

At dawn on 17 April the bird disappeared from the area in which it spent all the previous day, and a search of the whole island proved unsuccessful. I left the island later that day and located the bird at Fife Ness. The bird had therefore flown 8 km to the mainland in a force 4-5 wind. In our studies of Purple Sandpipers on the Isle of May, we had long suspected that they commuted to and from the mainland, using the island as a safe roosting place; the islands are rat-free (Summers *et al.* 1975). Unfortunately, we could not be sure that the tagged bird was commuting regularly. Further observation will be needed.

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Cádiz Bay, south-west Spain as a potential Ramsar site: its importance for wintering waders

A. Pérez-Hurtado & F. Hortas

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Although there is little knowledge about the wader populations of Cádiz Bay, recent studies show that the Bay is an internationally important wintering area for shorebirds. The wader population in winter 1990/91 was around 25,000 birds and numbers of some species, such as Black-winged Stilt *Himantopus himantopus*, Avocet *Recurvirostra avosetta*, Ringed Plover *Charadrius hiaticula*, Kentish Plover *Charadrius alexandrinus* and Black tailed Godwit *Limosa limosa* exceeded 1% of East Atlantic flyway populations. In terms of overall wader population size and the numbers of several species, Cádiz Bay exceeds criteria for international importance and so qualifies for designation as a Ramsar site. This paper presents data documenting the importance of Cádiz Bay as a wintering area for waders and assesses the numbers of some wintering species in relation to East Atlantic Flyway populations.

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INTRODUCTION

The wetlands of the East Atlantic flyway provide wintering areas for almost 7.5 million waders (Smit & Piersma 1989). During recent decades much time and effort has been invested in studying wintering and breeding population sizes, migration routes and location of important areas in relation to this flyway. Nevertheless, little information is available on populations, important sites and wader ecology in Spain.

During the 1970s, a partial census of wintering waders in Spain was started (Fournier & Fournier 1972; Prater 1976; Araugo & Garcia 1974). During the 1980s co-ordination increased, resulting in greater coverage and a general overview of the importance of several wintering areas (Alberto & Purroy 1981, 1983; Alberto 1983; Alberto & Velasco 1984, 1986, 1988). At present, knowledge of the distribution, important sites and the number of coastal wintering waders in Spain is improving (Velasco & Alberto 1993). The above data, combined with Portuguese studies (Rufino 1979, 1982, 1988, 1990; CEMPA 1979, 1980, 1981), have provided further information on the

Iberian populations (Alberto & Velasco 1988; Dominguez 1991).

South-west Spain, especially the Guadalquivir Marshes and Cádiz Bay, has been highlighted as the most important areas for wintering waders in Spain (Smit in press; Alberto & Velasco 1988; Domingues 1991; Velasco & Alberto 1993). However, there are few studies focused exclusively on the wintering populations of the Bay and the great importance of conserving the area (Hortas 1990; Pérez-Hurtado in prep; Pérez-Hurtado & Hortas 1992).

The aim of this work is to present information about the wintering population sizes in Cádiz Bay and their importance in an international context.

STUDY AREA

The wetlands of Cádiz Bay extend over 18,000 ha and are located between 36°23'N, 6°08'W and 36°37'N, 6°15'W, south-west Spain (Figure 1).

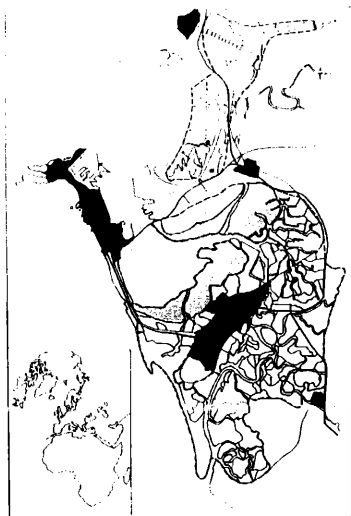


Figure 1. Location of Cádiz Bay in southern Europe and the Natural Park boundaries. Hatched area represents intertidal mudflats.

Due to the strategic geographic position of Cádiz Bay on the East Atlantic flyway, and its productive wetlands habitats (intertidal mudflats, salinas, fish ponds and semi-natural salt marsh), the Bay is an important wintering and staging area for shorebirds.

