Conservation of Charadriiformes on the Peruvian coast

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On the Pacific coast of Peru, the order Charadriiformes is represented by 75 species, of which 16 are resident and 59 migrate from the Nearctic and Austral regions and the Galapagos Islands. On the basis of studies done on shorebirds between 1982 and 1991, suggestions are put forward for modifying the criteria for the establishment of Hemispheric, International and Regional reserves within the Western Hemisphere Shorebird Reserve Network along the coasts of the southern Pacific. Also proposed is a strategy to be followed for the conservation of migratory birds on the coasts of Peru.

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En la costa del Pacifico en Peru, el orden de los Charadriiformes esta representado por 75 especies, de las cuales 16 son residentes y 59 migran de las regiones neartica y austral y de las islas Galapagos. En base a estudios hechos sobre aves playeras entre 1982 y 1991, se plantean sugerencias para modificar los criterios para el establecimiento de reservas hemisfericas, internacionales y regionales en el marco de la Red de Reservas de aves Playeras del hemisferos Occidental a lo largo de las costas del oceano Pacifico sur. Tambien se propone una estrategia para la conservacion de aves migratorias en las costas de Peru.

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Sur la côte pacifique du Pérou, l'ordre des Charadriiformes compte 75 espèces, dont 16 y nichent et 59 y migrent depuis les régions néarctiques et australes et les îles Galapagos. Sur la foi d'études d'oiseaux de rivage effectuées entre 1982 et 1991, on propose des modifications aux critères d'établissement, pour les côtes du Pacifique Sud, des réserves hémisphériques, internationales et régionales du Réseau de réserves pour les oiseaux de rivage de l'hémisphère occidental. On recommande aussi l'adoption d'une stratégie de conservation des oiseaux migrateurs des côtes du Pérou.

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Introduction

Until 1980, few studies had been done in Peru on the Charadriiformes that inhabit the Peruvian coast (*e.g.* Hughes 1968, 1970, 1976, 1979; Tovar & Ashmole 1970). Only part of studies conducted by the Peruvian Oceanic Institute (IMARPE) included Charadriiformes. In 1982, the Wildlife Directorate of the former National Wildlife Authority (INFOR), together with the Pan American Shorebird Program, the Philadelphia Academy of Science and other Peruvian non-governmental organizations, undertook the first studies on bird migration. In September 1982, under the leadership of J.P. Myers, a census of shorebirds was undertaken, and Sanderlings *Calidris alba* were banded on the sandy seashore of the Mejia resort area on the southern coast of Peru (Pulido 1983a, 1983b).

In March of the following year, censusing and banding of migratory shorebirds continued in the Mejia Lagoons National Bird Sanctuary and in the Paracas National Reserve. In 1983 and 1984, new research was begun in Paracas and in the Villa beaches and Paraiso Lagoon by E. Ortiz and G. Castro, respectively. These studies later extended to work on the ecology and conservation of areas important to shorebirds (Castro 1984; Castro & Myers 1987; Castro, Myers & Bertochi 1988; Castro, Ortiz & Bertochi 1990).

In 1985, under a letter of agreement between the Canadian Wildlife Service of Environment Canada and the former INFOR, a collaborative programme was set up to study the feeding habits and ecology of the Common Tern *Sterna hirundo* (Pulido 1987). In February 1986, the first aerial census of shorebirds was done along the entire Peruvian coast between Tumbes and Tacna. The resulting data were used by R.I.G. Morrison and R.K. Ross in the *Atlas of Nearctic shorebirds on the coast of South America* (Morrison & Ross 1989).

In 1987, 1989 and 1991, the Wildlife Research Directorate of the Instituto Nacional de Investigación Agraria y Agroindustrial (INIAA),

with the support of national and international organizations, organized workshops on research and conservation of wild birds, which included banding campaigns in the Paracas National Reserve. Nearly 1,600 specimens of various species of shorebirds were banded. Further banding campaigns took place in Paracas in 1990 and 1991.

Field studies undertaken along the Peruvian and the entire Pacific and Atlantic coasts have made it possible to standardize the banding of migratory shorebirds using metal bands and coloured flags and bands (Myers *et al.* 1987a, 1987b; Pulido 1989) and to establish avenues for research (Castro 1985; Castro & Sallaberry 1986).

