

## Breeding events of greater flamingos in southern Spain during 1865–1926

Manuel Rendón-Martos<sup>1\*</sup>, Miguel A. Rendón<sup>2</sup>, Araceli Garrido<sup>3</sup> & Juan A. Amat<sup>2</sup>

<sup>1</sup> Reserva Natural Laguna de Fuente de Piedra, Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible, Junta de Andalucía, 29520 Fuente de Piedra, Spain

<sup>2</sup> Departamento de Ecología de Humedales, Estación Biológica de Doñana (EBD-CSIC), Calle Américo Vespucio 26, 41092 Sevilla, Spain

<sup>3</sup> Agencia de Medio Ambiente y Agua de Andalucía, Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible, Junta de Andalucía, Cara Sur Lonja del Puerto, 29001 Málaga, Spain

\*Corresponding author: [manuel.rendon@juntadeandalucia.es](mailto:manuel.rendon@juntadeandalucia.es)

### Abstract

During 1865-1926 there were at least 19 breeding events of greater flamingos in southern Spain, of which at least 12 had not been previously reported in the ornithological literature. The evidence of breeding for such unreported events is based on the presence of eggshells in the collections of some natural history museums.

### Resumen

Durante 1863-1926 hubo al menos 19 eventos de reproducción de flamenco común (*Phoenicopterus roseus*) en el sur de España, de los cuales al menos 12 no habían sido reportados en la bibliografía ornitológica. La evidencia de esos casos de reproducción está basada en la presencia de cascarones de huevos en las colecciones de algunos museos de historia natural.

### Résumé

De 1863 à 1926, il y a eu au moins 19 tentatives de reproduction de flamants roses dans le sud de l'Espagne, dont au moins 12 n'avaient pas été signalées dans la littérature ornithologique. La preuve de ces cas de reproduction est basée sur la présence de coquilles d'œufs dans les collections de certains musées d'histoire naturelle.

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### Introduction

In Spain, the greater flamingo (*Phoenicopterus roseus*) forms part of a metapopulation that spreads across the Mediterranean and NW Africa (Balkiz et al., 2007). There are many breeding records of the greater flamingo in Spain from 1958 onwards (e.g. Vargas Yáñez et al., 1983; Johnson & Cézilly, 2007), indicating that the species is, nowadays, a regular breeder, which has even occupied new breeding sites in the last two decades (de Juana & Garcia, 2015).

The main habitats of the greater flamingo are shallow brackish and saline wetlands, which

are characterised by seasonal and annual variations in water depth depending on rainfall. The transformation of many of such wetlands in salt pans and fish farms has likely facilitated regular nesting of the species during the last decades, as water levels are managed and remain more or less stable throughout the year (Béchet & Johnson, 2008). Indeed, greater flamingos commute regularly during the chick provisioning period to salt pans and fish farms, which in Spain may be located up to 400 km from the main breeding site (Amat et al., 2005).

Before such habitat transformations, the breeding of greater flamingos around the Mediterranean was triggered by rainfall during months preceding breeding, which determined the water levels in natural wetlands used as foraging sites during chick provisioning, and ultimately affected breeding success (Rendón-Martos, 1996; Máñez et al., 2009). The reliance on rainfall for breeding, likely determined that breeding by greater flamingos was an irregular event during the past, and this may have determined that many breeding attempts in Spain have remained undocumented.

Riddell (1945) reported three breeding events of greater flamingos in the marshes of the Guadalquivir (SW Spain) in which the eggs hatched, namely in 1935, 1941 and 1945. Bernis & Valverde (1954) compiled information, based on game keepers, on breeding events of the greater flamingo in the marshes of the Guadalquivir during the first half of the 20<sup>th</sup> Century, and concluded that the species bred in only three occasions, which were the same as reported by Riddell (1945). However, some years later Valverde (1960) reported ten breeding events in the marshes of the Guadalquivir between 1870 and 1947, three of which had already been reported by British ornithologists (Lilford, 1880; Chapman & Buck, 1893). Bernis & Valverde (1954) also stated that there were more than one hundred eggshells of greater flamingos in natural history museums in the United Kingdom and Germany, which had been collected in Spain.

In this article, we report on at least 12 breeding events of greater flamingos in Spain that were not previously documented in the ornithological literature.

### **Methodology**

We relied on the occurrence of eggshells in natural history museums as evidence of greater flamingo breeding. Some natural history museums have databases of their collections accessible through Internet. These

databases are usually available in North American museums, but not so in European museums (at least in the most important ones). In two North American museums there are eggshells of greater flamingos that were collected in Spain (see Table 1). In addition, we requested information from the Natural History Museum (Tring, UK) and the Zoologisches Forschungsmuseum Alexander Koenig (Bonn, Germany), of which only the Natural History Museum holds greater flamingo eggshells collected in Spain.