Recently 10,000 ha have been set aside as a Natural Park (Figure 1). Nevertheless, as a consequence of human activity over the last 20 years, a great number of changes have and continue to take place in the important habitats of the Bay.

The most important transformations have been mudflat land claim for bivalve culture, and the filling or deepening of saline ponds to allow space for houses to be built, or the creation of fish farms. These changes affect the

waders, especially the smaller birds during winter (Pérez-Hurtado & Hortas 1992). The changes also decrease breeding success, as Rufino (in press) has shown by comparing Black-winged Stilts *Himantopus himantopus* breeding in salines and fish farms in Portugal.

METHODS

This paper is based on eight national winter counts organised by the Spanish Society of Ornithology (SEO) from 1978 to 1985 and undertaken by Velasco & Alberto (1993). Average counts carried out in Portugal during 1975-1982 and 1987-1990 (Rufino 1979, 1982, 1988, 1989, 1990; CEMPA 1979, 1980, 1981) have also been used.

As there are still few data published on the wintering population sizes in Cádiz Bay, we have used only the information of Velasco & Alberto (1993) and our recent counts.

We organised a comprehensive census during the winter of 1990/91 with ten counters with the aim of estimating wintering populations throughout Cádiz Bay. This gave good coverage of the whole area in a relatively short time. These counts were synchronised between sites, and were carried out within one and a half hours either side of low tide to minimise errors resulting from movement of birds. We compared our data with the East Atlantic flyway wader population estimates of Smit & Piersma (1989). As some species show different distributions between biogeographic populations, we used only the estimates for populations occurring in southwest Spain.

For the four races of Dunlin *Calidris alpina*, whose wintering distribution we assume overlaps in the Bay (Figure 2), we used the numbers for each subspecies, *C. a. alpina schinzii* (Icelandic), *C. a. schinzii* (temperate) *C. a. alpina* and *C. a. arctica*. Due to the occurrence of wintering Dunlin populations (*arctica* and Icelandic *schinzii*) in west Africa both populations certainly occur in



Figure 2. Flyway system for Dunlin *Calidris alpina*, along the East Atlantic coast. Breeding areas are in black. 1 = *arctica*, 2 = Icelandic *schinzii*, 3 = temperate *schinzii*, 4 = *alpina*. From Smit & Piersma (1989).

Table 1. Numbers of waders wintering in Cádiz Bay, Spain, Portugal, Iberian peninsula and East Atlantic Flyway. * = Estimations based only on Atlantic Spain data (Smit & Piersma 1989)

SPECIES	CADIZ 1985-1991	SPAIN	PORTUGAL	IBERIAN PENINSULA	ATLANTIC FLYWAY
<i>Haematopus ostralegus</i>	222	1,800	487	2,287	874,000
<i>Himantopus himantopus</i>	436	1,400	114	1,514	6,000
<i>Recurvirostra avosetta</i>	1,399	7,200	12,688	19,888	67,000
<i>Charadrius hiaticula</i>	1,861	4,700	1,850	6,550	48,000
<i>Charadrius alexandrinus</i>	3,171	6,500	1,065	7,565	67,000
<i>Pluvialis squatarola</i>	1,381	6,400	7,414	13,814	168,000
<i>Calidris canutus</i>	22	300	687	987	512,000
<i>Calidris alba</i>	138	2,000	173	2,173	123,000
<i>Calidris minuta</i>	65	1,600	298	1,898	211,000
<i>Calidris ferruginea</i>	13	*200	---	---	436,000
<i>Calidris maritima</i>	12	100	10	110	50,000
<i>Calidris alpina</i>	12,176	30,000	43,469	73,469	2,209,000
<i>Limosa limosa</i>	2,421	20,700	9,172	29,872	66,000
<i>Limosa lapponica</i>	373	1,800	3,655	5,455	115,000
<i>Numenius phaeopus</i>	40	300	34	334	69,000
<i>Numenius arquata</i>	465	3,800	1,631	5,431	348,000
<i>Tringa totanus</i>	1,630	5,600	4,040	9,640	177,000
<i>Tringa nebularia</i>	23	400	53	453	190,000
<i>Actitis hypoleucos</i>	56	*500	106	606	39,000
<i>Arenaria interpres</i>	195	800	164	964	67,000
TOTALS	25,998	96,100	87,100	182,900	5,842,000

Cádiz Bay both in spring and autumn. The main wintering population will consist of *alpina* whereas the bulk of the rather small Baltic *schinzii* population probably winters further north in Spain. Nevertheless, as we assume above, all four populations may occur in southern Spain (Smit & Piersma 1989; Smit pers. comm.).

