

# Population estimates of waders on Spanish non-estuarine coasts

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Hortas, F., Pérez-Hurtado, A., Robledano, F., Álvarez Laó, C. & Salvadores, R. 2008. Population estimates of waders on Spanish non-estuarine coasts. pp. 65–74. In: N.H.K. Burton, M.M. Rehfish, D.A. Stroud & C.J. Spray (eds). *The European Non-Estuarine Coastal Waterbird Survey*. International Wader Studies 18. International Wader Study Group, Thetford, UK.

The 1999/2000 Non-Estuarine Coastal Waterbird Survey in Spain (Spain-NEWS) aimed to provide population estimates for waders wintering on the Spanish non-estuarine coast. The survey covered 232 km or 6% of the country's non-estuarine coast. A total of 628 waders of 16 species were recorded during the survey. These data and information from other regional or species-specific surveys were used to calculate minimum population estimates for 2,253 km or 56% of the Spanish non-estuarine coastline (surveys have concentrated on the most important areas for waders and thus only small numbers of birds are thought to winter on the remaining 44% of the coast). We estimated that a minimum of 9,190 waders of 21 species winter on the country's non-estuarine coast. Population estimates for the three species which occur on the Spanish non-estuarine coast in numbers which surpass 1% of estimated biogeographic populations (Wetlands International 2006) are as follows: 1,434 Sanderling *Calidris alba* (1.2%), 758 Purple Sandpiper *C. maritima* (1.0%) and 1,763 Ruddy Turnstone *Arenaria interpres* (1.2%). The inclusion of new data from non-estuarine areas would increase the most recent estimate of the number of waders wintering in Spain by 3.7%, the most significant increases being for Purple Sandpiper (252%), Whimbrel *Numenius phaeopus* (22.6%), Common Sandpiper *Actitis hypoleucos* (64.8%) and Ruddy Turnstone (50.6%).

Length of non-estuarine coast	Coverage <sup>a</sup>	Representative of	Winter	Population estimate	Reliability
4,013 km	5.8%	Whole country	1999/2000	Minimum estimate	Average

<sup>a</sup> This is the coverage from Spain-NEWS; minimum estimates were calculated for 56% of the Spanish non-estuarine coastline using the results of this and previous surveys.

## Introduction

Data on the numbers of wintering waders in Spain have been collected since 1973 (Araujo & García-Rúa 1974, Alberto & Purroy 1981, 1983, Alberto & Velasco 1986, 1988, Velasco & Alberto 1993) and Martí & Del Moral (2002) recently reviewed available data from the last decade and population trends since 1980. This review suggested that the total numbers of wintering waders in Spain account for around 1.1% (0.4–2.3%) of the East Atlantic flyway population.

Spain supports over 75% of the Western European wintering populations of Black-winged Stilt *Himantopus himantopus*, Little Ringed Plover *Charadrius dubius*, Kentish Plover *C. alexandrinus* and Whimbrel *Numenius phaeopus*, between 50–75% of Western European Little Stint *Calidris minuta* and Ruff *Philomachus pugnax* and between 25 and 50% of Black-tailed Godwit *Limosa limosa*, Spotted Redshank *Tringa erythropus* and Greenshank *T. nebularia* (Velasco & Alberto 1993). However, Velasco & Alberto (1993) also reported that 61% of waders wintering in Spain were found in the estuaries of southern Spain, Cadiz Bay and Guadalquivir Marshes (i.e. Doñana) being the most important sites.

The population estimates reported by Velasco & Alberto

(1993) and Martí & Del Moral (2002) were largely based on information from annual midwinter counts organised by the Spanish Society of Ornithology (SEO) and hence contained only limited information from non-estuarine habitats. Information concerning wader populations on non-estuarine coasts in Spain is scarce and specific surveys for the non-estuarine coastline had not been developed before to this study.

Previous surveys of non-estuarine habitats in Spain have covered only a proportion of the coast, mainly in the north (Dominguez & Maneiro 1988, Dominguez & Lorenzo 1992, SEO-Pontevedra 2002, De Souza & Lorenzo 2003, Salvadores 2003). There have also been studies of particular species, such as the Purple Sandpiper *Calidris maritima* (García Sánchez 1995).

The Non-Estuarine Coastal Waterbird Survey in Spain (Spain-NEWS) was undertaken during the winter of 1999/2000 in order to better estimate the populations of waders using the country's non-estuarine coast. This paper summarizes the results of this survey and the overall distribution and number of waders counted and, using these results and information from other regional or species-specific surveys, provides minimum population estimates for the Spanish non-estuarine coast.

## Study area

Spain has a long coast, approximately 7,880 km, of which 24% is comprised of sandy beaches and much of the rest urbanised. The coast is affected by high population growth and as a result has experienced increases in tourism, agriculture, industry, transport, fishing and other activities. In total, 35% of the Spanish population lives on the coast and the population density here is four times the national average (this figure increases threefold during the summer). In this study we consider the 4,013 km of (non-urbanised) non-estuarine coast in Spain (excluding the Canary Islands).