Lastly, we reviewed the ornithological literature for cases of breeding of greater flamingos in Spain during the late 19<sup>th</sup> and early 20<sup>th</sup> Centuries. We did not consider later years because the breeding events from 1930 onwards have been reported (Riddell, 1945; Valverde, 1960; Vargas Yáñez et al., 1983; Johnson & Cézilly, 2007; de Juana & Garcia, 2015).

### **Results**

In the ornithological literature there are seven nesting records of greater flamingos occurring in Spain during 1865-1926 (Table 1). Moreover, and based on the occurrence of eggshells in the collections of natural history museums, it is clear that flamingos also bred in Spain on at least 12 additional occasions during that period (Table 1). The date of collection of an eggshell in the collection of the Natural History Museum is not accurate, as in on its card the date is indicated as “c. 1869” (Table 1). If such eggshell was not collected in 1870, when the flamingos certainly bred (Lilford, 1880), then there would now be 13 previously unreported breeding events in southern Spain. Most of the eggs in the museums where collected in the marshes of the Guadalquivir (Table 1). We assumed that in two occasions (1892 and 1904) the flamingos bred in Fuente de Piedra lake (southern Spain), as the locality of collection was “Malaga province”. On two occasions it was indicated that the eggs were collected in southern Spain, without any other specification.

*Table 1: Breeding events of greater flamingos in southern Spain from 1865-1926, according to the presence of eggshells in the collections of museums and records in bibliographic sources. NHM= Natural History Museum, UK; AMNH= American Museum of Natural History, USA; WFVZ= Western Foundation of Vertebrate Zoology, USA.*

<b>Year</b>	<b>Location</b>	<b>Source</b>
1865	South Spain	Eggshells at NHM
1866	Guadalquivir marshes	Eggshells at NHM
c. 1869	Guadalquivir marshes	Eggshells at NHM
1870	Guadalquivir marshes	Lilford (1880)
1872	Guadalquivir marshes	Chapman & Buck (1893), Eggshell at NHM
1879	Guadalquivir marshes	Lilford (1880), Eggshells at NHM and AMNH
1883	Guadalquivir marshes	Chapman & Buck (1893), Eggshells at NHM
1888	Guadalquivir marshes	Eggshells at NHM
1891	Guadalquivir marshes	Eggshells at NHM
1892	Fuente de Piedra lake	Eggshell at WFVZ
1893	Guadalquivir marshes	Eggshells at NHM
1899	Guadalquivir marshes	Eggshells at NHM
1902	South Spain	Eggshells at NHM
1904	Fuente de Piedra	Eggshells at WFVZ
1906	Guadalquivir marshes	Eggshells at NHM
1907	Guadalquivir marshes	Valverde (1960)
1911	Guadalquivir marshes	Valverde (1960), Eggshells at NHM and WFVZ
1914	Guadalquivir marshes	Eggshells at NHM
1920	Guadalquivir marshes	Valverde (1960)
1926	Guadalquivir marshes	Eggshells at WFVZ

## Discussion

There are prehistoric paintings of greater flamingos in caves of southern Spain (Gurney, 1921; Topper & Topper, 1998), which were made about 5000 BC, indicating that the species is a component of the avifauna of the country from thousands of years ago. Thus, breeding may have been occurring from

prehistoric times, although it was not reported until British ornithologists started to visit southern Spain in the 19<sup>th</sup> Century (e.g. Lilford, 1880). Chapman & Buck (1893) tried to look for greater flamingo colonies in the marshes of the Guadalquivir during several years, before finding one in 1883. Although the time they took in finding a colony might

have been due to the difficult access to this, by then, remote area, Chapman and Buck (1910) recognized that this could also have been due to the irregular nesting of greater flamingos in southern Spain. Indeed, these authors estimated that the species only bred after rainy winters, in two out of every five.

Even much less often than in the marshes of the Guadalquivir, the greater flamingo should have bred in Fuente de Piedra during the 19<sup>th</sup> Century. By then, the only sites for flamingo nesting in Fuente de Piedra lake were a few natural islets (called Canchones del Suroeste) that provided sufficient isolation only in years with exceptionally high water levels (Rendón-Martos & Johnson, 1996), otherwise the site was easily accessible to mammalian predators. However, in the late 19<sup>th</sup> Century a French company acquired the lake and constructed many dykes to exploit its salt content commercially. These dykes have allowed a more regular nesting pattern of the greater flamingo in Fuente de Piedra after the salt extraction and the disturbances ceased, and have been the main nesting sites of this flamingo in this area from 1950 onwards (Valverde, 1963; Vargas Yáñez et al., 1983; Rendón-Martos, 1996).