This study covers certain aspects of shorebird migration along the Pacific coast of Peru, including (1) the results of banding done over five years from 1987 to 1991, (2) the identification of those areas important to the conservation of shorebirds in Peru and (3) suggestions for the establishment of shorebird reserves by the Western Hemisphere Shorebird Reserve Network (WHSRN).

Shorebird migrations along the Pacific coast of Peru

Many migrant shorebirds that stop over on the coast of Peru come from the Nearctic region (Canada and the United States), the Galapagos Islands (Ecuador) and the Austral region (South Pole and Chile) by horizontal migration. Others migrate vertically when descending from the Andes to the Pacific coast or the Amazon region.

Of the 11 families that make up the order Charadriiformes, 10 occur in Peru (Parker, Parker & Plenge 1982; Hayman, Marchant & Prater 1986) (Table 1). These 10 families comprise 86 species, of which 75 (87%) inhabit Peru's coasts either temporarily or permanently. Of the 75 coastal species, 16 species are resident, whereas 59 are migratory species originating from the Nearctic region (48), the Austral region (6), the Galapagos Islands (1) and the Peruvian Andes (4) (Table 2).

Of the 10 families that occur in Peru, Scolopacidae is represented by 27 species (all of them Nearctic and migratory), followed by Laridae with 22 species (7 resident and 15 migratory) and Charadriidae with 11 species (4 resident and 7 migratory). The 7 remaining families include between 1 and 5 species.

Banding of shorebirds from 1987 to 1991

Six banding campaigns were carried out in the Paracas National Reserve in 1987 through to 1991. Shorebirds were banded in March 1987 (395), March 1989 (474), February and March 1990 (138 and 312 birds, respectively) and March and April 1991 (81 and 160, respectively). Overall, 1,560 specimens were banded: 568 Semipalmated Sandpipers *Calidris pusilla*, 519 Western Sandpipers *Calidris mauri*, 439 Sanderlings, 19 Short-billed Dowitchers *Limnodromus griseus*, 14 Semipalmated Plovers *Charadrius semipalmatus* and 1 Black-bellied Plover *Pluvialis squatarola* (Table 3).

Both the recapture and recovery rates were very low. For recaptured birds, the percentage did not exceed 2% of total birds banded for that campaign. For recoveries, the percentage on one occasion rose exceptionally high to 12%, pointing to a certain degree of site fidelity in migratory birds wintering in Paracas.

Important areas for shorebird conservation in Peru

The Peruvian coast is an arid strip, 3,080 km long and up to 200 km wide, which extends along the maritime littoral between Boca Capones in the north and Concordia in the south (Peñaherrera 1989). Its topography is varied; it includes 53 major rivers, vast expanses of coastal desert, cropland and hill formations. Throughout is a series of wetlands important to the conservation of Charadriiformes.

Of the most important wetlands along the Peruvian coast, only three are protected: the National Tumbes Mangrove Swamp Sanctuary (2,972 ha), the Paracas National Reserve (335,000 ha, of which 217,594 ha are marine) and the Mejia Lagoons National Bird Sanctuary (690.6 ha). Among the unprotected wetlands are the Virrilá Estuary, the San Pedro mangrove swamps, the Lambayeque coasts and the Paraiso Lagoon. Of all these areas, only the Paracas National Reserve has been recognized by the WHSRN, designated as a Regional reserve in September 1991.

Other wetlands of national importance on the Peruvian coast include the Ramón Lagoon, the mouth of the Chira River, the mouth of the Piura River, the mouth of the Eten River, the Medio Mundo Lagoons, the Villa Swamps Reserve, the mouth of the Lurín River, the Puerto Viejo Lagoons, the mouth of the Chincha River, the mouth of the Pisco River, the Agua Santa Lagoons, Punta Lomitas, Asma, the Tilimaco Lagoons, the Pucchún Lagoons, the mouth of the Camaná River, the mouth of the Tambo River, Punta Coles, the mouth of the Locumba River, the Ite Lagoons and the beaches of Tacna. All these wetlands of recognized importance to migratory birds are interconnected in various ways by means of avian migration routes. The distances between them range from a few kilometres to not more than 100 km. It is therefore important to protect most of these aquatic

Table 1. Species of Charadriiformes and their status on the Peruvian coast. R = resident, A = Austral (migratory), S = southern, An = Andes (migratory), G = Galapagos (migratory) and N = Nearctic.

