

Could Doñana, SW Spain, be an important wintering area for continental Black-tailed Godwits *Limosa limosa limosa*?

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In November 2010, we discovered the importance of the Doñana National and Natural Park, in SW Spain, for the declining nominate subspecies of the Black-tailed Godwit *Limosa limosa limosa*. Among about 15,000 godwits, we observed 109 different colour-ringed birds of which 91 (83%) were of the nominate race, four were from the Icelandic race *L. l. islandica* and 14 were indeterminate. This suggests that part of the continental Black-tailed Godwit population remains in Europe instead of migrating to their traditional W African non-breeding quarters.

INTRODUCTION

The nominate race of the Black-tailed Godwit *Limosa limosa limosa* is in decline and now classified as “near-threatened” (IUCN 2008). EU member states with important breeding, staging or wintering numbers of godwits, have tried to bring together available knowledge (Jenzen & Lutz 2006) and an IWSG workshop in La Rochelle concluded that the main cause of their decline has been the loss and degradation of grassland breeding habitat caused by agricultural intensification (Gill *et al.* 2007).

In W Europe, small numbers of Black-tailed Godwits breed in Germany, Belgium, Denmark, France and the UK. However, most of the *limosa* subspecies (about 47% of the European population represented by c. 100,000 individuals in the early 2000s) breed in the Netherlands (Thorup 2006). Much information on individual quality, timing, breeding habitat preferences, breeding site tenacity, breeding success and spatial population dynamics of Black-tailed Godwits has been published over the last 20 years (Buker & Groen 1989, Groen & Hemerik 2002, Roodbergen *et al.* 2008, Schekkerman *et al.* 2005, Schroeder *et al.* 2008a). However, do we know what is happening in the non-breeding areas?

Black-tailed Godwits of the nominate race are known to moult and spend the early winter from June to December in W Africa (Senegal, Guinea-Bissau and Mali) (Kuijper *et al.* 2006, Zwarts *et al.* 2009). These areas were rather well researched in the 1980s (Altenburg & van der Kamp 1985, Beintema & Drost 1986), with some further attention five years ago (Kuijper *et al.* 2006). There is detailed information about the phenology and the staging ecology of populations of both subspecies in the Tejo and Sado estuaries, Portugal

(Alves *et al.* 2010, Lourenço *et al.* 2010) and in Extremadura, Spain (Masero *et al.* 2010). For Doñana, Spain, information on the number of godwits in winter is available from a long-term monitoring project that started in 1978 (Rendón *et al.* 2008). Aerial surveys and ground counts are performed every month in Doñana. These censuses show that in recent years on average 10,000–20,000 godwits are still present in October and November (recent data from 2004–2010 are available on www-rbd.ebd.csic.es/Seguimiento/mediobiologico.htm; see also Fig. 3), but it is unclear whether these birds represent the *islandica* or *limosa* subspecies, or a combination of the two.

As the *islandica* subspecies winters in Europe (Alves *et al.* 2010), and as godwits are still present in Doñana in November, the latter were assumed to be *islandica*. However, the presence of three satellite-tagged *limosa* in southern Iberia throughout the entire winter of 2009–2010 (Hooijmeijer *et al.* 2011) suggested that the godwits that occur in Doñana could be a mix of *islandica* and *limosa*. The satellite-tagged birds did not fly to W Africa but spent the winter in the Algarve and Sado estuary (Portugal), Marismas del Odiel and Doñana (Spain).

During the non-breeding season, it is impossible to tell the two subspecies apart in the field, but since many hundreds of birds from both subspecies have been colour-ringed in the last 20 years, it is possible to estimate the proportion of each subspecies in mixed flocks on the basis of the origin of colour-ringed birds (Alves *et al.* 2010, Roodbergen *et al.* 2008, van den Brink *et al.* 2008). Here, we report on preliminary studies in Doñana to determine whether this area is only a stopover site for migrating *limosa* on their way to and from W Africa, or whether it is a regular wintering area for the subspecies as suggested by the three satellite-tagged birds.