The north coast, Galicia in particular, is highly complex with many estuarine rias. The most important intertidal areas are found within estuaries, which offer security from poor weather, or below cliffs. Further east, the coastline of Cantabria is steeper, with fewer beaches and relatively small estuaries. The non-estuarine coast in the north is approximately 1,459 km long.

The south coast of Andalucía is mainly low-lying and sandy and is particularly flat around the outlets of the Rivers Guadiana and Guadalquivir. There are many beaches and dunes, though there are also some cliffs, mainly in Almería and Cádiz. In total, the non-estuarine coast length of Andalucía is around 830 km (Macías & Gracia y Calvo 2002).

The east coast covers the Spanish western Mediterranean from Murcia to Catalonia and has a total non-estuarine coast length of 1,500 km. Three main different geomorphologic types are found in this region. Around 30–40% is sandy or cobble coast, frequently backed by lagoons, marshland and fluvial-marine wetlands which represent the main wader habitats. These areas have suffered the greatest change from human activities and much of the habitat has been lost. Cliffs are found along 20–25% of the coast making these areas difficult to survey. The remaining 30–40% is rocky coast in which some species (e.g. Common Sandpiper *Actitis hypoleucos*) can reach the same densities as found in coastal wetland areas.

The Balearic Islands have a long coast in relation to their area. In total, the non-estuarine coast length is approximately 224 km. The coastal characteristics vary between islands. In Mallorca, there are many coves and cliffs, as well as beaches and marshy areas. Menorca has a more homogeneous coast, with discrete beaches, whereas on Ibiza there are many cliffs and few beaches.

## Methods

### Organisation and field methods

The methodology used to collect the count data was broadly similar to that used by Moser & Summers (1987) and the UK-NEWS pilot project (Browne *et al.* 1996).

The non-estuarine coast was defined following the JNCC Coastal Directories Services (Davidson *et al.* 1991, Barne *et al.* 1997a to Barne *et al.* 1997b). The waders on each section were counted once between mid-December 1999 and 31 January 2000. Parts of south and east Spain were counted between December 2000 and mid-February 2001. All surveys were carried out in normal weather conditions (i.e. without excessive rain or cold). Counts started three hours before low tide and finished three hours afterwards. Waders in flight were not recorded and we only recorded birds on intertidal areas. A total of 22 sections, selected at random, were covered. Count sections were allocated to professional and semi-professional counters by regional organisers. Counts were made, in most

cases, on foot, though on some (rocky) sections, it was necessary to cover the area by car.

### Coast-lengths and coverage by Spain-NEWS

Spain-NEWS covered 232 km or 5.8% of the Spanish non-estuarine coastline (Table 1). The most complete coverage was obtained in the Balearic Islands (18.3%) and the least complete on the east coast (2.0%). The coverage reflects the number of counters available per unit length of coast and the accessibility of the sections. For example, along rocky coasts with cliffs, many sections could not be counted either from the shore or land. In Murcia, the few accessible stretches of rocky coast held few birds because the shore and the adjacent sea are highly polluted, due to large amounts of dumped mineral waste. Dumping stopped in the early 1990s, but the effects still persist.

The results of Spain-NEWS are probably representative of average densities for non-estuarine species on the north coast. Results from the south coast for Ruddy Turnstone *Arenaria interpres* are also thought to be representative of average densities. Due to the low coverage obtained, results from the east coast are less representative. In contrast, the higher coverage obtained for the Balearic Islands means that the information obtained from Spain-NEWS for these islands can be considered representative.

### Analysis and population estimates

Due to the low coverage obtained by Spain-NEWS, it was not possible to make direct comparisons with the results of previous studies. It was also not possible to calculate population estimates solely from the results of the survey, since most of the waders on Spanish non-estuarine coasts are found in a few discrete areas which were poorly represented in the data. The results obtained from Spain-NEWS were thus complemented with information from other regional or species-specific surveys to calculate minimum population estimates for 2,253 km or 56% of the Spanish non-estuarine coastline. These previous surveys have concentrated on the most important areas for waders and thus only small numbers of birds are thought to winter on the remaining 44% of the coast. Population estimates for each species are presented separately for the north, south and east coasts and also for the Balearic Islands (Figure 1). For the Balearic Islands, information has been taken exclusively from the results obtained in Spain-NEWS.

The counts on some non-estuarine sites, particularly in Galicia, were affected by their proximity to estuarine areas. For Galicia, we have thus used the results of the study of De Souza & Lorenzo (2003) in preference to the results of Spain-NEWS.

In addition to the species for which results are reported, Black-winged Stilt, Stone Curlew *Burhinus oedicephalus*, Little Ringed Plover, Jack Snipe *Lymnocyptes minimus*, Common Snipe *Gallinago gallinago* and Eurasian Woodcock *Scolopax rusticola* also winter in Spain, but as they are rarely recorded on non-estuarine habitats they are not considered in this paper.

