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Status of Glossy Ibis *Plegadis falcinellus* in the Ebro Delta (Catalonia)

Antoni CURCÓ MASIP*, Yago BRUGNOLI SEGURA

Parc Natural del Delta de l'Ebre, Generalitat de Catalunya. Av. Catalunya 46, Deltebre 43580, Catalonia (Spain)

*Corresponding author; e.mail: acurcom@gencat.cat

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ABSTRACT

In this paper we summarize the current status of the Glossy Ibis *Plegadis falcinellus* in the Ebro delta based on the information obtained from specific and non-specific bird monitoring programs developed by the Ebro Delta Natural Park's technical team. It was quite a rare species until 1990s. The first data included in the International Waterbird Census of mid-January was of one bird in 1988 and, from this year, the wintering population has grown almost exponentially. Currently counts fluctuate between 3,500 and 4,000 birds, with a maximum of nearly 6,600 birds recorded in the winter of 2017/2018. The Glossy Ibis feeds mainly in the rice paddies, particularly when they are flooded with fresh water and nearly the entire wintering population is concentrated in just a few groups. Roosting sites are located in some coastal lagoons, mainly in salt and reed marshes. The first record of a breeder was obtained in 1996 (four pairs). Since that year, growth in the breeding population has been strong and in 2014 there were 214 pairs. Until 2014 there were five breeding sites. In 1996 a special ringing programme featuring the use of plastic bands that incorporated engraved unique codes began. Of 236 chicks banded during the 1996-2017 period, 108 (45.8%) have been observed one or more times. The overall number of resightings amounted to 432, with an average of four resightings per individual (range: 1-35). 90% of resightings occurred in Spain and in the south of France, although observations were distributed among seven countries, all of which are in Europe. We took into consideration some methodological difficulties of the counting of this gregarious species, both in the winter and breeding population. We analyse succinctly its vulnerability to some agricultural changes, particularly the surface flooded decrease in rice paddies in winter.

Introduction

Until 1990s, the Glossy Ibis *Plegadis falcinellus* was quite a rare species that was sighted on a rather irregular basis in the Ebro delta. It is, however, currently present throughout the year, albeit with major monthly fluctuations. According to Wetlands International, the population of the Ebro delta is part of the Black and Mediterranean Sea/West Africa

subpopulation and exceeds the threshold of 1% of the population in all periods (breeding, migration and wintering) of its life cycle.

Given this species' interest from a conservation perspective, the Ebro Delta Natural Park's technical team included it in the bird monitoring programme, adapting the monitoring methodology and frequency

to its abundance and phenological cycle. This article provides a summary of the main data obtained from monitoring.

Study Area

The Ebro delta, which covers an area of some 320 km², is one of the major wetlands in the Mediterranean basin. It includes coastal lagoons, shallow-water bays, beaches, dunes and freshwater marshes, brackish waters and salt flats. Nonetheless, because of the major agricultural changes that took place from the late nineteenth to the early twentieth centuries, many of the natural habitats were replaced by rice paddies, which currently occupy over 65% of the zone. This area is internationally significant because of the large number of aquatic birds: more than 30,000 pairs of more than 40 species regularly breed there (particularly coastal and marine species) and over 310,000 birds of about 100 species use the Ebro delta as a wintering zone (Curcó and Bigas 2018). The area's numerous and very diverse economic activities include agriculture (particularly rice cultivation), hunting, fishing, shell fishing, tourism, salt harvesting and livestock ranching. Some legal frameworks have been established with a view to conserving the biodiversity: Natural Park (1983), SPA (1988), Ramsar wetland (1993) and Biosphere Reserve (2013).

Methods

Breeding population

The methods for counting the Glossy Ibis breeding population in the Ebro delta have evolved over time and have been adapted, particularly, to its abundance and distribution. In the initial years (1996-2009), when only a few pairs bred, the count methodology involved prior detection from outside of colonies (mixed colonies were always formed with herons) and subsequent confirmation of breeding by visiting all nests. As the breeding population grew, this methodology became cumbersome, given that the colonies were hard to access (with a significant increase in effort) and the presence of many other species, particularly herons, which increased

disturbance during the count within the colony. From 2010 onwards, the census methodology therefore changed. Counts now involve aerial photography synchronised with the census of colonial *Ardeidae*, carried out only every 4 years. The counts in the colonies located in open vegetation habitats (salt and reed marshes) are very easy, since the nests are quite exposed and the black coloration of the adults while incubating differs without any complication from other species (Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, Western Cattle Egret *Bubulcus ibis*, Great Egret *Ardea alba*, Little Egret *Egretta garzetta*, Black-crowned Night Heron *Nycticorax nycticorax* or Squacco Heron *Ardeola ralloides*). In contrast, in Tamarix woodlands, where vegetation cover is much higher and nests can be arranged at different levels, this method is not as suitable and, in these cases, the counts are carried from the ground, avoiding a long stay in the colony.