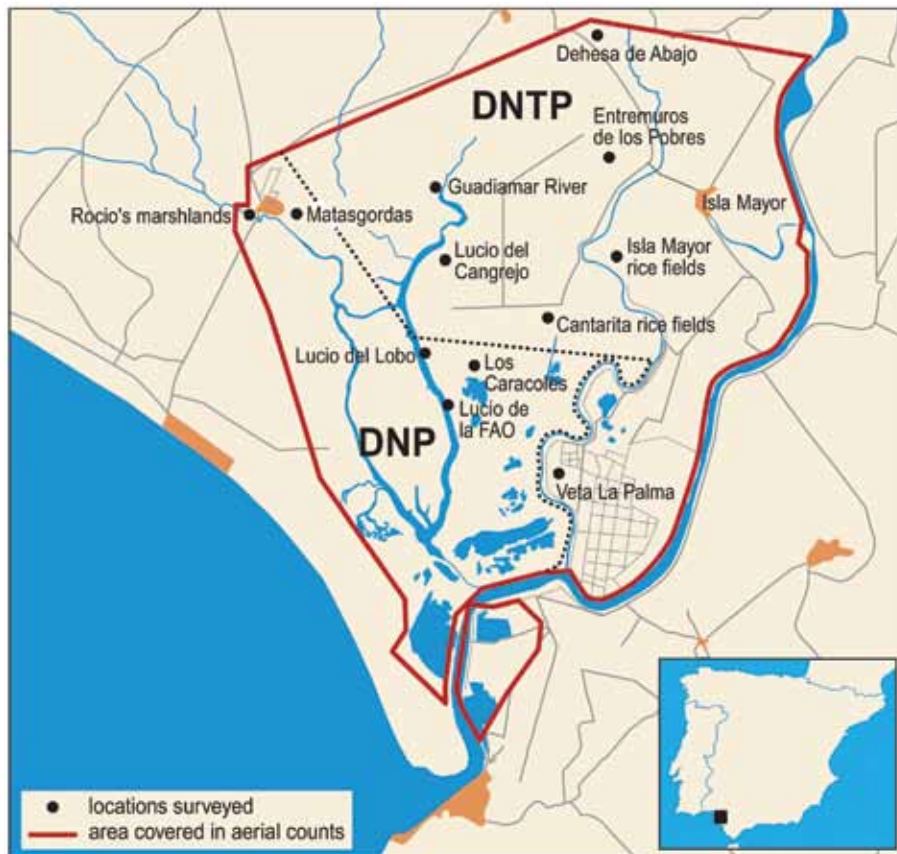


Fig. 1. Location map of the Doñana Natural Area in SW Spain and the different locations surveyed for Black-tailed Godwits in November 2010. (DNP: Doñana National Park; DNTP: Doñana Natural Park.)

STUDY AREAS AND METHODS

The Doñana Natural Area (108,087 ha) in SW Spain is one of the most important wintering sites for migratory waterbirds in the Mediterranean basin (Fig. 1; Martí & Del Moral 2002, Rendón *et al.* 2008). The presence of wetlands, marshlands and rice fields around the estuary of the Guadalquivir River gives refuge to high numbers of waders in winter (Bernués 1990) and is internationally important as a wintering site for Black-tailed Godwits (Barbosa 1997).

Field work was conducted from 17 to 23 Nov 2010. We looked for godwits in wetlands and rice fields that were accessible by 4 × 4 vehicle or could be scanned from high positions (Fig. 1). These areas are all also covered by the Doñana aerial counts. We especially searched the locations that were recommended by the Doñana Monitoring Group of Natural Processes based on the results and distribution of the birds during the last aerial count. Counts and colour-ring observations were made from a vehicle using a telescope. First of all we checked specifically for colour-ringed birds in detail, and later, as an independent measure, fast sample counts were made to estimate the density of colour-ringed birds in the flock (see Lourenço *et al.* (2010) for methods).

Since 2004, >1,500 Black-tailed Godwits have been colour ringed in the Netherlands under the University of Groningen (RUG) ringing scheme. We used this dataset to test whether the sex-ratios, age-classes or ringing locations of individuals observed in Doñana differed from that of the birds in the Netherlands. Sex was assigned according to Schroeder *et al.* (2008b). Age was categorized as 1st calendar year, 2nd calendar year or adult. Ringing site was divided between North (Friesland including the Wadden Sea islands) and South (the

rest of the Netherlands). For the purposes of calculating the age and ringing site distribution of individuals in the RUG dataset we estimated how many individuals per category were still alive in Nov 2010. For this we assumed that the annual survival of adults was 0.85, 1st calendar year survival (chicks >10 days old) was 0.5 and survival between spring and autumn 2010 was 0.925 (adults and 2nd calendar year) and 0.75 (1st calendar year chicks). Survival estimates are based on seven years of survival data in the RUG dataset (RUG unpubl. data).

