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Status, distribution and long-term changes in the waterbird community wintering in Doñana, south–west Spain

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ARTICLE INFO

Article history:
Received 21 November 2007
Received in revised form
5 February 2008
Accepted 8 March 2008
Available online 29 April 2008

Keywords:
Wetlands
Aerial counts
Population trends
Habitat transformation
Migratory status
Trophic guild

ABSTRACT

The Guadalquivir Marshes or Doñana wetland complex is the most important wintering site for migratory waterbirds in the Mediterranean region. However, there is a lack of previous information on the status of different species in this area. Using monthly aerial counts conducted from 1978 to 2005, we analysed the size of wintering populations of 21 waterbird species, their distribution within the Guadalquivir Marshes, and their long-term population trends. We used Underhill indices to replace missing values and to correct for flocks of unidentified ducks. Based on long-term means, we identified 16 species whose populations at Doñana exceed 1% of the biogeographical flyway population. For at least 1 month of the year, mean counts were around 10% of the flyway population for six species. The natural, temporary marshes of Doñana National Park were particularly important for Anatidae, ricefields for gulls, white storks and grey herons, fish ponds for flamingos, cormorants and avocets, and salt pans for shelduck. Four Anatidae species have undergone long-term declines and eight non-Anatidae have undergone long-term increases. Population trends were related with trophic guild, migratory status and habitat use. Winter visitors and herbivorous species showed more negative trends than resident, omnivorous–carnivorous species. Those species concentrated in strictly-protected natural marshes have tended to decline. The surface area of ricefields and fish ponds has increased over the study period, and bird species concentrated in these artificial wetlands have tended to increase. This raises questions about the value of waterbirds as flagship or umbrella species for wetland conservation.

1. Introduction

Human activities have caused loss and degradation of wetlands worldwide (Moser et al., 1996). In Europe more than 50% of natural wetlands have been lost, mainly due to drainage for agricultural use, and all remaining wetlands are affected to some extent by human activities. In contrast, the surface area of artificial wetlands such as fish ponds or ricefields has increased in many areas, and these provide alternative habitats for waterbirds (Elphick and Oring, 1998; Elphick, 2000; Tourenq et al., 2001b; Ma et al., 2004). However, the net consequences of such habitat transformation for waterbird populations remains unclear (Day and Colwell, 1998; Elphick, 2000; Ma et al., 2004). For example, there is little information as to which waterbird species are better able to adapt to such transformed habitats, and which are more dependent on

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doi:10.1016/j.biocon.2008.03.006

wetlands in a natural state. In particular, few studies have been able to compare bird counts in the same area before and after habitat transformation has occurred.

The wetlands within the delta of the River Guadalquivir in south–west Spain (also known as the marismas del Guadalquivir, the Guadalquivir marshes or Doñana wetlands) have long been recognised as one of the most important habitats for waterbirds in the Western Palaearctic (Chapman and Buck, 1910), and a steadily increasing proportion of remaining wetlands have been protected since the 1960s (García-Novo and Marín, 2006; Fernández-Delgado, 2006). However, despite some studies of the ecology of wintering waterbirds (e.g. Amat, 1981, 1986), there is a shortage of detailed studies on the numbers and distribution of waterbirds wintering in the Guadalquivir marshes (GM from hereon). Based on analyses of midwinter counts carried out during the International Waterbird Census (IWC), GM is known to be the most important site in the West Mediterranean for many wildfowl (Anatidae) species (Scott and Rose, 1996). GM is also the most important wintering site in the Iberian Peninsula for many other waterbirds (Martí and del Moral, 2002).

Here, we present the first detailed analysis of the numbers of waterbirds wintering in GM, and of their distribution between major habitat types therein. The area is too large and inaccessible to count effectively from the ground. We take advantage of an extensive data set of aerial counts from 1977 to 2005, which has not previously been subject to detailed analysis. Our main objectives are as follows: (1) to quantify the size of wintering populations in GM, and to identify those species present in internationally important numbers (i.e. more than 1% of the total flyway population, Wetlands International, 2006); (2) to identify long-term trends and seasonal patterns (i.e. phenology within a winter) for each bird species; (3) to quantify the distribution of each species between the different major natural and transformed habitats found in GM; (4) to assess the relationship between long-term trends for different species and their habitat use, trophic guilds and migratory status; and (5) to consider the conservation implications of our findings.