Wintering population

The Glossy Ibis features on the list of species that are counted each year since 1972 during the International Waterbird Census (IWC) of mid-January. The count is based on the sum of the partial daytime counts recorded in the different sectors that form the Ebro delta (13 rice paddy sectors and 12 natural habitat sectors, including the Ebro River, the coastal lagoons, the bays and the marshes). The count in all sectors is performed, on average, in 15 days (asynchronous method). When the winter population of Glossy Ibis was small (1972-2014), sources of error were negligible, but as the population grew, the probability of double counts or false zeros increased. This is particularly significant, given the high level of gregariousness and considerable mobility of this species in the rice paddy sectors. In order to minimise these sources of error, recent years (2015-2016) have seen the use of other methods such as synchronous counting or, in other words, the performance of a swift specific census by surveying all the sectors in a day. Evening census methods have also been tested (2015-2016) given that this species forms large roosts in the evening.

Monitoring of other aspects

The movement patterns of the Glossy Ibis in the Ebro delta have been studied by means of two methodologies: fortnightly censuses of aquatic birds in the main wetlands and the programme of ringing birds with special bands. The fortnightly censuses of aquatic birds are part of the Natural Park bird monitoring programme and this species was only included from 2000 to 2006, the period covering the initial years of colonisation of the Ebro delta.

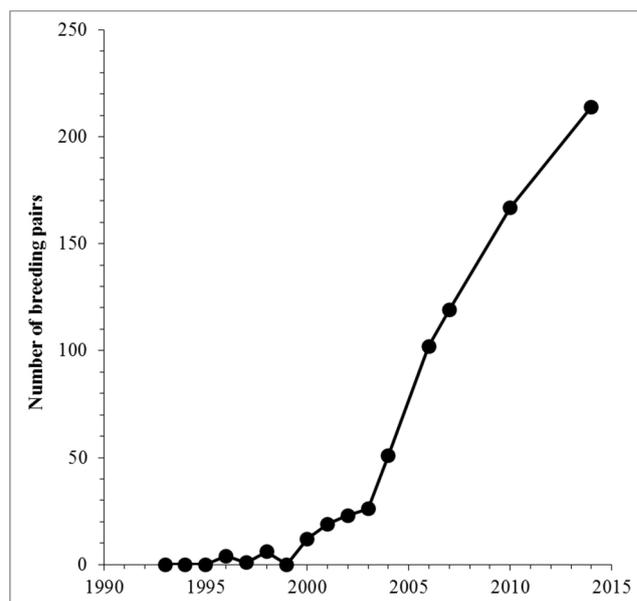
In 1996 a special ringing programme began which featured the use of plastic bands that incorporated engraved unique codes, supplied by and coordinated with the Doñana Biological Station (Spain). Banding and observations data management is performed by means of an Access program that was developed by the team from La Tour du Valat (France). These data not only provide information about the species' migratory patterns, but also help to reveal other essential aspects associated with conservation: demography, degree of interrelation with other populations, etc. During the 1996-2017 period, 236 chicks were banded with these special bands.

Results

Breeding population

The first records on breeding in the Ebro delta were obtained in 1996 (Martinez Vilalta 1996), a year in which 4 pairs settled on Illa de Buda. Since that year, growth in the breeding population has been exponential and in 2014 there were 214 pairs (Figure 1). The breeding population in the Ebro delta appears to fluctuate less than those of the Guadalquivir river wetlands, probably because the area covered by the flooded rice paddies is more stable (Máñez and Rendón-Martos). Depending on the year, the Ebro delta hosts between two and 36% of the population in Spain. Until 2014 there were five breeding sites, which correspond to three coastal lagoons (Illa de Buda, Encanyissada and Canal Vell) and are always located in areas of reed swamps, halophilous salt marshes and tamarisk woods and associated with *Ardeidae* colonies.

