

# Management and conservation of the habitats used by migratory shorebirds at Coquimbo, Chile

*E. Tabilo, R. Jorge, R. Riquelme, A. Mondaca, C. Labra, J. Campusano, M. Tabilo, M. Varela, A. Tapia & M. Sallaberry*

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Migratory shorebirds in Chile are concentrated mainly in Patagonia, Chiloe Island and some areas in the northern part of the country. One of these areas is the Coquimbo coastline, with 350 km of coast and 80 km of beaches and lagoons that annually receive hundreds of Nearctic and austral shorebirds. These habitats are under constant pressure owing to human activity. The characteristics of the annual life cycle of migratory birds make them very vulnerable to habitat deterioration. In order to design conservation strategies, it is very important to know areas of concentration and to understand annual rhythms of abundance as well as the environmental problems associated with the habitats that the birds occupy. This study describes the habitats used by migratory shorebirds in Coquimbo, population fluctuations and sources of environmental impact. The information obtained by Coquimbo RECAP (the Chilean Shorebird Network) is being used to design strategies for the management and conservation of these birds and their habitats in the area of Coquimbo, Chile.

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En Chile los Chorlos y Playeros migratorios se concentran mayoritariamente en la Patagonia, Isla de Chileo y algunos puntos del Norte del país. Unos de estos sitios es el litoral de Coquimbo con unos 350 km de costa y 80 km de playas y lagunas que reciben anualmente a cientos de Chorlos neárticos y australes. Estos ambientes están siendo sometidos a una permanente presión ambiental por actividades humanas. Las características del ciclo de vida anual de un ave migratoria las hace muy vulnerable al deterioro ambiental. Conocer las áreas de concentración, ritmos de abundancia anual y los problemas ambientales asociados al lugar son claves en la hora de diseñar estrategias de conservación. Este trabajo describe los ambientes usados por Chorlos y Playeros migratorios en Coquimbo, fluctuaciones poblacionales y las fuentes de impacto ambiental. La información obtenida por RECAP Coquimbo se está usando para diseñar una estrategia de conservación y manejo de estas aves y sus ambientes en Coquimbo, Chile.

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Au Chili, les oiseaux de rivage migrateurs se concentrent essentiellement en Patagonie, aux îles Chiloe et dans certaines régions du nord du pays, notamment la région de Coquimbo. À cet endroit, la côte s'étire sur 350 km, dont 80 de plages et de lagunes, et reçoit tous les ans des centaines d'oiseaux de rivage néarctiques et australs. Les activités anthropiques exercent des pressions constantes sur ces régions. À cause des caractéristiques propres à leur cycle annuel de vie, les oiseaux de rivage sont particulièrement sensibles à la détérioration des habitats. Afin de pouvoir élaborer des stratégies de conservation, il faut connaître les secteurs de concentration des oiseaux et les rythmes annuels d'abondance, ainsi que les problèmes environnementaux associés aux habitats de prédilection des oiseaux. La présente étude décrit les habitats qu'utilisent les oiseaux de rivage dans la région de Coquimbo, les fluctuations démographiques et les sources potentielles d'impact sur l'environnement. Les résultats de l'étude réalisée dans le cadre du RECAP pour la région de Coquimbo servent à élaborer des stratégies de gestion et de conservation de ces oiseaux et de leurs habitats dans la région de Coquimbo au Chili.

*E. Tabilo, Corporación Nacional Forestal, IV Region – Chile.*

*R. Jorge & R. Riquelme, Depto. Biología Marina, Univ. Católica del Norte, Coquimbo.*

*A. Mondaca, C. Labra, J. Campusano, M. Tabilo, M. Varela & A. Tapia, Depto. Biología, Univ. de La Serena, La Serena, Chile.*

*M. Sallaberry, Depto. Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile.*

## Introduction

Many authors have described sites of large concentrations of long-distance migratory shorebirds in Chile (Myers *et al.* 1984, 1985, 1990;

Tabilo 1987; Tabilo & Noton 1987, 1989; Tabilo *et al.* 1987; Morrison & Myers 1989; Morrison & Ross 1989; Sallaberry & Tabilo 1990; M. Sallaberry & J. Abarca, pers. commun.). These sites are located on Tierra del Fuego, Chiloe Island and the coastlines of

Concepción, Valparaíso, Coquimbo, Mejillones and Arica.