## Results

Results of Spain-NEWS and a summary of previous information on wintering waders on Spanish non-estuarine coasts

In total, 16 species were recorded by Spain-NEWS:

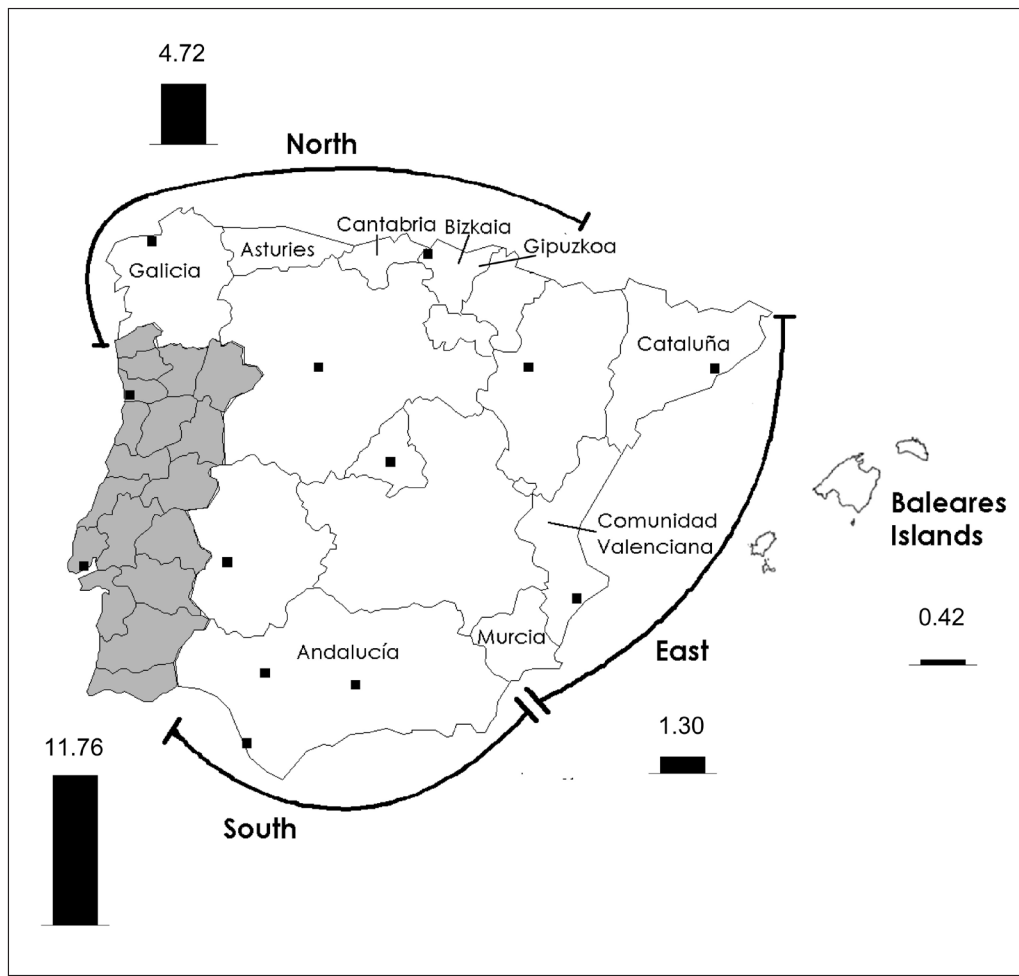


Figure 1. Densities (birds/km) of wader species on non-estuarine coasts in Spain.

Eurasian Oystercatcher *Haematopus ostralegus*, Common Ringed Plover *Charadrius hiaticula*, Kentish Plover, Eurasian Golden Plover *Pluvialis apricaria*, Grey Plover *P. squatarola*, Northern Lapwing *Vanellus vanellus*, Sanderling *Calidris alba*, Little Stint, Purple Sandpiper, Dunlin *C. alpina*, Ruff, Bar-tailed Godwit *Limosa lapponica*, Whimbrel, Eurasian Curlew *Numenius arquata*, Common Sandpiper and Ruddy Turnstone (Table 1). Information from previous surveys also indicates that the Spanish non-estuarine coast supports small numbers of wintering Red Knot *Calidris canutus*, Spotted Redshank, Common Redshank *Tringa totanus*, Green Sandpiper *T. ochropus* and Grey Phalarope *Phalaropus fulicarius*.

The results of Spain-NEWS and previous surveys indicate that the non-estuarine shores of the north coast, and specifically Galicia, are of national importance for wintering Ruddy Turnstone, Common Sandpiper and Purple Sandpiper, while also supporting relatively important numbers of Eurasian Oystercatcher, Sanderling and Whimbrel and to a lesser extent Common Ringed Plover and Eurasian Curlew. However, several of these species are irregularly distributed along the coast and thus their presence is highly variable between sectors (De Souza & Lorenzo 2003, Salvadores 2003). Of the 16 species recorded by Spain-NEWS, all but Little Stint were found on the north coast.