Family/Species	Common name	Status
Haematopodidae		
Haematopus palliatus	American Oystercatcher	R
Haematopus ater	Blackish Oystercatcher	R
Charadriidae		
Vanellus resplendens	Andean Lapwing	An
Pluvialis squatarola	Black-bellied Plover	N
Pluvialis dominica	Lesser Golden-Plover	N
Charadrius semipalmatus	Semipalmated Plover	N
Charadrius alexandrinus	Snowy Plover	R
Charadrius alticola	Puna Plover	An
Charadrius collaris	Collared Plover	R
Charadrius vociferus	Killdeer	R
Charadrius wilsonia	Wilson's Plover	N
Charadrius modestus	Rufous-chested Dotterel	A
Oreopholus ruficollis	Tawny-throated Dotterel	R
Scolopacidae		
Aphriza virgata	Surfbird	N
Arenaria interpres	Ruddy Turnstone	N
Tringa solitaria	Solitary Sandpiper	N
Tringa flavipes	Lesser Yellowlegs	N
Tringa melanoleuca	Greater Yellowlegs	N
Actitis macularia	Spotted Sandpiper	N
Heteroscelus incanus	Wandering Tattler	N
Catoptrophorus semipalmatus	Willet	N
Calidris canutus	Red Knot	N
Calidris minutilla	Least Sandpiper	N
Calidris bairdii	Baird's Sandpiper	N
Calidris fuscicollis	White-rumped Sandpiper	N
Calidris melanotos	Pectoral Sandpiper	N
Calidris pusilla	Semipalmated Sandpiper	N
Calidris mauri	Western Sandpiper	N
Calidris alba	Sanderling	N
Calidris alpina	Dunlin	N
Calidris ferruginea	Curlew Sandpiper	N
Calidris himantopus	Stilt Sandpiper	N
Tringites subruficollis	Buff-breasted Sandpiper	N
Philomachus pugnax	Ruff	N
Bartramia longicauda	Upland Sandpiper	N
Numenius phaeopus	Whimbrel	N
Limosa haemastica	Hudsonian Godwit	N
Limosa fedoa	Marbled Godwit	N
Limnodromus scolopaceus	Long-billed Dowitcher	N
Limnodromus griseus	Short-billed Dowitcher	N
Recurvirostridae		
Himantopus mexicanus	Black-necked Stilt	A
Recurvirostra andina	Andean Avocet	An
Phalaropodidae		
Phalaropus fulicaria	Red Phalarope	N
Phalaropus lobatus	Red-necked Phalarope	N
Phalaropus tricolor	Wilson's Phalarope	N
Stercorariidae		
Catharacta chilensis	Chilean Skua	A
Catharacta maccormicki	South Polar Skua	A
Stercorarius pomarinus	Pomarine Jaeger	N
Stercorarius parasiticus	Parasitic Jaeger	N
Stercorarius longicaudus	Long-tailed Jaeger	N
Burhinidae		
Burhinus superciliaris	Peruvian Thick-knee	R

Continued

Table 1. (*Cont'd*) Species of Charadriiformes and their status on the Peruvian coast. R = resident, A = Austral (migratory), S = southern, An = Andes (migratory), G = Galapagos (migratory) and N = Nearctic.

Family/Species	Common name	Status
Thinocoridae		
Thinocorus rumicivorus	Least Seedsnipe	R
Laridae		
Larus modestus	Grey Gull	A
Larus belcheri	Peruvian Tern	R
Larus dominicanus	Kelp Gull	R
Larus atricilla	Laughing Gull	N
Larus cirrocephalus	Grey-hooded Gull	R
Larus serranus	Andean Gull	An
Larus pipixcan	Franklin's Gull	N
Xema sabini	Sabine's Gull	N
Creagrus furcatus	Swallow-tailed Gull	G
Cheidonias niger	Black Tern	N
Gelochelidon nilotica	Gull-billed Tern	N
Sterna hirundinacea	South American Tern	R
Sterna hirundo	Common Tern	N
Sterna paradisaea	Arctic Tern	N
Sterna trudeaui	Trudeau's Tern	A
Sterna fuscata	Sooty Tern	R
Sterna albifrons	Little Tern	N
Sterna lorata	Peruvian Tern	R
Sterna maxima	Royal Tern	N
Sterna elegans	Elegant Tern	N
Sterna sandvicensis	Sandwich Tern	N
Larosterna inca	Inca Tern	R
Rynchopidae		
Rynchops niger	Black Skimmer	R