2. Materials and methods

2.1. *Study area*

GM is a mosaic of extensive wetlands of deltaic origin located in south-Western Spain (37°N, 6°25′W) (Fig. 1A). The marshes occupied c. 180,000 ha in 1900, but drainage for agriculture and other transformations have gradually reduced the remaining area of natural marshes to c.30,000 ha, almost all of which is protected within the Doñana National Park (Enggass, 1968; García-Novo and Marín, 2006). The climate of GM is Mediterranean sub-humid with rainy winters and dry summers. During the study period the mean winter precipitation (September–February) was 422.6 mm (coefficient of variation, CV = 47%), accounting for more than the 70% of annual rainfall (data collected at the Palacio de Doñana).

The total area covered during the aerial surveys is 91,890 ha, divided into four main sectors (Fig. 1A):

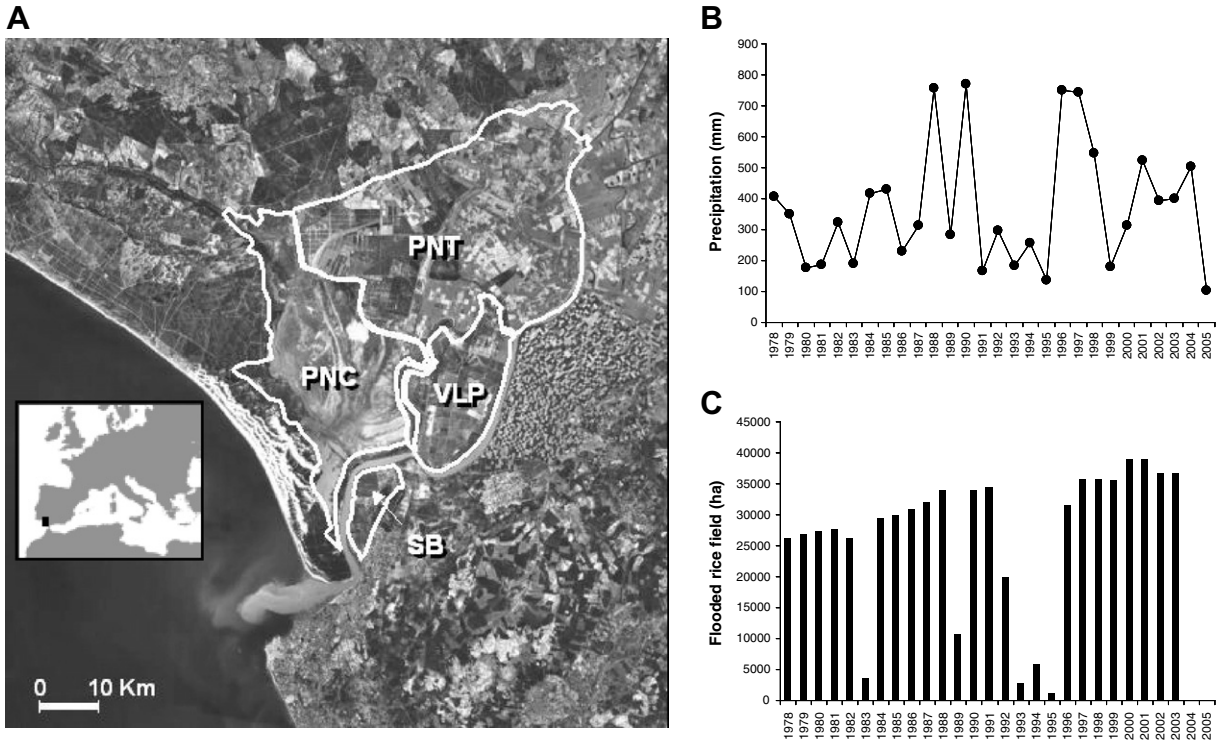

Fig. 1 – (A) Location of the study area and satellite image of the Guadalquivir marshes, showing the four main areas included in the aerial counts (PNC: Parque Nacional, PNT: Parque Natural Norte, SB: Salinas de Bonanza, VLP: Veta la Palma). (B) Accumulated precipitation (September–February) at the Palacio de Doñana from 1978 to 2005. (C) Area of ricefields cultivated in the Guadalquivir marshes from 1978 to 2003.