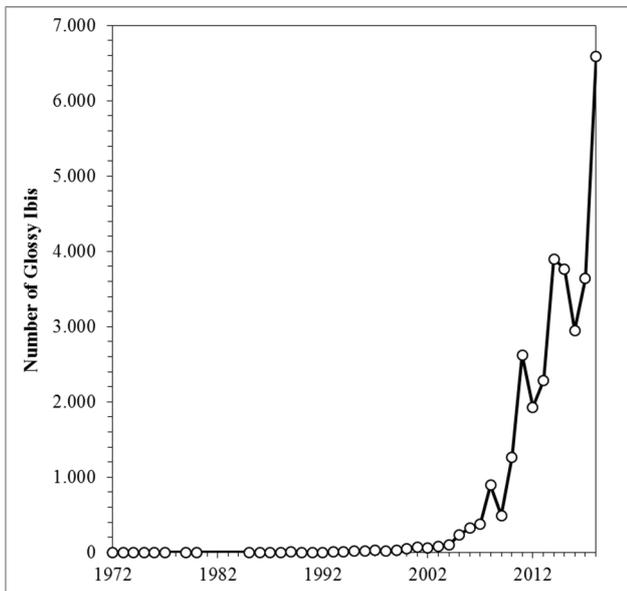
Figure 1. Evolution of the breeding population of Glossy Ibis in the Ebro delta (Years in X axis)



Wintering population

The first count performed as part of the International Waterbird Census (IWC) of mid-January took place in 1988, when 1 bird was counted. Since that year growth in the wintering population has been exponential (Figure 2) and it currently fluctuates between 3,500 and 4,000 birds (Curcó and Bigas 2018), with a maximum of nearly 6,600 birds in the winter of 2017/2018. In recent years, the winter population in the Ebro delta has accounted for between 20 and 25% of the population in Spain (González and Pérez-Aranda 2011).

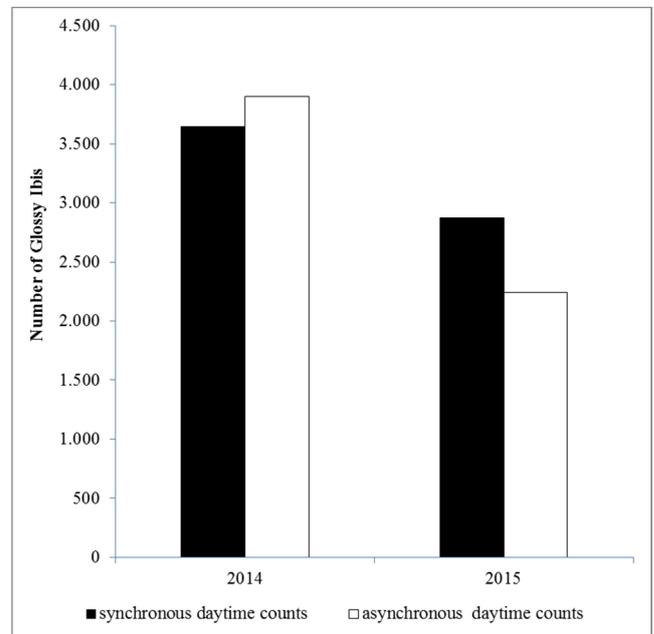
Figure 2. Evolution of the winter population of Glossy Ibis in the Ebro delta (Years in X axis)



In the Ebro delta, the Glossy Ibis feeds mainly in the rice paddies, particularly when they are flooded with fresh water (Curcó and Bigas 2018). Nearly the entire wintering population is concentrated in just a few groups, which move erratically in search of areas of food. In the evening, the concentrations are even larger and they form sizeable roosts in some coastal lagoons, particularly Els Calaixos de Buda and L’Encanyissada. After several trials, we have determined that the method of counting at the roosts is rather complicated, because prior to entering the roost they circle it often and, moreover, visibility is very poor. Roost wintering censuses, widely used for other highly gregarious species such as the Great Cormorant *Phalacrocorax carbo*, the Western Marsh Harrier *Circus aeruginosus* and some *Ardeidae* (Little Egret, Western Cattle Egret and Black-crowned Night Heron), seems to be unsuitable for the Glossy Ibis. The comparison between the synchronous and asynchronous count methods are still not very conclusive although in one of the 2 years during which they have been tested there were differences of over 20% (Figure 3, Curcó and Bigas 2018). The synchronous count is probably the most accurate method for the Glossy Ibis wintering census. This method, used for years for the wintering counts of the Greater Flamingo *Phoenicopterus roseus* in the Ebro

delta, assumes, however, an increase in effort compared to asynchronous method.

