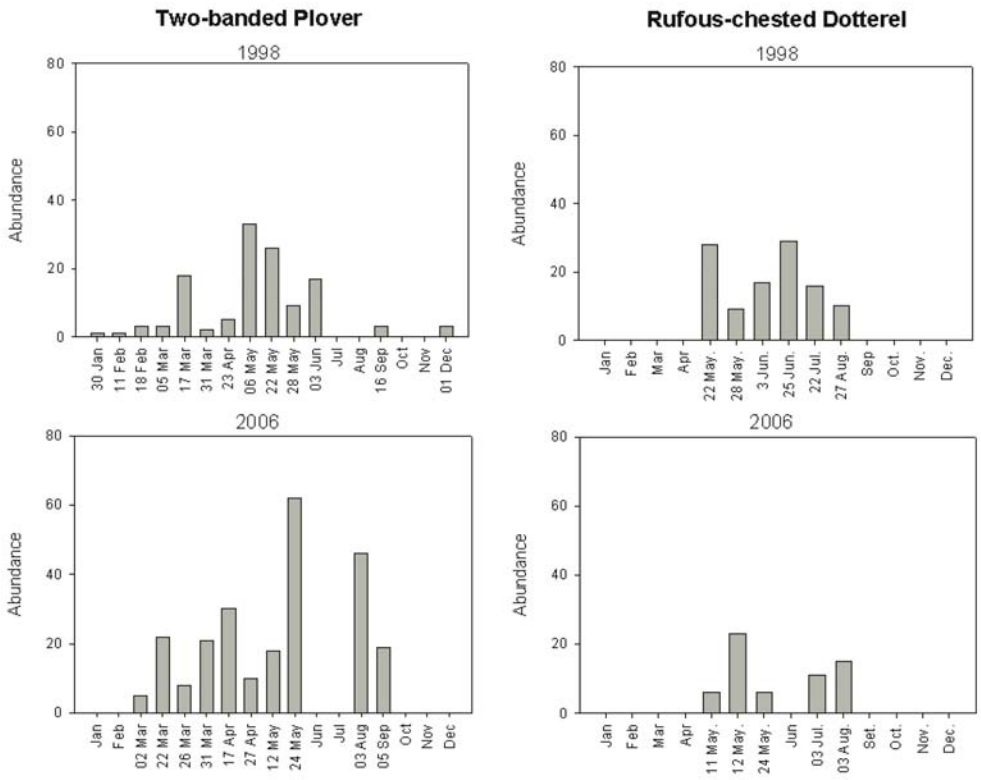

FIG. 3. Temporal variation in abundance of Two-banded Plovers and Rufous-chested Dotterels in Rocha Lagoon sandbar (Rocha, Uruguay) during 1998 and 2006.

among nine departments, mainly in inland grasslands (Table 2, Table 3, Fig. 2). Maximum numbers were found in coastal grasslands of Rocha Lagoon (93, Jul 2006) and in inland grasslands of Salto (50, Jul 2005) and Florida (33º56'S, 55º45'W) (40, Jun 2006) Departments. This species was observed associated with Rufous-chested Dotterel in Rocha and Salto, and with Chocolate-vented Tyrant (*Neoxolmis rufiventris*) in Florida and Salto. Records have been obtained between April to August (Table 2).

DISCUSSION

This study shows that Neotropical Charadriinae shorebirds are well represented and widely distributed in Uruguay. Particularly, the abundances registered for the three migrant species indicate that Uruguay is an important wintering ground along their Atlantic distribution. The Collared Plover is known as an inhabitant of coastal and aquatic environments distributed along the southern and western Uruguay (Uruguay River, La Plata River, and the Atlantic Ocean) and in main inland rivers and streams (Teague 1955, Gerzenstein 1965, Gore & Gepp 1978, Azpiroz 2003). Our data supports this view although most of the available information was gathered in Maldonado and Rocha Departments. The association of Collared

Plovers with Yellow-billed Terns during the breeding season has also been found in Buenos Aires Province, Argentina (Maugeri 2005). In this type of associations between *Charadrius* plovers and *Sterna* terns, the former are thought to benefit from the tern's strong anti-predator behavior (Maugeri 2005, Nguyen *et al.* 2006). This strategy has been observed at least four times in Uruguay but more research is needed to understand its influence on Collared Plover breeding success.