The special characteristics of the biological cycles of these species make them very sensitive to environmental disturbance (Myers *et al.* 1987), because these birds use environments desired for human development, recreation, agricultural needs and industry (Smit, Lambeck & Wolff 1987). These kinds of disturbances produce accumulative effects on the wetlands (Harris 1988; Risser 1988; Weller 1988), which are evident in structural changes in the bird community and in biodiversity (Hutto 1989), with displacement of species with highly specialized habitat requirements, such as migratory shorebirds, by generalist species (Myers *et al.* 1987). This deterioration of the environment will produce loss and fragmentation and a decrease in the biodiversity of the aquatic ecosystem.

Shorebirds in Chile experience serious deterioration of their habitats, due especially to the pollution of the coastline. Bore, Pizarro & Cabrera (1986) suggested that in Chile the contamination of the coastline is very high but localized. Great amounts of human and industrial residues are released into the ocean without any treatment. In the northern part of Chile, there is a large amount of contamination by the mining companies. In the central part, the contamination is due to the big cities, in the southern part, mainly chemicals or products of the forestry companies, and in the extreme south, petroleum companies.

The Coquimbo coastline, approximately 350 km long, is an important area, both nationally and internationally, for Sanderlings *Calidris alba* and Whimbrels *Numenius phaeopus* (Myers *et al.* 1984, 1985, 1990; Tabilo 1987; Morrison & Ross 1989). Unfortunately, these wetlands receive industrial, domestic and petroleum contamination. The accelerated urbanization of the coastline owing to increased tourism is also a problem. Coastal highways and tourist complexes have been built right on the beach. In 1987, Tabilo & Noton published a *Management field guide*, which contained the scientific bases that support the conservation of these habitats. They proposed a series of management activities, among them that the Coquimbo coastline be included in the Western Hemisphere Shorebird Reserve Network as a Regional reserve for migratory shorebirds.

Attempts to arouse interest in protecting these environments have been relatively successful. The existence of abundant and solid biological information about these habitats and the migratory shorebirds that use them is the key to securing support for our efforts. Permanent and updated information, including wetland inventories, shorebird counts and knowledge of habitat deterioration, is needed in order to propose

conservation strategies, management and sustainable use of the coastline. With this information, it will be possible to visualize the general situation and prioritize conservation activities (what to do and where to do it) in the wetlands.

The purpose of this paper is to describe the aquatic environment of the Coquimbo coastline, the species of shorebirds that use the wetlands and the environmental impact variables associated with each site. We also propose mechanisms for conservation and management of these habitats.

## Methodology

Monthly counts of aquatic birds were carried out from March 1990 through April 1991 between Coquimbo Bay to the north and the southern tip of Playa Changa to the south (Figure 1), according to standardized counting methods (Tabilo 1987). In this study, we put special emphasis on the comparative richness, abundance and diversity (Hair 1987) of Charadriidae and Scolopacidae. The coastline was inspected for 71 different sources of environmental impact (Smit, Lambeck & Wolff 1987; Bojórquez & Ortega 1989) at each wetland site.

For analysis of the data, we compared only the percentages of the 71 environmental impact variables that applied at each wetland site. From this information, we assessed the conservation status of migratory shorebirds, and we proposed management activities for each wetland site along the coast of Coquimbo, Chile. For the bird list, we used the field guide *Guía de Campo de las Aves de Chile* (Araya & Millie 1988), and for the wetland classification, we followed Ramsar (1990) criteria.

## Study site

The Coquimbo coastline (29–32°S, 71–72°W) is characterized by extensive beaches, cliffs, peninsulas and estuaries (Figure 1). With regard to climate, it is a transitional zone under strong influences, both from the desert to the north and from mediterranean habitats to the south, that affect the physiognomy of the landscape. Interannual climatic variations are marked. There is a predominance of xerophytic vegetation, which classifies the region as arid mediterranean, in which the arid aspect is less pronounced than in equivalent latitudes elsewhere, owing to the existence of the cold Humboldt Current (Di Castri & Hajek 1976).