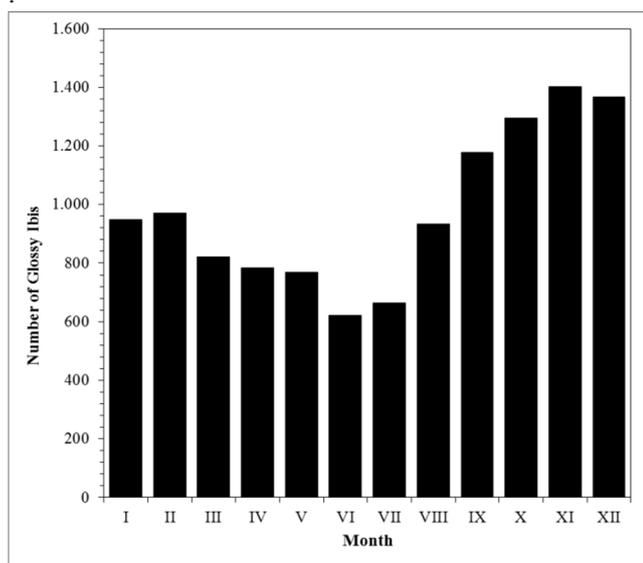
Figure 3. Comparison of the methods for counting the Glossy Ibis in the winter census of aquatic birds in the Ebro delta (International Waterbird Census Data)



Monitoring of other aspects

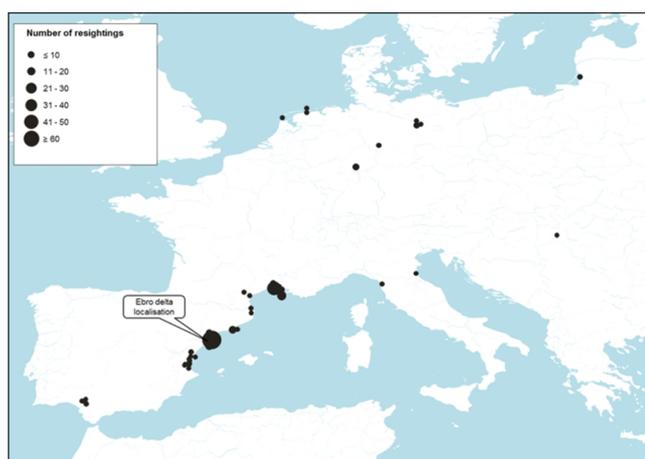
Fortnightly censuses of aquatic birds (2000-2006) reveal population minimums during the breeding season (June-July) and maximum values during post-breeding migratory movement and winter (Figure 4).

Figure 4. Monthly variations in the population of Glossy Ibis in the Ebro delta (2000–2006)



Of 236 chicks banded during the 1996–2017 period, 108 (45.8%) have been observed one or more times. The overall number of resightings amounted to 432, with an average of four resightings per individual and a range of between one and 35 resightings. Although observations were distributed among 7 countries, all of which are in Europe, 90% of resightings occurred in Spain and in the south of France (Figure 5). There were no observations in the north of Africa

Figure 5. Map of distribution of resightings of Glossy Ibis chicks banded with special tags in the Ebro delta



Discussion

In recent decades, the Glossy Ibis, like other species (e.g. Great Egret, Mediterranean gull *Ichthyaetus melanocephalus*), has been experiencing a process of expansion, from East to West, in the Western Palaearctic (Bekhuis *et al.* 1997; Ławicki 2014). In the Ebro delta, colonisation took place in the nineteen-eighties, first as a migratory and wintering species and, from the 1996, as a breeding population. In this process, population increases in the Ebro delta have been very significant and virtually exponential, and account for between 20 and 25% of the wintering population (1991–2015), and between 2 and 36% of the breeding population (1993–2015) in Spain.

The success of this colonisation is probably due to good adaptation resulting from use of the flooded rice paddies as feeding zones and to the existence of ideal and sufficiently isolated and peaceful breeding sites in natural habitats (reed swamps, halophilous salt marshes and tamarisk woods). Winter flooding of rice paddies is a practice that was promoted as an agri-environment measure in the Common Agricultural Policy (CAP) between the late nineteen-nineties and 2014. However, in the new Rural Development Programme (2014–2020) of Catalonia, flooding is no longer encouraged and the area of flooded rice paddies has decreased from about 20,000 to 3,400–8,900 ha in 2016–2017. High winter dependence of the Glossy Ibis on flooded rice paddies as feeding habitat represents a significant threat, which also affects many other species of aquatic birds.

The Apple Snail *Pomacea insularum* is a mollusc that is native to freshwater areas in South America and has invaded many countries with a tropical or temperate climate. It features among the “100 of the World's Worst Invasive Alien Species” (Lowe *et al.* 2000) and since 2009 has invaded the Ebro delta and become an agricultural pest in the rice paddies. In 2010 a programme was initiated to fight the Apple Snail and has entailed winter management of the rice paddies (drying, forced salinization of the paddies and of agricultural channels) and the use of saponins. SEO/BirdLife has also recently initiated a study on the role of the Glossy Ibis in controlling this exotic species, based on analysis of stable isotope ratios as biomarkers of diet. The results, albeit in a very early

stage, are very promising.

Acknowledgements

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