Although it is possible that the Spanish wintering population of Knots *Calidris canutus* consists of a mixture of Siberian *C. c. canutus* and Nearctic *islandica* birds, there is insufficient data yet to establish this. We assume in this paper that Spanish wintering birds belong to the Nearctic population (Wymenga *et al.* 1990) while the birds on passage in early autumn and mid-May are Siberian birds (Smit pers. comm.).

The same applies for Black-tailed Godwit *Limosa limosa*; both the continental and Icelandic population could be present in Cádiz Bay, although for the moment, we assume only the Icelandic birds are present as they are more characteristic of the type of intertidal habitats found at Cádiz Bay than the continental population, which are more likely to feed inland, for example at the Guadalquivir marshes (Smit pers. comm.).

The separation of the European and African Turnstone *Arenaria interpres* populations has been made on a rather arbitrary basis using the Strait of Gibraltar as a provisional border (Smit & Piersma 1989). So we consider only the European Turnstone population.

Redshank *Tringa totanus* are considered to belong to the west European/west African population (Figure 3).

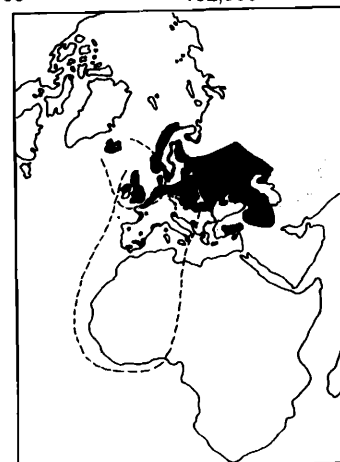


Figure 3. Flyway system for Redshank *Tringa totanus*, along the East Atlantic coast. Breeding areas are in black. From Smit & Piersma (1989).

For Ringed Plover *Charadrius hiaticula*, we assume the population wintering in Europe and Northwest Africa is distinct from that wintering from west Africa to South Africa.

In the case of Bar-tailed Godwit *Limosa lapponica* we use only the estimate of the European population according to Smit & Piersma (1989), who use the Strait of Gibraltar provisionally as the border between the European and African populations.

RESULTS

The wader population in Cádiz Bay during the winter of 1990/91 was approximately 25,000 birds (Table 1).

Similar numbers were observed for the 1980-1985 period (Velasco & Alberto 1993).

During the winter of 1985/86, there was a peak of 29,500 birds (Solis pers. comm.). This was probably related to better coverage and a colder winter in Europe. Although there is little information with which to compare the data, they seem to indicate that Cádiz Bay has had a winter wader population greater than 20,000 birds for the last ten years.

The total number of waders in Cádiz Bay during winter 1990/91 is nearly 25% greater than the totals in Spain (Table 2), suggested by other authors for the 1978-1985 winter periods (Velasco & Alberto 1993). It is clear that species, such as Dunlin, Kentish Plover, Ringed Plover, Stilts, Redshank and Bar-tailed Godwit, account for around 25%. When the Bay is compared with the Iberian Peninsula, only the Kentish Plover, Ringed Plover exceed this percentage (Table 2).

The Cádiz Bay populations of Kentish Plover, Ringed Plover, Black-winged Stilt, Avocet and Black-tailed Godwit account for over 1% of the East Atlantic flyway populations of these species (Table 2).

Table 2. Numbers of certain wader species (as percentages) in Cádiz Bay compared with Spain, Iberian Peninsula and East Atlantic Flyway totals. * = percentages according to Atlantic Spain data (Smit & Piersma 1989).