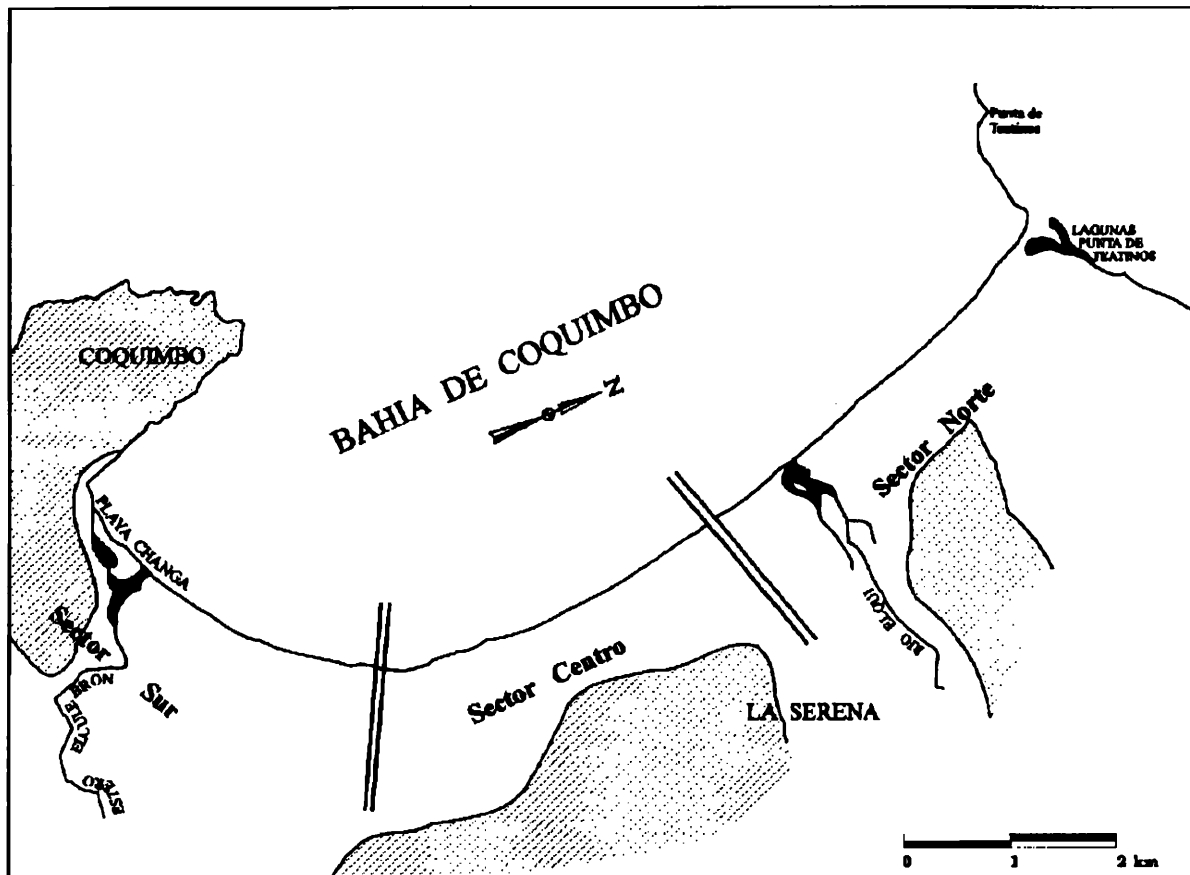


Figure 1. Coquimbo Bay in Chile showing the south (sur), central (centro) and north (norte) sections (sector) described in this study.

## Results and discussion

### Bird biology

Of the birds counted, the resident plovers showed higher relative abundance. The Southern Lapwing *Vanellus chilensis* was observed at all wetland sites along the Coquimbo coastline. It is a common species near humid sites throughout the country (Araya & Millie 1988). Owing to its flexibility in use of habitats and its abundance, we considered this species to have no conservation problems in the area.