RESULTS AND DISCUSSION

Aerial surveys showed that at the time of our observations there were about 16,000 Black-tailed Godwits in Doñana (www-rbd.ebd.csic.es/Seguimiento/mediobiologico.htm). Although we checked many areas of suitable habitat, we only found flocks of Black-tailed Godwits at two sites: the Rocio's Marshlands where there were about 100 godwits and Veta La Palma fish farm (VLP) (11,300 ha) between the Guadalquivir and Guadiamar rivers (south of Isla Mayor) where about 15,000 godwits occurred throughout the study period (Fig. 1).

We made 140 colour ring observations of 109 different godwits from five different colour-ring schemes (Table 1). To determine the density of ringed birds, we checked an aggregate total 4,969 birds in a series of separate scans and concluded that on average one individual in every 110 birds carried colour rings. Therefore our study flock of about 15,000 probably contained about 136 with colour rings (15,000/110). Most of the colour-ringed godwits were clearly of the *limosa* subspecies as they had been ringed at breeding grounds in the Netherlands (RUG, Wageningen University) or



Fig. 2. A large flock of Black-tailed Godwits at Veta La Palma fish farm, Doñana Natural Park, SW Spain, in November 2010. (Photo: Rubén Rodríguez Olivares EBD-CSIC.)

Table 1. Resightings of individually colour-ringed Black-tailed Godwits in the Doñana Natural Park, SW Spain, in November 2010 from five different colour-ringing schemes.

Scheme	Country where ringed	Total number of resightings	Number of individuals
University of Groningen	Netherlands	101	76
University of Badajoz	Spain	6	6
NABU Institute	Germany	2	2
University of Wageningen	Netherlands	8	7
University of La Rochelle	France	23	18
Total		140	109

Table 2. Numbers of individually colour-ringed Black-tailed Godwits according to sex, age and ringing location resighted in the Doñana Natural Park, SW Spain, in November 2010 compared with those in the complete dataset of the University of Groningen Black-tailed Godwit colour ring scheme but discounted to the numbers assumed to be alive in November 2010 (see Study area and Methods).

	Doñana	RUG dataset
Sex		
Male	37	516
Female	25	536
Age		
1st calendar year	2	110
2nd calendar year	2	57
Adult	66	584
Ringing site		
North Netherlands	55	720
South Netherlands	14	188

Germany (NABU). As the French and Spanish schemes have banded birds of both subspecies, we asked the scheme coordinators for any information available as to the subspecies of the 24 birds we recorded from France or Spain. Only four and six birds from France could be ascribed to the *islandica* and *limosa* subspecies respectively; the subspecific status of the other 14 from France and Spain was not known. Therefore of the 109 colour-ringed godwits, 91 (83%) were *limosa*, four (4%) were *islandica* and 14 (13%) were of unknown status.

Although marginally more female than male Black-tailed Godwits have been colour ringed in the Netherlands under the RUG scheme, we found more males than females in our sample of colour-ringed RUG birds (Table 2). The difference in sex-ratios is not significant in respect of our sample of 62 birds ($\chi^2 = 2.645$, $df = 1$, $p = 0.104$), neither does the sex-ratio of the birds seen in Doñana differ significantly from equality ($\chi^2 = 2.323$, $df = 1$, $p = 0.128$). However, it is worth noting that if in future we are able to double the sample, and if the same sex-ratio is maintained, these effects would be significant (existing power 0.40; with a $N = 163$ individuals the power would be 0.80; analyses carried out with G*Power 3).

The proportion of Netherlands colour-ringed godwits that we resighted in Doñana as adults was significantly greater than those that we resighted as 1st or 2nd calendar year birds (Table 2; $\chi^2 = 10.73$, $df = 2$, $p = 0.005$). However, there was no difference in the proportion of resighted birds that had originally been marked in the northern or southern parts of the Netherlands compared with the numbers marked in those regions ($\chi^2 = 0.007$, $df = 1$, $p = 0.93$).

As the fish farm at VLP is part of the Doñana Natural Park where birdlife conservation and fish farming coexist, it should be less vulnerable to detrimental habitat change than most other sites, making it an attractive location for non-breeding Black-tailed Godwits. Semi-permanent flooding has created artificial wetlands with many brackish fish ponds (Figuerola *et al.* 2002). The shallow water is maintained at a constant level in a considerable number of the ponds; therefore conditions are highly predictable, unlike the natural ponds and salt marshes in the rest of Doñana where water is scarce in dry winters. The birds are not disturbed by farmers or hunters; moreover food seems to be abundant. At 3,000 km closer to the breeding grounds, this could make VLP an attractive alternative wintering location for *limosa* godwits.