For Asturias, previous information on non-estuarine waders was found in general works (Noval 1976, 1986), annual ornithological reports (García Sánchez 1996, 1997, 1998), general waterbird censuses (Diego García 1988, COA

2002) and some studies on specific species, such as Purple Sandpiper (García Sánchez 1995). The coast of Asturias has several river mouths and estuaries which are important for waterbirds. In contrast, the non-estuarine areas are generally less important, though the rocky zones are used by Eurasian Oystercatcher, Purple Sandpiper and Ruddy Turnstone. When the winter weather across northern Europe is severe, meadows along this coast are filled with Northern Lapwing, Eurasian Curlew, Whimbrel and Eurasian Golden Plover. In normal winters, only a few areas in the west of this region receive small flocks of these species (COA 2002, García Sánchez & Álvarez Laó 2002).

The coast of Cantabria, in spite of its relatively short length, has several river mouths and estuaries which are of importance for waterbirds. In contrast, the non-estuarine areas are less important, some rocky areas being used by Purple Sandpiper and Ruddy Turnstone (Herrero *et al.* 2002).

Information for the non-estuarine coast of Gipuzkoa and Bizkaia is very scarce. A few sections have been covered in general waterbird surveys and there are also published notes in annual ornithological reports (Gorospe 2002, Ocio & Hidalgo unpubl. data).

On the east coast, waterbird surveys concentrate on coastal wetlands and may, as a result, also take in adjacent intertidal areas. These areas probably account for no more than 10–15% of the 1,500 km considered in this paper. There is a remarkable scarcity of data from other non-estuarine areas (AHSA 2003), though these data do suggest that the numbers of some species may be underestimated by only considering counts

from areas adjacent to wetlands. In the winter of 1995/96, for instance, two to three Whimbrel were counted during surveys of intertidal areas in southern Alicante (beaches adjacent to the main wetlands and the rocky island of Tabarca). In contrast, the total numbers counted at wetlands in the Comunidad Valenciana between 1992 and 1995 vary between just one and six birds (EOA 2002). Counts of Sanderling are similarly higher on intertidal areas not associated with the main wetlands: 36 birds were recorded in December 1996 in Playa Babel-Agua Amarga in Alicante, compared to just 70 birds in the whole of the Comunidad Valenciana (average from 1983–98 January censuses, EOA 2002). Spain-NEWS recorded just three species on the east coast: Sanderling, Purple Sandpiper and Common Sandpiper.

On the south coast, previous data for non-estuarine areas are scarce and patchy and are normally included in more general waterbird surveys. The majority of waders on the non-estuarine coast are concentrated in the regions of Huelva and Cádiz, specifically in the Doñana area (adjacent to the Guadalquivir Marshes) and at Los Lances. These two areas are important for Eurasian Oystercatcher and Sanderling respectively (Maneiro & Barroso unpubl. data, Pineda & Maneiro unpubl. data, Fiscal & Ponce unpubl. data, Garrido *et al.* 2001, Garrido 2002, Cuenca & Arroyo unpubl. data, Barroso & Barroso unpubl. data, López Carrique unpubl. data, Ríos unpubl. data). In total, Spain-NEWS recorded six species along the south coast: Common Ringed Plover, Kentish Plover, Sanderling, Purple Sandpiper, Whimbrel and Ruddy Turnstone.

In the Balearic Islands, previous data for non-estuarine areas are also scarce, those that do exist being included in more general waterbird surveys. The results from Spain-NEWS indicate that the coast of these islands holds small numbers of Common Ringed Plover, Kentish Plover, Little Stint and Common Sandpiper.

#### *Population estimates for non-estuarine coasts*

The information obtained from previous surveys and the results of Spain-NEWS were used to calculate minimum population estimates for 2,253 km or 56% of the Spanish non-estuarine coast. However, the results obtained are believed to constitute realistic estimates for the whole of the Spanish non-estuarine coast as most waders are concentrated in specific areas which were covered by the information considered in this study.

According to the results obtained, the Spanish non-estuarine coast supports more than 9,000 waders (over 4 birds/km over the area covered), though this figure increases enormously when there is cold weather in northern Europe. Previous national population estimates (Velasco & Alberto 1993, Martí & Del Moral 2002) have only included small numbers from non-estuarine coasts. The inclusion of our estimates from non-estuarine areas would increase Martí & Del Moral's (2002) estimate of the number of waders wintering in Spain as a whole by 3.7%, the most significant increases being for Purple Sandpiper (252%), Whimbrel (22.6%), Common Sandpiper (64.8%) and Ruddy Turnstone (50.6%) (Table 2).