SPECIES	CADIZ/ SPAIN	CADIZ/ IBERIA	CADIZ/E. ATLANTIC FLYWAY
<i>Haematopus ostralegus</i>	12.3	9.7	<0.1
<i>Himantopus himantopus</i>	31.1	28.8	7.3
<i>Recurvirostra avosetta</i>	19.4	7.0	2.1
<i>Charadrius hiaticula</i>	39.6	28.4	3.9
<i>Charadrius alexandrinus</i>	48.8	41.9	4.7
<i>Pluvialis squatarola</i>	21.6	10.0	0.8
<i>Calidris canutus</i>	7.3	2.2	<0.1
<i>Calidris alba</i>	6.9	6.3	0.1
<i>Calidris minuta</i>	4.0	3.4	<0.1
<i>Calidris ferruginea</i>	6.5	---	<0.1
<i>Calidris maritima</i>	12.0	10.9	<0.1
<i>Calidris alpina</i>	40.6	16.6	0.5
<i>Limosa limosa</i>	11.7	8.1	3.7
<i>Limosa lapponica</i>	20.7	6.8	0.3
<i>Numenius phaeopus</i>	13.3	12.0	<0.1
<i>Numenius arquata</i>	12.2	8.6	0.1
<i>Tringa totanus</i>	29.1	16.9	0.9
<i>Tringa nebularia</i>	5.7	5.1	<0.1
<i>Actitis hypoleucos</i>	11.2	9.2	0.1
<i>Arenaria interpres</i>	24.4	20.2	0.3

DISCUSSION

The importance of Cádiz Bay, as demonstrated here is supported by other authors; Velasco & Alberto (1993) show that eight Spanish coastal sites account for over 80% of the total Spanish wintering wader populations.

Cádiz Bay and the Guadalquivir Marshes are the two main wintering sites, supporting 25% and 22% respectively of Spanish totals.

Although 10,000 ha of Cádiz Bay have recently been declared a Natural Park, the area needs stronger protection to decrease, or to better regulate, the number of human interferences (mudflat land claims, drainage of salinas for building, creation of recreational areas).

A system for evaluation of ornithological sites has been described by Fuller & Langslow (1986). Application of the 1% criterion as a means of identifying wetlands of international importance has been accepted by Contracting Parties to the Ramsar Convention (Spagnesi 1982). In Spain, a site is of international importance if it holds at least 1% of the East Atlantic Flyway population of a wader population. It is also of international importance if it holds more than 20,000 waterfowl.

Cádiz Bay clearly meets Ramsar criteria, by:

1. holding 25,000 waders in the winter of 1990/91, and more than 20,000 wintering shorebirds for each of the last ten years (Ramsar criterion 3a);
2. holding in excess of 1% of the East Atlantic Flyway population of Black-winged Stilt, Avocet, Ringed Plover, Kentish Plover and Black-tailed Godwit (Ramsar criterion 3c);
3. qualifying as the most important wintering wader site in Spain (Ramsar criterion 2c);
4. ranking as one of the eight coastal sites which together hold 80% of the shorebirds wintering in Spain (Ramsar criterion 2b).

In addition, Cádiz Bay may be a significant staging area and of importance during the breeding season.

Hence, Cádiz Bay should be designated by Spain as a Ramsar site.

Coverage of Spanish estuarine areas has varied considerably from year to year and in some areas it has not been carried out using compatible methods (Dominguez 1990). Probably with better, up-dated coverage, our percentages, would be somewhat different in relation to the Iberian Peninsula totals. However, they would probably be very similar for the East Atlantic Flyway population numbers. The Bay would still meet criteria international importance.

It is essential to increase effort on wader studies in Spain, not only winter population sizes, but also during migration and breeding seasons. Increased ringing effort in some important areas, would be of value, as other authors have suggested recently (Barbosa & Asensio 1991); thus allowing improved understanding of the rôle of Iberian areas during migrations.

Finally, it would also be valuable to learn how the birds use these Iberian areas, and the effect human impact has on them. Such studies would improve knowledge of the areas, changes in bird numbers, and would allow qualified information to become available for the better protection of importance sites. Evaluation of the effects of conservation management could then be better assessed.

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