The Snowy Plover *Charadrius alexandrinus* was relatively common and used the sandy beaches as nesting and feeding sites. Lagoons were used as roosting sites. Nevertheless, we speculate that this species will present conservation problems in the future (R. Jorge, pers. commun.), because of the fact that it is very specialized in its habitat and highly sensitive to environmental disturbance. This species has modified its distribution patterns in the area as a result of the ongoing loss of nesting sites. As an example, in Coquimbo Bay, with its 18 km of sandy beaches, this plover is concentrated along the last 6 km of beach at the northern part of the bay. The birds are continuously disturbed by people,

vehicles and dogs, and many of their nests are destroyed.

The Banded Plover *Charadrius collaris* is considered a resident species. Hayman, Marchant & Prater (1986) described the status of this plover as unclear. However, it was common to observe small flocks throughout the year along the Coquimbo coastline, where the species is even known to nest (R. Jorge & A. Mondaca, unpubl. data).

All the austral migrants occurred in small groups between March and September each year, and they were distributed throughout all the aquatic environments along the coastline.

Nearctic migratory shorebirds, such as the Black-bellied Plover *Pluvialis squatarola*, occurred in small numbers during the summer months at the wetland sites near Tongoy. The Semipalmated Plover *Charadrius semipalmatus* occurred in small flocks almost exclusively at lagoons to the south of Coquimbo Bay.

Yellowlegs (*Tringa* spp.) were commonly observed in small groups in the lagoons and bays of Coquimbo and Tongoy. The Ruddy Turnstone

*Arenaria interpres* seemed to move about a great deal within the area, and it was normally present in all coastal habitats of the Coquimbo coastline, occasionally in large numbers.

The Common Snipe *Gallinago gallinago* used only those wetland sites that included abundant vegetation. This species has almost completely disappeared from the lagoons near Coquimbo Bay, because these sites have been severely affected by coastal urbanization.

Sanderlings and Whimbrels are the most common and abundant shorebirds of the Coquimbo coastline. Tabilo (1987) pointed out that Sanderlings are especially abundant in Coquimbo Bay, and the same is true for Whimbrels in Tongoy Bay. In spite of this, Sanderlings have shown a continued decrease in abundance in Coquimbo Bay during the last five years. We suspect that this is due to the decline of the environmental quality of the bay.

Another group of shorebirds occurred in the area irregularly and in low numbers (see Table 1; where abundance = 1). We believe that these shorebirds stopped in the area to rest for a few weeks while they accumulated reserves to continue their migration. They used the beaches and lagoons of the region sporadically, coinciding with their migratory patterns. Other species, such as Red Knot *Calidris canutus* and Hudsonian Godwit *Limosa haemastica*, were seen only occasionally, and we suspect that those sightings were of birds that had strayed off their usual routes.

From the above results, we conclude the following:

- (1) The regular visits of small flocks of austral and boreal migratory shorebirds in this area could be explained by the need of these birds for high-quality and safe overwintering sites. Destruction and loss of their traditional environments could cause an ongoing decline in the numbers of those birds that stop off at these sites each year.
- (2) Some occasional visits could be of birds that use the Pacific corridor by mistake. They could also be due to birds that normally use this corridor but do not overwinter at Coquimbo. These birds are observed as they use the site for short stops to refuel before continuing their migrations.
- (3) We suspect that abundant species such as Sanderling will have serious conservation problems in the near future owing to the current rate of deterioration of the aquatic ecosystems. For example, the Snowy Plover is faced with nesting difficulties, and Sanderlings show a population decrease. Resident shorebirds move

locally up and down the coast, and it is increasingly difficult for them to find sites in good condition for feeding, roosting and nesting requirements.

## Wetlands

The bays of Coquimbo and Tongoy present the greatest variety of different aquatic micro-environments locally. This could be the reason why Tongoy (Table 2) showed the greatest bird diversity as well as a relatively low environmental impact index (58%). This situation will change greatly in the future with increasing coastal urbanization for tourism. Currently, the major environmental impacts are seen during the summer and are associated with an excess of people and vehicles on the beach and near the lagoons. Tourism is a fundamental part of the region's economy, and improved urban infrastructure is needed in these areas to take advantage of their economic potential.