The Spanish north coast (4.7 birds/km) is most important for Eurasian Oystercatcher (estimate >250 birds), Purple Sandpiper (>750 birds), Whimbrel (>100 birds), Eurasian Curlew (> 200 birds), Common Sandpiper (approximately 800 birds) and Ruddy Turnstone (>1,600 birds) (Table 3). This part of the Spanish coast also has the greatest overall

abundance of non-estuarine waders.

The south coast (11.8 birds/km) is important for Sanderling (approximately 800 birds), Eurasian Oystercatcher (*c.* 300) and Kentish Plovers (130 birds) (Table 4) and has the highest overall density of non-estuarine waders (Figure 1). In contrast, the east coast (1.3 birds/km) is important for Sanderling (*c.* 500 birds), Common Sandpiper and Ruddy Turnstone (Table 5).

Finally, the Balearic Islands (0.4 birds/km) hold small numbers of Common Ringed Plover, Kentish Plover, Little Stint and Common Sandpiper (Table 1).

Three species occur on the Spanish non-estuarine coast in numbers which surpass 1% of their estimated biogeographic populations (Wetlands International 2006): Sanderling (1.2%), Purple Sandpiper (1.0%) and Ruddy Turnstone (1.2%) (Table 2).

## **Discussion**

It was not possible to use the results from Spain-NEWS to calculate population estimates for the whole country's non-estuarine coast as most waders are found in a few discrete areas which were poorly represented among the randomly selected sectors. This problem could be overcome in future surveys by increasing the number of sectors covered.

Nevertheless, the results of the survey and the population estimates obtained through additional reference to previous surveys have shown the importance of non-estuarine areas for some species of waders. The present national waterbird counts are centred on estuaries and other coastal and interior wetlands and it would be of benefit if counts from non-estuarine areas were included in these surveys in order that populations of species that are not restricted to these main sites are not underestimated.

Although several species such as Purple Sandpiper, Whimbrel, Common Sandpiper and Ruddy Turnstone are normally underestimated at national level, our results indicate that the Spanish coast as a whole may be considered as internationally important for these species. The numbers of Grey Phalarope estimated to occur on the north coast are also of note, as this species is also generally under-recorded by national waterbird counts.

Overall, however, the non-estuarine coast holds only a small proportion of Spain's wintering waders (Table 2), the majority (over 61%) being found on large estuaries and supratidal habitats, notably at the Guadalquivir Marshes (*i.e.* Doñana) and Cádiz Bay in the southwest of the country and the Ebro Delta in the northeast.

## **Acknowledgements**

We are indebted to many people and particularly thank Gonzalo M. Arroyo, Juan Luis Barroso, Isidro Barroso, David Cuenca José Antonio De Souza, Jordi Figuerola, Victor Fiscal, Hector Garrido, Ricard Gutierrez, Jon Hidalgo, Enrique López Carrique, Miguel Angel Maneiro, Gorka Ocio, Carlos Oltra, Miguel Angel Pineda, Tomás Ponce and David Ríos.

Among those who participated in the counts were: Rafael Salvadores, Mark Eaton and Richard Fuller (north coast), Alejandro Pérez-Hurtado, Francisco Hortas, David Cuenca, Miguel Angel Pineda, Miguel Angel Maneiro (south coast), Francisco Robledano, Enrique López Carrique, Hermelindo Castro (east coast).



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**Table 1.** Numbers of waders counted during the 1999/2000 Non-Estuarine Coastal Waterbird Survey in Spain (Spain-NEWS).

	North coast		South coast		East coast		Balearic Islands		Total	
	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	135	1.28	0	0	0	0	0	0	135	0.58
Common Ringed Plover <i>Charadrius hiaticula</i>	4	0.04	6	0.11	0	0	2	0.05	12	0.05
Kentish Plover <i>Charadrius alexandrinus</i>	1	0.01	6	0.11	0	0	5	0.12	12	0.05
Eurasian Golden Plover <i>Pluvialis apricaria</i>	1	0.01	0	0	0	0	0	0	1	0.00
Grey Plover <i>Pluvialis squatarola</i>	46	0.44	0	0	0	0	0	0	46	0.20
Northern Lapwing <i>Vanellus vanellus</i>	2	0.02	0	0	0	0	0	0	2	0.01
Red Knot <i>Calidris canutus</i>	0	0	0	0	0	0	0	0	0	0
Sanderling <i>Calidris alba</i>	2	0.02	60	1.06	8	0.27	0	0	70	0.30
Little Stint <i>Calidris minuta</i>	0	0	0	0	0	0	4	0.10	4	0.02
Purple Sandpiper <i>Calidris maritima</i>	24	0.23	2	0.04	1	0.03	0	0	27	0.12
Dunlin <i>Calidris alpina</i>	18	0.17	0	0	0	0	0	0	18	0.08
Ruff <i>Philomachus pugnax</i>	1	0.01	0	0	0	0	0	0	1	0.00
Bar-tailed Godwit <i>Limosa lapponica</i>	2	0.02	0	0	0	0	0	0	2	0.01
Whimbrel <i>Numenius phaeopus</i>	15	0.14	1	0.02	0	0	0	0	16	0.07
Eurasian Curlew <i>Numenius arquata</i>	61	0.58	0	0	0	0	0	0	61	0.26
Spotted Redshank <i>Tringa erythropus</i>	0	0	0	0	0	0	0	0	0	0
Common Redshank <i>Tringa totanus</i>	0	0	0	0	0	0	0	0	0	0
Green Sandpiper <i>Tringa ochropus</i>	0	0	0	0	0	0	0	0	0	0
Common Sandpiper <i>Actitis hypoleucos</i>	50	0.47	0	0	2	0.07	6	0.15	58	0.25
Ruddy Turnstone <i>Arenaria interpres</i>	122	1.16	41	0.73	0	0	0	0	163	0.70
Grey Phalarope <i>Phalaropus fulicarius</i>	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>484</b>	<b>4.59</b>	<b>116</b>	<b>2.06</b>	<b>11</b>	<b>0.38</b>	<b>17</b>	<b>0.42</b>	<b>628</b>	<b>2.71</b>
Length of coast surveyed (km)	105.5		56.4		29.3		40.9		232.1	
Total length of coast (km)	1,459		830		1,500		224		4,013	
% of coast surveyed	7.2		6.8		2.0		18.3		5.8	