In the late 19<sup>th</sup> and early 20<sup>th</sup> Centuries the nesting colonies of greater flamingos were rarely successful in the marshes of the Guadalquivir, mainly because of eggs being taken by local people, who sold the eggs for human consumption (Lilford, 1880; Chapman & Buck, 1893). This practice likely facilitated the egg collectors that were visiting southern Spain, and who purchased eggs in the markets of villages surrounding the Guadalquivir marshes (e.g., Coria del Río, La Puebla del Río, Santiponce, Sanlúcar de Barrameda), as inferred after examining the cards of these eggshells. In other cases, the eggs could have been retrieved directly from nests by egg collectors themselves, as there are descriptions of nests and the characteristics of the associated breeding colonies on the eggshells' cards.

Although our sample of museum is limited, two of these museums are hold the most important eggshells collections in the world, (Natural History Museum and Western Foundation of Vertebrate Zoology), we show the importance of museum egg collections to filling in gaps in our knowledge of species natural history. We provide a method for others to follow so that additional breeding events may be reported in the future when the collections of more museums are considered. The examination of eggshells collections may complement the cases reported in the literature to gain insights into the frequency of historic breeding events of greater flamingos.

### Acknowledgements

With thanks to Dr Douglas G.D. Russell and Dr Till Töpfer who kindly replied to our queries on the occurrence of greater flamingo eggshells in the collections of the Natural History Museum, Tring (UK) and Zoologisches Forschungsmuseum Alexander Koenig (Germany), respectively.

### References

- Amat, J.A., Rendón, M.A, Rendón-Martos, M., Garrido, A. & Ramírez, J.M. (2005). Ranging behaviour of greater flamingos during the breeding and post-breeding periods: linking connectivity to biological processes. *Biological Conservation*, 125, 183-192.
- Arévalo y Baca, D.J. (1887). *Aves de España*. Tomo XI. Memorias de la Real Academia de Ciencias Exactas, Físicas y Naturales, Madrid, Spain.
- Balkiz, Ö, Özesmi, U., Pradel, R., Germain, C., Siki, M., Amat, J.A., Rendón-Martos, M., Baccetti, N. & Béchet, A. (2007). Range of the greater flamingo, *Phoenicopterus roseus*, metapopulation in the Mediterranean: new insights from Turkey. *Journal of Ornithology*, 148, 347-355.

- Béchet, A. & Johnson, A.R. (2008). Anthropogenic and environmental determinants of greater flamingo *Phoenicopterus roseus* breeding numbers and productivity in the Camargue (Rhône delta, southern France). *Ibis*, 150, 69-79.
- Bernis, F. & Valverde, J.A. (1954). Sur le flamant rose dans la Péninsule Ibérique. *Alauda*, 22, 32-39.
- Chapman, A. & Buck, W.J. (1893). *Wild Spain*. Gurney & Jackson, London, UK.
- Chapman, A. & Buck, W.J. (1910). *Unexplored Spain*. Edward Arnold, London, UK.
- de Juana, E. & Garcia, E. (2015). *The Birds of the Iberian Peninsula*. Christopher Helm, London, UK.
- Gurney, J.H. (1921). *Early Annals of Ornithology*. Witherby, London, UK.
- Johnson, A.R. & Cézilly, F. (2007). *The Greater Flamingo*. T. & A.D. Poyser, London, UK.
- Lilford, Lord (1880). On the breeding of the Flamingo in southern Spain. *Proceedings of the Zoological Society of London* 48, 446-450.
- Máñez, M., Ibáñez, F., Garrido, H., García, L., Arroyo, J.L., del Valle, J.L., Chico, A. & Rodríguez, R. (2009). The breeding of greater flamingos *Phoenicopterus roseus* in the Guadalquivir marshes from 1989 to 2007. *Flamingo*, 1, 44-47.
- Rendón-Martos, M. 1996. La laguna de Fuente de Piedra en la dinámica de la población de flamencos (*Phoenicopterus ruber roseus*) del Mediterráneo Occidental. PhD thesis, University of Málaga, Málaga, Spain.
- Rendón-Martos, M. & Johnson, A. R. (1996). Management of nesting sites for greater flamingos. *Colonial Waterbirds*, 19, 167-183.
- Riddell, W. H. (1945). Field notes from observations in Spain on birds in the British list. *Ibis*, 87, 409-422.
- Topper, U. & Topper, U. (1998). *El Arte Rupestre en la Provincia de Cádiz*. Diputación Provincial, Cádiz, Spain.
- Valverde, J.A. (1960). Vertebrados de las marismas del Guadalquivir. Introducción a su estudio ecológico. *Archivos del Instituto de Aclimatación de Almería*, 1, 1-168.
- Vargas Yáñez, Blasco Ruiz, M. & Antúnez Corrales, A. (1983). *Los Vertebrados de la Laguna de Fuentepiedra (Málaga)*. Monografías 28, ICONA, Ministerio de Agricultura, Pesca y Alimentación, Madrid, Spain.