Table 2. Numbers of resident and migratory species of Charadriiformes on the Peruvian coast. R = resident, A = Austral (migratory), S = southern, An = Andes (migratory), G = Galapagos (migratory) and N = Nearctic (migratory).

Family	R	N	A	G	An	Total species
Haematopodidae	2	–	–	–	–	2
Charadriidae	4	4	1	–	2	11
Scolopacidae	–	27	–	–	–	27
Recurvirostridae	–	–	1	–	1	2
Phalaropodidae	–	3	–	–	–	3
Stercorariidae	–	3	2	–	–	5
Burhinidae	1	–	–	–	–	1
Thinocoridae	1	–	–	–	–	1
Laridae	7	11	2	1	1	22
Rynchopidae	1	–	–	–	–	1
Total species	16	48	6	1	4	75

environments using the legal instruments available to the Peruvian government.

Suggestions for the establishment of shorebird reserves as part of the WHSRN

Some of the criteria for establishing International, Hemispheric and Regional shorebird reserves within the WHSRN may need to be modified in the case of areas that do not meet the criteria established to date, such as those along the coast of the southern Pacific.

In principle, the same parameters should be used to establish Hemispheric, International or Regional reserves for the Nearctic region as for the Neotropical region. However, the farther away wintering grounds are located, the fewer species and individuals reach them (Rappole *et al.* 1983),

Table 3. Shorebirds banded in Paracas.

Species	Status	87/3	89/3	90/2	90/3	91/3	91/4	Total
Calidris alba	1	118	37	9	66	51	158	439
	2	1	0	0	0	0	4	5
	3	11	2	0	4	5	12	34
								478
Calidris mauri	1	100	216	59	114	30	0	519
	2	5	0	0	3	1	0	9
	3	5	2	5	9	0	0	21
								549
Calidris pusilla	1	165	211	69	123	0	0	568
	2	2	0	0	3	0	0	5
	3	6	2	5	10	8	9	40
								613
Charadrius semipalmatus	1	1	9	0	3	0	1	14
	2	0	0	0	0	0	0	0
	3	0	1	0	0	0	0	1
								15
Limnodromus griseus	1	11	1	1	5	0	1	19
	2	0	0	0	1	0	0	1
	3	1	0	0	1	0	0	2
								22
Pluvialis squatarola	1	0	0	0	1	0	0	1
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
								1
Total banded		395	474	138	312	81	160	1,560
Total recaptured		8	0	0	7	1	4	20
Total recovered		23	7	10	24	13	21	98
Total captured		426	481	148	343	95	185	1,678

although they may be essential habitats for those that do.

In the Nearctic region, in both pre-breeding and post-breeding periods, large numbers of plovers and shorebirds concentrate at key sites, such as Delaware Bay and the Bay of Fundy on the Atlantic coast, San Francisco Bay and the Copper River Delta on the Pacific coast and Stillwater, Great Salt Lake and Cheyenne Bottoms in continental areas.

There are also sites with high concentrations of shorebirds on the coasts of the southern Atlantic: the large populations of (1) Semipalmated Sandpiper on the coasts of Suriname (about 80% of the world population), (2) Wilson's Phalarope *Phalaropus tricolor* and Red-necked Phalarope *P. lobatus* in the Mar Chiquita Lagoon in Argentina and (3) Red Knot *Calidris canutus*, White-rumped Sandpiper *C. fuscicollis* and Hudsonian Godwit *Limosa haemastica* in Tierra del Fuego. Generally speaking, those species that breed farther north occupy overwintering areas farther south (Myers *et al.* 1987a). In contrast, on the Pacific coast, smaller concentrations of birds are dispersed over a wide area.