**Table 2.** Winter wader population estimates for the non-estuarine coast in Spain in relation to national and biogeographic population estimates.

	Previous estimates for Spanish wintering wader populations <sup>c</sup>			(Minimum) population estimates for the non-estuarine coast			% increase in national population estimates resulting from the inclusion of new data from non-estuarine areas <sup>d</sup>	% of biogeographic population on the non-estuarine coast <sup>e</sup>
	Velasco & Alberto (1993) <sup>a</sup>	Marti & Del Moral 2002 <sup>b</sup>		Mean	Number	Birds / km		
		Min	Max					
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	2,100	1,412	2,959	2,111	551	0.24	5.3	0.1
Common Ringed Plover <i>Charadrius hiaticula</i>	6,000	943	6,366	2,606	85	0.04	1.5	0.1
Kentish Plover <i>Charadrius alexandrinus</i>	8,500	881	6,755	3,739	192	0.09	0.4	0.3
Eurasian Golden Plover <i>Pluvialis apricaria</i>	–	2,878	16,261	7,117	933	0.41	13.1	0.1
Grey Plover <i>Pluvialis squatarola</i>	7,200	2,314	7,236	5,604	111	0.05	1.5	0.0
Northern Lapwing <i>Vanellus vanellus</i>	–	18,763	148,250	59,716	1,756	0.78	2.9	0.0
Red Knot <i>Calidris canutus</i>	300	11	167	86	9	0.00	5.8	0.0
Sanderling <i>Calidris alba</i>	2,200	890	12,191	2,806	1,434	0.64	19.7	<b>1.2</b>
Little Stint <i>Calidris minuta</i>	2,200	627	18,133	6,341	4	0.00	0.0	0.0
Purple Sandpiper <i>Calidris maritima</i>	–	62	306	226	758	0.34	252.2	<b>1.0</b>
Dunlin <i>Calidris alpina</i>	40,500	13,310	100,139	45,858	138	0.06	0.1	0.0
Ruff <i>Philomachus pugnax</i>	1,400	289	3,003	1,752	1	0.00	0.0	0.0
Bar-tailed Godwit <i>Limosa lapponica</i>	1,800	301	3,244	1,279	13	0.01	0.5	0.0
Whimbrel <i>Numenius phaeopus</i>	300	61	313	221	143	0.06	22.6	0.1
Eurasian Curlew <i>Numenius arquata</i>	4,300	1,973	8,652	4,298	231	0.10	2.6	0.0
Spotted Redshank <i>Tringa erythropus</i>	300	34	2,694	729	1	0.00	0.0	0.0
Common Redshank <i>Tringa totanus</i>	5,800	1,675	5,082	3,498	18	0.01	0.4	0.0
Green Sandpiper <i>Tringa ochropus</i>	–	25	766	389	10	0.00	2.6	0.0
Common Sandpiper <i>Actitis hypoleucos</i>	–	299	1,383	832	919	0.41	64.8	0.1
Ruddy Turnstone <i>Arenaria interpres</i>	1,400	586	1,695	1,303	1,763	0.78	50.6	<b>1.2</b>
Grey Phalarope <i>Phalaropus fulicarius</i>	–	–	–	–	120	0.05	–	0.0
<b>Total</b>	<b>84,300</b>	<b>47,334</b>	<b>345,595</b>	<b>150,511</b>	<b>9,190</b>	<b>4.08</b>	<b>3.7</b>	

<sup>a</sup> For the period 1978–1985, using additional data from 1972–1991 (Velasco & Alberto 1993).