The Two-banded Plover uses coastal areas (especially mudflats and sandy beaches) along the La Plata River and the Atlantic Ocean, mainly during fall and winter (Teague 1955, Gerzenstein 1965, Gore & Gepp 1978, Azpiroz 2003). In the coast of Buenos Aires Province and southern Brazil, it was observed in estuarine and marine habitats (Blanco *et al.* 2006, Vooren & Chiaradia 1990). As in the case of Buenos Aires Province and southern Brazil (Myers & Myers 1979, Vooren & Chiaradia 1990), the species can be found throughout the year in Uruguay, but is far more numerous in fall and winter. The largest concentrations were reported from José Ignacio Lagoon (Maldonado), with numbers similar to those found in southern Brazil (Vooren & Chiaradia 1990). Interestingly, mudflats at José Ignacio Lagoon have high concentrations of southwestern Atlantic burrowing crab (*Chasmagnathus granulata*), a feature also present in areas along the coast of Buenos Aires Province where the species is most common (Botto *et al.* 2000, Blanco *et al.* 2006). As already mentioned, the single breeding record obtained in the Rocha Lagoon probably reflects a very unusual event.

The Rufous-chested Dotterel was found in coastal areas as well as grasslands in the southern coastal departments of the country (Teague 1955, Gerzenstein 1965, Gore & Gepp 1978, Azpiroz 2003, Blanco *et al.* 2004). Most of the records of this species came from Rocha and Maldonado Departments, but it was also found repeatedly in grasslands of northern Uruguay (Salto Department). This species is common in grazed flooding pampas grasslands of Buenos Aires Province, but it has also been observed in mudflats along the southern coast of Brazil and Uruguay (Vooren & Chiaradia 1990, Isacch & Martínez 2003a, 2003b; Alfaro & Clara 2007). The largest numbers of this species were observed in pasture lands followed by mudflats, as it is also the case in Argentina (Blanco *et al.* 2004). Uruguay harbors large areas of pasture lands and this species is probably more widely distributed than what the current available records show. Numbers of this species recorded in coastal grasslands of Rocha Lagoon are very important from a regional perspective, being the highest ever recorder (Isacch & Martínez 2003a). The species presence in Uruguay (mainly April to August) is similar to seasonality patterns in Brazil (April–August) and Buenos Aires Province (April–September, Myers & Myers 1979, Vooren & Chiaradia 1990, Isacch & Martínez 2003b, Alfaro & Clara 2007).

Uruguayan records of the Tawny-throated Dotterel have been scarcely reported in the literature (Teague 1955, Gore & Gepp 1978, Azpiroz 2003) and we were able to obtain few additional unpublished observations. General sources indicate that the species is found in grasslands throughout the country (Teague 1955, Gore & Gepp 1978, Azpiroz 2003). In Buenos Aires Province, this species is known to use pasture lands and plowed fields during the non-breeding season (late April to late August, Isacch & Martínez 2003a, Isacch & Martínez 2003b, Blanco *et al.* 2004). Our data indicate that this species uses inland and coastal grasslands for feeding and resting during the same time period. Records of this species were largely confined to the southern departments, with only a few concentrated in

southwestern Salto, in northern Uruguay. Lack of observations in other regions of the country probably reflects limited survey efforts in such areas. The highest numbers were registered in the coastal grasslands surrounding the Rocha Lagoon; these concentrations, however, were smaller than those reported in grasslands of Buenos Aires Province (Isacch & Martínez 2003a).

Due to several factors (e.g., ease of access, occurrence of many areas with high concentrations of birds), ornithological research in Uruguay, especially in the case of shorebirds and other migratory species, has largely concentrated in areas relatively close to Montevideo (i.e., southern Uruguay). Thus, in this analysis, the importance of coastal areas may have been overvalued to some extent, but more importantly, the relevance of inland sites has very probably been underestimated. However, this is a valid first approximation of the distribution and biology of the study species in Uruguay. This should serve as a basis for future research which identifies the places used by these species as well as their absences.

Our study highlights the importance of sites such as Rocha Lagoon, José Ignacio Lagoon and the native grasslands of southeastern Salto Department as important wintering areas for Neotropical migrant plovers. Rocha Lagoon and José Ignacio Lagoon are included in the MAB-UNESCO Reserve of the Eastern Wetlands of Uruguay, and Rocha Lagoon is also a National Park and Protected Area, but both lagoons lack a management plan. Native grasslands in Salto are private lands and thus are protected only by their owners. We believe that the information presented here will provide a baseline for future studies on the ecology and conservation of these species and their environments.

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