Another factor is that shorebird populations in the Nearctic region are close to attaining the optimal numbers of birds in relation to their reproductive capacity. Furthermore, these populations include juveniles that have opted not to migrate south, adults that have bred and those birds born in the boreal summer of the year. In the south, only part of the population that began the post-breeding migration actually reaches the wintering grounds, *i.e.* some of the juveniles, immature birds and breeding adults. From this total must be subtracted the number of birds that die during the post-breeding migration to the wintering grounds and those that die at the wintering grounds from depredation or other climatic factors or because of the destruction of their habitat, which affects birds concentrating in small areas during migration.

This means that the possibility of a population of migratory birds disappearing with the passage of time is greater at wintering sites. This is fundamentally due to the destruction of habitats, which is occurring more rapidly every year in South America as a result of anthropogenic activities.

Time is another factor. As the breeding period is relatively short (from June to August), birds are forced to have a greater sense of timing in the north, particularly those migrating great distances from the Arctic (Myers *et al.* 1987a). This exerts pressure on birds to obtain certain advantages and to locate

better nesting sites to ensure breeding success. The result is a longer wintering period, which also includes pre- and post-breeding travel.

It is also likely that a greater destruction of northern areas supporting habitats for these birds is causing a greater concentration of birds in particularly productive sites. Senner & Howe (1984) showed that birds do not have the option of locating in other areas given the availability of food and habitats precisely in those specific locations. With regards to food supply, food is abundant in the north, which makes large concentrations of birds possible, especially at particular times, such as at the end of May in Delaware Bay (Myers 1986). Along the coast of the southern Pacific, on the other hand, maximum advantage is taken of available food. In the first case, the limiting factor is space, and in the second, it is food. With regards to habitat in the United States, by 1978 close to 40% of all aquatic and continental habitats had been lost (Horwitz 1978). Although no quantitative data are available, the destruction of wetlands in South America has probably not yet reached that extent, which should make a wider dispersion of birds possible, as there is more habitat available. Then there is the fact that some populations spend a relatively short period of time at each wintering site. It is therefore important to conserve not one location but several locations near each other along the coast, as is the case in coastal Peru.

A different survival strategy is adopted by birds in the south than in the north. While in the north, they survive to nest and thus ensure breeding success; in the south, they survive to recover from the post-breeding migratory effort and to store sufficient energy during the wintering period to reinitiate the return on pre-breeding flights.

Although the criteria for establishing reserves by the WHSRN are appropriate for North America and for the Atlantic coast of South America, they need to be modified for the southern Pacific. The WHSRN, in addition to taking into account the number of birds in a given place, must also stress other aspects such as species diversity, strategic staging sites along migration routes, the natural and pristine state of aquatic environments and their importance as conservation areas for resident and migratory species.

On the Pacific coast of Peru and northern Chile, the presence of the Humboldt Current ensures the existence of numerous coastal areas with an appreciable food supply. However, basic factors such as human intervention and pollution and the destruction and disappearance of wetlands could be forcing birds to fly to different wintering areas. The low recovery rates of banded shorebirds would appear to confirm this.

The Mejia Lagoons, for instance, constitute one of the most important wetlands of the Pacific coast of Peru. One of the largest Sanderling populations is concentrated here. Even so, the number of birds of this species is not sufficient to include the Mejia Lagoons in any of the WHSRN's categories. Nonetheless, in this single protected area of 690.6 ha, 172 species have been recorded, or one species for every 4 ha (Pulido 1987; Pulido & Myers 1987). Also, 64 species of Charadriiformes were found on 10 km of beach, or between 6 and 7 species per kilometre.

For this reason, the appropriate strategy for the conservation of migratory shorebirds must necessarily include the establishment of a series of protected areas along the Peruvian coast. First, the establishment of such areas must be approved and supported by the Peruvian government. Second, efforts must be concentrated on managing these areas. This means not only applying protective measures but also developing a plan for the comprehensive management of wetlands. To this end, it is necessary to consider important factors such as staging sites, feeding grounds, variations in water levels and habitat diversity in such management areas. Only in this way will it be possible to ensure the conservation of wetlands along the Peruvian coast so that shorebirds from different latitudes may find a safe place to stop along the way in the yearly migration to their overwintering areas.

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