<sup>b</sup> Minima, maxima and mean population estimates for the period 1990–2001 (Marti & Del Moral 2002).

<sup>c</sup> Minimum population estimates and densities for the 2,253 or 56% of the non-estuarine coast included in the present study (surveys have concentrated on the most important areas for waders and thus only small numbers of birds are thought to winter on the remaining 44% of the coast).

<sup>d</sup> These figures represent the increases in the respective mean population estimates for Spain reported by Marti & Del Moral (2002) resulting from the inclusion of new data for the non-estuarine coast.

<sup>e</sup> The estimates for the non-estuarine coast expressed as percentages of respective biogeographic populations (taken from Wetlands International 2006). Species for which Spain's non-estuarine coast holds more than 1% of the biogeographic population are highlighted in bold.

**Table 3.** Winter wader population estimates for the non-estuarine coast of north Spain.

	Galicia		Asturies		Cantabria		Gipuzkoa		Bizkaia		Total	
	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	162	0.18	100	0.36	0	0	2	0.03	10	0.09	274	0.19
Common Ringed Plover <i>Charadrius hiaticula</i>	0	0	30	0.11	0	0	2	0.03	0	0	32	0.02
Kentish Plover <i>Charadrius alexandrinus</i>	46	0.05	0	0	0	0	0	0	0	0	46	0.03
Eurasian Golden Plover <i>Pluvialis apricaria</i>	0	0	800	2.91	100	0.84	30	0.48	3	0.03	933	0.64
Grey Plover <i>Pluvialis squatarola</i>	0	0	50	0.18	0	0	5	0.08	0	0	55	0.04
Northern Lapwing <i>Vanellus vanellus</i>	0	0	1,150	4.18	550	4.62	50	0.81	6	0.06	1,756	1.20
Red Knot <i>Calidris canutus</i>	0	0	5	0.02	0	0	0	0	0	0	5	0.00
Sanderling <i>Calidris alba</i>	65	0.07	20	0.07	0	0	15	0.24	5	0.05	105	0.07
Little Stint <i>Calidris minuta</i>	0	0	0	0	0	0	0	0	0	0	0	0
Purple Sandpiper <i>Calidris maritima</i>	188	0.21	300	1.09	100	0.84	50	0.81	120	1.11	758	0.52
Dunlin <i>Calidris alpina</i>	0	0	15	0.05	0	0	10	0.16	0	0	25	0.02
Ruff <i>Philomachus pugnax</i>	1	0.00	0	0	0	0	0	0	0	0	1	0.00
Bar-tailed Godwit <i>Limosa lapponica</i>	0	0	5	0.02	0	0	0	0	0	0	5	0.00
Whimbrel <i>Numenius phaeopus</i>	92	0.10	5	0.02	0	0	10	0.16	0	0	107	0.07
Eurasian Curlew <i>Numenius arquata</i>	118	0.13	40	0.15	50	0.42	20	0.32	0	0	228	0.16
Spotted Redshank <i>Tringa erythropus</i>	0	0	0	0	0	0	0	0	0	0	0	0
Common Redshank <i>Tringa totanus</i>	0	0	5	0.02	0	0	10	0.16	0	0	15	0.01
Green Sandpiper <i>Tringa ochropus</i>	0	0	10	0.04	0	0	0	0	0	0	10	0.01
Common Sandpiper <i>Actitis hypoleucos</i>	372	0.42	150	0.55	0	0	20	0.32	250	2.31	792	0.54
Ruddy Turnstone <i>Arenaria interpres</i>	1,099	1.23	350	1.27	30	0.25	30	0.48	130	1.20	1,639	1.12
Grey Phalarope <i>Phalaropus fulicarius</i>	0	0	100	0.36	0	0	10	0.16	10	0.09	120	0.08
<b>Total</b>	<b>2,143</b>	<b>2.39</b>	<b>3,135</b>	<b>11.40</b>	<b>830</b>	<b>6.97</b>	<b>264</b>	<b>4.26</b>	<b>534</b>	<b>4.94</b>	<b>6,906</b>	<b>4.73</b>
Length of coast surveyed (km) <sup>a</sup>	895		275		119		62		108		1,459	
Total length of coast (km)	895		275		119		62		108		1,459	
% of coast surveyed	100		100		100		100		100		100	

<sup>a</sup> The length of coast considered in calculating population estimates.