Coquimbo Bay presented the greatest species richness and highest abundance of shorebirds in the area, but it had an alarming 92% environmental impact index. This was to be expected, as both the Port of Coquimbo and the city of La Serena are located on the bay. This urban centre includes a human population of nearly 400,000 and almost all of the industry of the IV Region. Tourism is also a very important activity in the area and has led to the construction of coastal highways and condominiums. As a result of these activities, wetlands have been destroyed, drained, fragmented and contaminated. Our data indicate that, in the southern part of the bay, specialist bird species are being replaced by more generalist species.

Owing to factors beyond our control, it proved impossible to realize counts in Guanaqueros Bay, and thus information for this area is lacking. It showed an environmental impact index of only 54% in the summer months, mostly because of the construction of buildings at the edge of the beach.

With regards to lagoons, the mouth of the Limari River showed the highest species diversity of shorebirds as well as the greatest number of different aquatic microhabitats. It is an environment that is relatively little altered. The northern edge of the river-mouth borders Fray Jorge National Park, and it thus is constantly watched by park personnel. The greatest bird abundance was observed at Conchali Stream, the area that also presented the highest environmental impact index because of a nearby highway and summer camping. The rest of the coastal environments (Cebada and Quilimari) showed low bird abundance, probably because these areas are poor in alternative aquatic microhabitats. On the other hand, this series of small coastal lagoons may become important if we analyse them on a regional scale.

**Table 1.** Wader species in Coquimbo coastline, IV Region of Chile.

Species	Status	Type of migrants	Season	Occurrence	Relative abundance
<b>Fam. Charadriidae</b>					
<i>Vanellus chilensis</i>	R			R	2
<i>Pluvialis squatarola</i>	M	B	S	R	1
<i>Charadrius semipalmatus</i>	M	B	S	R	1
<i>C. alexandrinus</i>	R			R	3
<i>C. falklandicus</i>	M	A	W	R	1
<i>C. collaris</i>	R			R	1
<i>C. modestus</i>	M	A	W	R	1
<b>Fam. Scolopaciidae</b>					
<i>Tringa flavipes</i>	M	B	S	R	1
<i>T. melanoleuca</i>	M	B	S	R	1
<i>Catoptrophorus semipalmatus</i>	M	B	S	I	1
<i>Numenius phaeopus</i>	M	B	S	R	3
<i>Limosa haemastica</i>	M	B	S	I	1
<i>Arenaria interpres</i>	M	B	S	R	2
<i>Calidris canutus</i>	M	B	S	I	1
<i>C. bairdii</i>	M	B	S	I	1
<i>C. alba</i>	M	B	S	R	3
<i>C. melanotos</i>	M	B	S	O	1
<i>C. pusilla</i>	M	B	S	I	1
<i>C. fuscicollis</i>	M	B	S	I	1
<i>Gallinago gallinago</i>	R			R	2

Status: R: resident; M: migratory. Type of migrants: B: boreal; A: austral. Season: S: summer; W: winter. Occurrence: R: regular; I: irregular; O: occasional. Relative abundance: 1: scarce; 2: regular; 3: abundant.

**Table 2.** Comparison of different variables among beaches and lagoons of the Coquimbo coastline: different microhabitats (Ramsar 1990), number and abundance of shorebirds, Shannon-Weaver index of diversity (H) and percentage of the environmental impact variables of relevance at each site.

Habitat	Microhabitat	No. of wader spp.	Abundance	H	Environmental impact index (%)
<b>Bays</b>					
Coquimbo	6	21	18.052	2.2	92
Guaqueros	4				54
Tongoy	6	18	9.630	2.6	58
<b>Lagoons</b>					
Limari	7	11	1.478	2.5	34
Cebada	3	12	0.289	1.8	38
Conchali	4	15	2.070	2.0	41
Quilimari	4	11	0.739	2.0	37

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