At VLP godwits were present all day in a restricted number of ponds where they foraged and roosted in large compact groups of several thousand (Fig. 2). Birds seemed to look for prey in the top layer of the mud. We could not see what they were feeding on, but repeated swallowing movements indicated that they were quite successful. The nearby rice fields seemed to be good for foraging too, but on our way to and from the fish farm we never saw any birds in these fields, nor any flocks coming in or going out of the fish farm. Additionally, the number of godwits observed in the rice fields in comparison to VLP and natural marshes during 30 monthly counts was very low (Toral 2011, Toral & Figuerola 2010).

On the basis of the colour-ring sightings, we have firmly established that Doñana is used mainly by the *limosa* subspecies of Black-tailed Godwit in November. We have also shown that proportionately more adults occur there than first or second year birds. Our data also suggest that more adult males may occur there than adult females, but this needs to be confirmed with more resightings in future expeditions. If confirmed, it might be evidence of a tendency for males to winter closer to the breeding grounds than females, as has been found in other species such as Western Sandpiper *Calidris mauri* (Nebel *et al.* 2002).

If possible we need to establish whether the presence of *limosa* birds at Doñana in late autumn is a recent development or whether they have always occurred there at that time of year but were unrecorded. The RUG godwit colour-ring database holds no observations from S Iberia in November, but if birds stay in areas such as VLP with seriously restricted access, they would have had a very low chance of being discovered. On the other hand the VLP fishponds were only created in 1992, and since then they have provided a major new area of suitable habitat that is now used by birds that presumably previously flew to Africa. Therefore it is possible that *limosa* birds staying in Iberia have been stimulated by the availability of the VLP fish ponds.

The censuses carried out by Estación Biológica de Doñana (Fig. 3) show that Doñana holds Black-tailed Godwits throughout the year. Birds are even present in May when most adults are breeding in the Dutch meadows. However, it still needs to be established whether these are immatures that have not yet attempted to breed. From June onwards, numbers increase with a peak in October. Those present in June–July could be adults that left the breeding grounds in early June (Zwarts *et al.* 2009) and use the VLP fish ponds as a staging site en route to W Africa at a time when other wetlands dry out in summer. In September and October more birds arrive in Doñana. However, information from satellite-tagged birds shows that at least some adults on their way to W Africa leave Europe before mid August (Hooijmeijer *et al.* 2011); similarly there are many resightings in the RUG database of Dutch breeders stopping in France, Portugal and Spain in August and September. Therefore it seems unlikely that the increased numbers at Doñana in October can be explained as a cohort of birds bound for Africa. The lower numbers in November might be associated with the start of the winter rains, making more wetlands suitable for waders, and thereby allowing the wintering population to spread. There are few resightings from other locations in Europe during October–November, so it is likely that most *limosa* are in Africa by then. Peak numbers occur at Doñana in December, when the first godwits start arriving from W Africa (Lourenço & Piersma 2008). In January, birds start to leave Doñana for staging sites in Portugal and elsewhere in Spain and from there to the breeding grounds.

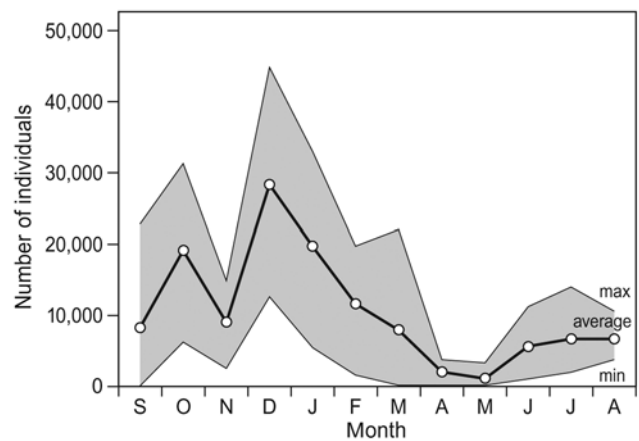


Fig. 3. Monthly counts of Black-tailed Godwits carried out by Estación Biológica de Doñana in the Doñana Natural Park, SW Spain, during 2004–2010 (www-rbd.ebd.csic.es/Seguimiento/mediobiologico.htm).

Our results show that Doñana could be a wintering area for *limosa* Black-tailed Godwits, but for the moment we need to be cautious. Possibly the presence of a substantial part of the *limosa* population at Doñana in November could be explained by the early arrival of birds from W African staging areas, maybe driven by changes in climate, habitat or hunting pressure (Kuijper *et al.* 2006, Zwarts *et al.* 2009). However, this is not supported by data from the satellite-tagged birds which did not move north until much later (Hooijmeijer *et al.* 2011). We hope to clarify whether *limosa* winter at Doñana and resolve the other issues that our preliminary study has identified over the next few years.

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