**Table 4.** Winter wader population estimates for the non-estuarine coast of south Spain.

	Huelva		Cádiz		Almería		Total	
	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	277	5.38	0	0	0	0	277	2.25
Common Ringed Plover <i>Charadrius hiaticula</i>	0	0	44	5.25	0	0	44	0.36
Kentish Plover <i>Charadrius alexandrinus</i>	53	1.03	72	8.59	2	0.03	127	1.03
Eurasian Golden Plover <i>Pluvialis apricaria</i>	0	0	0	0	0	0	0	0
Grey Plover <i>Pluvialis squatarola</i>	0	0	28	3.34	0	0	28	0.23
Northern Lapwing <i>Vanellus vanellus</i>	0	0	0	0	0	0	0	0
Red Knot <i>Calidris canutus</i>	0	0	4	0.48	0	0	4	0.03
Sanderling <i>Calidris alba</i>	412	8.00	404	48.21	23	0.36	839	6.80
Little Stint <i>Calidris minuta</i>	0	0	0	0	0	0	0	0
Purple Sandpiper <i>Calidris maritima</i>	0	0	0	0	0	0	0	0
Dunlin <i>Calidris alpina</i>	0	0	113	13.48	0	0	113	0.92
Ruff <i>Philomachus pugnax</i>	0	0	0	0	0	0	0	0
Bar-tailed Godwit <i>Limosa lapponica</i>	1	0.02	6	0.72	0	0	7	0.06
Whimbrel <i>Numenius phaeopus</i>	0	0	1	0.12	0	0	1	0.01
Eurasian Curlew <i>Numenius arquata</i>	0	0	0	0	0	0	0	0
Spotted Redshank <i>Tringa erythropus</i>	0	0	1	0.12	0	0	1	0.01
Common Redshank <i>Tringa totanus</i>	0	0	3	0.36	0	0	3	0.02
Green Sandpiper <i>Tringa ochropus</i>	0	0	0	0	0	0	0	0
Common Sandpiper <i>Actitis hypoleucos</i>	0	0	2	0.24	0	0	2	0.02
Ruddy Turnstone <i>Arenaria interpres</i>	0	0	5	0.60	0	0	5	0.04
Grey Phalarope <i>Phalaropus fulicarius</i>	0	0	0	0	0	0	0	0
<b>Total</b>	<b>743</b>	<b>14.43</b>	<b>683</b>	<b>81.50</b>	<b>25</b>	<b>0.39</b>	<b>1,451</b>	<b>11.76</b>
Length of coast surveyed (km) <sup>a</sup>	51.5		8.4		63.5		123.4	
Total length of coast (km)							830	
% of coast surveyed							14.9	

<sup>a</sup> The length of coast considered in calculating population estimates.

**Table 5.** Winter wader population estimates for different habitats on the non-estuarine coast of east Spain.

	Sandy coast		Rocky coast		High cliff		Total	
	n	Birds/km	n	Birds/km	n	Birds/km	n	Birds/km
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	0	0	0	0	0	0	0	0
Common Ringed Plover <i>Charadrius hiaticula</i>	7	0.10	0	0	0	0	7	0.01
Kentish Plover <i>Charadrius alexandrinus</i>	14	0.20	0	0	0	0	14	0.02
Eurasian Golden Plover <i>Pluvialis apricaria</i>	0	0	0	0	0	0	0	0
Grey Plover <i>Pluvialis squatarola</i>	7	0.10	21	0.10	0	0	28	0.04
Northern Lapwing <i>Vanellus vanellus</i>	0	0	0	0	0	0	0	0
Red Knot <i>Calidris canutus</i>	0	0	0	0	0	0	0	0
Sanderling <i>Calidris alba</i>	490	7.00	0	0	0	0	490	0.78
Little Stint <i>Calidris minuta</i>	0	0	0	0	0	0	0	0
Purple Sandpiper <i>Calidris maritima</i>	0	0	0	0	0	0	0	0
Dunlin <i>Calidris alpina</i>	0	0	0	0	0	0	0	0
Ruff <i>Philomachus pugnax</i>	0	0	0	0	0	0	0	0
Bar-tailed Godwit <i>Limosa lapponica</i>	1	0.01	0	0	0	0	1	0.00
Whimbrel <i>Numenius phaeopus</i>	14	0.20	21	0.10	0	0	35	0.06
Eurasian Curlew <i>Numenius arquata</i>	1	0.01	2	0.01	0	0	3	0.00
Spotted Redshank <i>Tringa erythropus</i>	0	0	0	0	0	0	0	0
Common Redshank <i>Tringa totanus</i>	0	0	0	0	0	0	0	0
Green Sandpiper <i>Tringa ochropus</i>	0	0	0	0	0	0	0	0
Common Sandpiper <i>Actitis hypoleucos</i>	0	0	84	0.40	35	0.10	119	0.19
Ruddy Turnstone <i>Arenaria interpres</i>	56	0.80	63	0.30	0	0	119	0.19
Grey Phalarope <i>Phalaropus fulicarius</i>	0	0	0	0	0	0	0	0
<b>Total</b>	<b>590</b>	<b>8.43</b>	<b>191</b>	<b>0.91</b>	<b>35</b>	<b>0.10</b>	<b>816</b>	<b>1.30</b>
Length of coast surveyed (km) <sup>a</sup>	70		210		350		630	
Total length of coast (km)	550		600		350		1,500	
% of coast surveyed	12.7		35.0		100		42.0	

<sup>a</sup> The length of coast considered in calculating population estimates.